

*Current*

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# Anthropology



## THE WENNER-GREN SYMPOSIUM SERIES

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### REINTEGRATING ANTHROPOLOGY: FROM INSIDE OUT

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GUEST EDITORS: AGUSTIN FUENTES AND POLLY WIESSNER

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Reintegrating Anthropology: From Inside Out

The Extended Evolutionary Synthesis, Ethnography, and the Human Niche  
Evolutionary Cultural Anthropology

Becoming DADS: Developmental Plasticity and Paternal Biology

Being Human in Cities: Phenotypic Bias from Urban Niche Construction

Cultural Emergence and Ecological Pyrodiversity in Australia's Western Desert

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Age Grouping and Social Complexity

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# Reintegrating Anthropology: From Inside Out

## Wenner-Gren Symposium Supplement 13

Leslie C. Aiello



Figure 1. Participants in the symposium “Integrating Anthropology.” Front row, from left: Leslie Aiello, Cristina Moya, Douglas Bird, Ashley Grimes, Kathryn Coe, Mary Shenk, Maurice Bloch, Polly Wiessner, Beverly Strassmann, Laurie Obbink. Back row, from left: Agustin Fuentes, Greg Downey, Pierre Lienard, Ben Purzycki, Alan Barnard, Lee Gettler, Barry Hewlett, Scott Atran. A color version of this figure is available online.

*Reintegrating Anthropology: From Inside Out* is the 150th symposium in the Wenner-Gren series and the thirteenth symposium to be published as an open-access supplementary issue of the Foundation’s journal, *Current Anthropology*. The symposium, titled “Integrating Anthropology: Niche Construction, Cultural Institutions, and History,” was organized by Agustin Fuentes (University of Notre Dame) and Polly Wiessner (University of Utah) and was held October 16–22, 2014, at the Tivoli Palacio de Seteais, Sintra, Portugal (fig. 1).

The starting point for this symposium was Eric Wolf’s statement that “Anthropology is both the most scientific of the humanities and the most humanistic of the sciences”

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(Wolf 1984). Anthropology, after all, is the study of human biological and cultural variation over time, and anthropologists variously approach the broad field from both scientific and humanistic perspectives—and have done so since the beginnings of the discipline. The focus of *Reintegrating Anthropology* is not the disciplinary, theoretical, or methodological breadth of anthropology, but rather the value of integrating both scientific and humanistic or constructivist approaches to answer specific anthropological questions. The title of the symposium emphasizes reintegration, and it is true that after the exponential expansion of the field (particularly in North America) from the mid-1960s to the mid-1970s, much of the appreciation of the value of cross-fertilization between ethnographic, evolutionary, experimental, and interpretive approaches was lost (Fuentes and Wiessner 2016). The main aim of the symposium was to rekindle interest in the

value of integration and to provide concrete examples from across the discipline demonstrating the uniquely anthropological understandings that derive from theoretical pluralism.

The symposium brought together 17 participants who were enthusiastic about intellectual engagement with diverse theoretical approaches. Fuentes and Wiessner (2016; Fuentes 2016) offered niche construction theory and the extended evolutionary synthesis as a common framework for analysis; however, it rapidly became clear that the focus should be on a broader theoretical engagement. In particular, the integration of etic (from the outside) and emic (from the inside) approaches became a central theme (e.g., Bloch 2016; Wiessner 2016). The unifying factor among all of the participants was a deep interest in drawing on multiple theoretical approaches and the rich results that could be achieved through the (re)integration of anthropology as a scientific/humanistic discipline.

Some examples of the breadth of topics include Hewlett (2016), who proposes an integrated theoretical approach called evolutionary cultural anthropology (ECA) and uses the Ebola outbreak as well as hunter-gatherer childhood as examples. Atran (2016) and Sheikh, Gómez, and Atran (2016) develop the devoted actor model to understand suicide bombers, the global jihadi, and the Islamic State. And Downey (2016) approaches questions of being human in cities, the epitome of human niche construction. He outlines novel challenges of the city, such as unprecedented levels of social interaction and high-energy food resources, and their effect on aspects of human biology and culture.

The Wenner-Gren Foundation is no stranger to integrated anthropology, which has been part of its mission since it was founded 75 years ago. The first Wenner-Gren symposium, the “International Symposium on Anthropology” organized by Alfred Kroeber in 1952, brought together 81 international anthropologists representing the breadth of the discipline to inventory anthropology and leading ultimately to the creation of *Current Anthropology* (Silverman 2009). The next major multidisciplinary symposium, “Man’s Role in Changing the Face of the Earth,” organized by Carl Sauer, Marston Bates, and Lewis Mumford in 1955, focused on human influence on the environment. Both the symposium and the resulting volume (Thomas 1956) are considered benchmarks in the multidisciplinary study of ecological systems, foreshadowing current interest in the Anthropocene.

Over the past 40 years, as integrated approaches have fallen out of favor with many anthropologists, the Foundation has continued to champion theoretical breadth. Some of the symposia discussed the value of integrated approaches straight on (e.g., Goodman and Letterman 1998), while others addressed

topics such as food habits (Harris and Ross 1987), tools, language, and intelligence (Gibson and Ingold 1993), sexuality (Abramson and Pinkerton 1995), and genetics (Goodman, Heath, and Lindee 2003) from broad and diverse theoretical perspectives. The current contributions follow on from this rich history and provide clear examples of the value of the integrated approach to anthropology and the significant contributions that can be made by breaking down the barriers that have continued to rise between scientific and humanistic approaches to our discipline.

We are always looking for new ideas from all areas of anthropology for future Foundation-sponsored and Foundation-organized symposia and eventual CA publication. Please contact us with your ideas and a proposal. Information about the Wenner-Gren Foundation, the symposium program, application procedures and deadlines, and what constitutes a good symposium topic can be found on the Foundation’s website (<http://wennergren.org/programs/international-symposia>).

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# Reintegrating Anthropology: From Inside Out

## An Introduction to Supplement 13

by **Agustin Fuentes** and **Polly Wiessner**

Both evolutionary/scientific and constructivist or humanistic approaches have brought valuable understandings to anthropology and continue to do so today. Discussions of the split(s) and possibilities of reintegration across anthropology have been valuable; however, practical reintegration will only come from a serious and open intellectual engagement with a diverse range of theoretical contexts and a direct connection to data. This volume is an attempt to provide innovative contexts for, and examples of, anthropologists reporting on their data and/or conceptualizing approaches to the data in ways that cross or straddle boundaries. While we offer niche construction theory and the extended evolutionary synthesis as common framework, the articles are not all in agreement on explanatory means and priorities. And this is a good thing. To develop an effective reintegration requires anthropologists to move away from artificial dichotomies and standing grudges and toward collaborations and a respect for theoretical plurality. The unifying endeavor of this collection is in the sincere attempt by all of its members to draw on more than a single approach and to integrate understandings gleaned from the inside and the outside.

The subject matter of anthropology is intrinsically messy. A fetus is formed via the interactions between the genes and developmental processes, laying the baseline for body and behavior. In the womb, it is exposed to environmental factors such as diet and stress that shape its development and can set off epigenetic change. After birth an infant may be strapped to a cradleboard, cuddled by the father, or nursed by a number of caretakers with an impact on the physiology of both caretaker and infant. From early on, children have the dispositions to charm investment from community members and acquire the roles and rules of society. They begin to embody the skills to negotiate challenging physical and social terrain. Even basic perceptions such as smell and color are mutually shaped physiology and cultural experience. Growth and maturity are often ushered in by complex rites of passage, with social selection pressures shaping reproductive chances and outcomes and what those processes mean to the individual and the society. Humans develop in community. Adults carry out economic enterprises in niches built over generations of history. They acquire ideological outlooks that guide their motivations, goals, and loyalties. Humans learn the rules of cultural institutions while individual agents push

the limits, bringing about game changes that alter niches and make history.

Given the amount of variation created in the interlacing of biological, social, and cultural forces, arriving at an understanding of human behavior and human societies is daunting. Nearly 80 years ago, Alfred Kroeber and Franz Boas (Boas 1936; Kroeber 1935) debated the correct integration of “science” and “history,” of reductionist and constructivist approaches, in anthropology. Kroeber and Boas largely agreed that diverse patterns and substantial complexity were at the heart of human societies but dissented on the details of how to best arrive at the most suitable or, better put, “most anthropological,” methods, explanations, and interpretations.

Both scientific and constructivist or humanistic approaches have brought valuable understandings in anthropology and continue to do so today. As Eric Wolf (1964:88) wrote: “Anthropology is both the most scientific of the humanities and the most humanistic of the sciences.” Scientific approaches, using encompassing theories and reductive methodologies, have yielded many important insights and set off productive debates. These range from culture and personality, to cultural ecology, to modes of production, to patterns in the structures of the human mind, and currently, to evolutionary theory as used in behavioral ecology, evolutionary anthropology, and cultural transmission/evolution. In this increasingly globalized world, such encompassing theories are essential for understanding evolutionary processes, selection pressures, human development, and shared perceptions, tendencies, and strategies across societies.

Constructivist or interpretive approaches allow for exploration of the impact of history, ideology, power relations,

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perceptions, and institutions on human lives. They also clarify the cultural relativism of certain norms and values that have been central to human rights debates and the institutions that create a certain degree of path dependency in society. In a globalized world where much material culture looks uniform, it is easy to overlook critical cultural differences. Constructivist or interpretive approaches are key to understanding many local and regional phenomena—for example, the frightening reality of the ongoing crisis involving ISIS/ISIL, Sunni and Shia groups, Iran, Syria, and Iraq (see, in this volume, Atran 2016; Sheikh, Gómez, and Atran 2016).

In humans, as Margaret Lock notes, “individual bodies are not mere containers stuffed with biological entities that age and die over a lifetime; rather, they are products of human evolution; the *longue durée* of history; environments expansive and local; the communities that people live in; the diets they eat; the toxins, insults, and abuses they are exposed to; and the good times too” (2015:171–172). Thus the challenge of how to integrate history, biology, culture, language, and institutions into anthropological practice and theory is as old as the discipline itself and as pressing today as ever. Realizing that there are currently many anthropologists who cross the science-humanities/constructionist boundaries, we convened a workshop with the enthusiastic support of the Wenner Gren Foundation on the topic “Integrating Anthropology: Niche Construction, Cultural Institutions, and History.” We invited colleagues who were conducting research that involved approaches that cross, straddle, and even ignore the boundaries to present their ideas on re-integrating the field and to illustrate them with data from their research.<sup>1</sup> We purposefully chose colleagues who worked on a wide range of topics and made no attempt to force uniform theoretical nor methodological approaches. Anthropology is the study of biological and cultural variation in human societies over time: there are many successful ways to practice it. The debate surrounding this topic has ebbed and flowed, contributing to, and detracting from, anthropology’s ability to make sense of the world.

At the heart of this debate is a dual “inside-outside” dichotomy. The first dichotomy views the biology as the somatic “inside” the body and culture as the extrasomatic “outside.” From this perspective, biology on the inside is shaped by evolutionary processes such as those that produce the human body and physiology that creates a series of options for behavior that interface with the cultural milieu

on the outside. The outside sets the playing field for the deployment of the options created by evolutionary forces.

The second dichotomy reverses the inside-outside nomenclature to make methodological assertions. “Hard” scientific data can only be collected from the “outside,” while “soft” humanistic perceptions are only available from the “inside.” Rigorous scientific data are collected via objective and quantitative assessment, measurement, and observation by external observers, unclouded by the biases of the actors themselves. Humanistic and experiential emic data are found on the inside, that is, in the minds and perceptions of the actors themselves.

Both dichotomies are useful for some purposes, and both have severe limitations. With the nature-culture dichotomy come explanations for causality: the ultimate and the proximate (e.g., Mayr 1961; but see Laland et al. 2011). The ultimate (inside) explanation assumes that the key process of relevance is best explained via action of evolutionary forces, mainly, natural selection. The proximate (outside) explanation is then connected to the immediate stimulus and the landscape established via cultural factors. The core argument is that the ultimate explanation is the “why”: why in an evolutionary sense the “inside” behavior in question evolved as it conferred relatively enhanced fitness on individuals. The proximate explanation is the “how”: how the “outside” social, historical, situational context or mechanism enabled the actions to happen.

In this worldview, the ultimate answer is achieved not via examining the specifics of the behavioral, cultural, or perceptual patterns involved but via developing a scenario where the action in question provides or provided an evolutionary benefit to individuals in a given ecological context. However, recent work in evolutionary theory suggests that this distinction between ultimate and proximate is not as robust, even in evolutionary biology, as was previously thought (Laland et al. 2011). It is increasingly evident that in understanding evolutionary processes, the how and the why (the inside and the outside) are not necessarily mutually exclusive. Under the rubric of the extended evolutionary synthesis (EES; Laland et al. 2014, 2015; Pigliucci and Mueller 2010), “organisms are constructed in development, not simply ‘programmed’ to develop by genes. Living things do not evolve to fit into pre-existing environments, but co-construct and coevolve with their environments, in the process changing the structure of ecosystems” (Laland et al. 2014:162).

The EES expands on basal neo-Darwinian approaches to include the processes of niche construction and epigenetic, behavioral, and cultural inheritance as well as developmental and phenotypic plasticity as central in evolutionary processes (Jablonka and Lamb 2005; Laland et al. 2015; Odling-Smee, Laland, and Feldman 2003; West-Eberhard 2003; see also, in this volume, Fuentes 2016; Wiessner 2016). In the EES the how might be a causal component of the why, instead of simply being the proximate facilitator of an evolved pattern. If this is the case, then experiential, ecological, be-

1. Because Wenner-Gren symposia involve small groups, we had to exclude a large proportion of colleagues in the field, including those working in applied anthropology and “political” anthropology. However, many researchers from all walks of anthropology also become engaged in applied work or political interventions. It is hard to separate research from engagement in today’s world. The potential for integrating scientific, humanistic, and engaged anthropology is great, but this must be the topic of another conference.



havioral, social, cultural, and cognitive factors might be as relevant in causal evolutionary explanations as are specific aspects of our biology. In the EES, the inside and the outside are not always separable, nor are they a true dichotomy.

The inside-outside dichotomy for data collection, that “science” is best done from the outside, and “humanistic” questions are best examined from the inside, also has severe problems as recognized by the increasing use of qualitative techniques employed in anthropology (see, in this volume, Barnard 2016; Hewlett 2016). In short, meaningful quantitative methods are difficult to develop in the absence of inductive explorations and the use of qualitative techniques to discover what is there. Moreover, it is often necessary to return to qualitative and interpretive methods to understand the results of quantitative studies. Finally, anthropology’s encounter with postmodernism has seriously questioned the idea of how unbiased any observer can be in any culture, much less in a foreign one.

### Reintegrating Anthropology

Since the Kroeber-Boas exchange, anthropologists have produced ethnographies, experiments, and analyses in periods of collaborative engagement and during times of acrimonious strife. For much of the 1940s through the early 1970s, collaborative engagement favored cross-fertilization between ethnographic, evolutionary, experimental, and interpretive approaches (e.g., see volumes edited by Meggers 1959; Tax 1965; and Washburn 1961). Between the 1970s and the early 2000s there was extensive fragmentation between different theoretical and methodological strains of anthropological inquiry. Trends in evolutionary and social theory meshed with a particularly sociopolitical context and ratcheted up the ubiquitous debate about “science and history.” The result was a highly unfortunate but quite substantial disentanglement of ethnographic, constructivist, and evolutionarily oriented methodologies. Some departments split, debates raged, and questions were raised as to whether anthropology would continue to exist as an integrated interdisciplinary field (e.g., Segal and Yananisako 2005, but see the discussion in Schultz 2009).

While this was going on, many of our colleagues recognized that the reintegration of anthropology was both theoretically and methodologically warranted if anthropology is to be of relevance to problems at hand: that anthropology can (and should) act as a “social space for reinventions of our distinctive hybridity” (Lederman 2005:73). The premise for this integrated perspective is that when diverse approaches are valued and combined, or at least interface with one another, it produces a better and more comprehensive suite of answers than any individual thread does by itself.

For instance, Harris and Robb (2012) have suggested that humans accommodate and accept multiple ontogenies and world realities, allowing people holding different ontogenies to communicate with one another over such matters as the

human body and allowing historical change to take place. The discussions by Latour and Descola at the American Anthropological Association annual meeting in 2013 proposed that the concept of the Anthropocene results in the recognition of the impact of human agency on the natural and social environment as well as the corresponding responsibility of humans to tackle the problems of such change through connecting the physical and cultural (and more). Ingold (2013:22) has called for a renewed paradigm of evolution as processual, developmental, and relational, not as the change along lines of descent but as “the developmental unfolding of an entire matrix of relations within which forms of life, human and non-human, emerge and are held in place.”

Discussions of the split(s) and possibilities of reintegration have been valuable; however, practical reintegration will only happen by anthropologists doing it with data. This volume is an attempt to provide examples of anthropologists reporting on their data and/or conceptualizing approaches to the data in ways that cross or straddle boundaries. For this purpose we intentionally chose colleagues who worked on a wide range of topics and did not attempt to force a uniform theoretical context or ideas as to what is “correct” in terms of methodological approaches: anthropology is not one thing, and there are many successful ways to practice it.

### *Setting the Stage*

In the first section, papers by Agustin Fuentes (2016) and Barry Hewlett (2016) provide contemporary and integrative perspectives on evolutionary approaches. In both of these contextualizing articles the authors provide theoretical possibilities that implicitly acknowledge the complexities of that moving target that is human. They propose that “doing” an integrated evolutionary anthropology requires blurring the science-humanist divide in undertaking evolutionary approaches. There is an emphasis on contemporary evolutionary theory and the patterns and analytic possibilities that a focus on what culture-biology-ecology interactions can provide.

Fuentes reminds us that bodies and evolutionary histories are not quantifiable features that can be measured separately from human cultural experiences; nor is that experience wholly extractable for the biological and ecological contexts and structures that are part of it. In response to some current trends, Fuentes argues that for anthropology to be most successful in what it purports to do, the study of the human (writ large), we need a more effective integration of diverse methodological and theoretical toolkits. Such an integrative framework would enable the inclusion of key social, historical, perceptual, and institutional variables as part of the human evolutionary ecology, not simply as emergent from or irrelevant to it.

Fuentes draws on the extended evolutionary synthesis (Laland et al. 2015), specifically, niche construction theory

and multi-inheritance theory, to develop a heuristic framework that prioritizes a “human niches” approach, seeing the biological and social as intertwined processes that are not wholly separable (e.g., Lock 2015). The niche framework Fuentes proposes encompasses individual bodies, face-to-face interactions within social groups, interactions among social groups, and dynamics at the community level as relevant in evolutionary inquiry. The pattern of response and feedback in social and ecological processes at all levels in the niche creates a local ecology of interactive material, social, and cognitive aspects that is passed from one generation to the next. Fuentes walks us through this framework via an overview example of human sexual partnering (mating). He concludes that human niche construction creates an inherited ecology that includes cultural context and requires an analysis that takes seriously developmental dynamics and the intensive and mutually mutable entanglement of the biological and the social.

Hewlett also begins by noting that contemporary evolutionary approaches often minimize the role of culture as a core explanatory factor for human behavior. Conversely, most cultural anthropological approaches assume that human experience, belief, and social structures play central roles in explaining human behavior but usually ignore the role of biology. Hewlett proposes that we consider using an approach he dubs “evolutionary cultural anthropology (ECA).” Hewlett describes the ECA as a mode of study of human culture that is multidisciplinary and incorporates contributions from disciplines such as evolutionary biology, cognitive sciences, neurobiology, and developmental psychology. ECA also stresses the value of using both informal open-ended interviews to collect emic data and structured observations or accounts of actual behavior (etic).

In the ECA approach, ethnographic and cultural analyses are integrated with a framework of cultural niche construction where the feedback nature of niches that humans construct is central in understanding the ways in which individuals think, feel, and behave both within and between cultures. Hewlett notes that the ECA approach is not another attempt to develop a theory of “cultural evolution” or gene-culture coevolution. To illustrate an example of the ECA premise, he uses his experience over the past 15 years in efforts to contain Ebola outbreaks in the Congo Basin and East Africa and summarizes a case study of parenting practices among the Aka foragers and Ngandu farmers. For the Ebola case, Hewlett suggests that the interactions of local explanations of illness and traditional funerary practices interact to expose or protect individuals from disease. These interactions also influence mortality and morbidity patterns, thus potentially affecting selection and, thus, biology. In thinking about Aka and Ngandu hunter-gatherer childhoods, Hewlett proposes an integration of cultural models of childhood and broader foundational schemas of parenthood for the Ngandu and Aka with biological and ecological patterns. In doing so Hewlett seeks to develop a broad evolutionary

and anthropological context to create strong comparative analysis of the similarities and differences in these two overlapping but distinct culture groups.

### Providing Examples of an Integrated Anthropology

Humans construct, and are constructed by, niches with ecological, technical, and cultural components that influence selection pressures. Niche construction theory (NCT) is especially important in an integrated anthropology because it includes the effects of cultural contexts and perceptions, as well as bodies and ecologies, as key parts of human niches. Human interfaces with ecological contexts are often mediated via material culture (tools, clothes, buildings, towns), and the actions involved in the construction of niches are rooted in the beliefs, institutions, histories, and practices of human groups. Cultural practices and humanly constructed landscapes are important factors in niche construction processes.

However, while niche construction is a powerful framework for integrating the many factors that contribute to human behavior and the construction of human societies (Fuentes 2015, 2016), and it allows us to identify selection pressures that result from constructed niches, it has its limitations. For example, it does not provide a theory for explaining why humans living in different environments chose to modify their environments in certain ways, how bodies and behaviors develop and are reshaped, how technological innovations arise, or how and why social and cultural components of niches take the forms that they do. The articles in this special issue draw on numerous theoretical frameworks, in most cases integrating them, to gain a deeper understanding of human processes underlying niche construction through the use of qualitative and quantitative methods. These include frameworks from evolutionary biology, physiology, comparative primatology, behavioral ecology, cognitive science, institutional theory, actor-network theory, and linguistic/kinship theory, to name just a few. At the heart of most papers is the question of human ultrasociality—how humans build cooperative groups of considerable scale.

Lee Gettler (2016) tackles fatherhood via an integration of physiology, social history, and cultural institutions. He uses fatherhood as a framework for modeling human behavior across different explanatory scales, including evolutionary, ontogenetic-developmental, ecological, and cultural, as well as corresponding mechanisms of transmission and feedback. Gettler focuses on testosterone and the biology of fatherhood to integrate various aspects of human niches with patterns and adaptive processes in our physiology. He argues that culturally specific institutions across human groups shape the actions, beliefs, expectations, and structures of fathering. It is in human developmental plasticity (and some canalization) that individual- and cross-cultural variability in be-

liefs and behavior can be connected to patterns of neuroendocrine responses.

Gettler delves into animal and primate models in order to provide the core physiological context (and neuroendocrine correlates) needed to develop a niche construction scenario for human fatherhood. Here the interfaces between broadly shared evolutionary patterns and culturally mitigated aspects of gender socialization and paternal roles interact in the construction and navigation of cultural niches and shape boys' developmental trajectories from infancy, through adolescence, to fatherhood. Gettler concludes that "culturally constructed neurobiological-endocrine pathways enable individual behavior-cognition and social interactions, which are at least contributing factors to the emergent phenomenon of cultural complexity."

Drawing on niche construction theory, neuroanthropology, ethnography, ecology, social theorists, and inferences from studies of various small-scale societies, Greg Downey (2016) demonstrates the power of an integrated anthropological analysis. He uses the template of niche sensitivity that he and Daniel Lende (Downey and Lende 2012) developed to demonstrate that the human neurological endowment primes us to heightened receptivity to a developmental niche. Using the urban landscape as that niche, Downey walks us through a case study of street children and urbanization to show how urban niche construction influences developmental trajectories and how the niche stratification of urban landscapes results in diverse effects on humans living there. Downey outlines how the urban context, with its radically simplified foraging landscape, availability of diverse high-energy food resources, decreased activity patterns, and challenges to mental health from unprecedented levels of social interaction, creates novel ecological and social challenges for its inhabitants. This is especially true for those on the lower rungs of the socioeconomic ladder. In the case of the children, some street children have so finely tuned their skills to harvest available urban resources, to exploit the urban niche, that they do better than one might expect outside of the traditional social structures.

While Downey notes that cities are too young to currently assess if urbanization has profound population genetic consequences, he demonstrates that the scale of urban anthropogenic change and its concomitant ecological consequences result in substantial phenotypic effects on their inhabitants. However, Downey cautions against an overly mechanistic application of niche construction theory (NCT) or any simplistic evolutionary approaches, and he stresses the need to move beyond reliance on meeting the neo-Darwinian litmus test of population-genetic consequences in attempts to connect NCT with core anthropological endeavors.

Doug Bird and his coauthors (2016) unpack the forces that create the productive landscape mosaic in the western desert of Australia through an anthropogenic fire regime. They draw on the concept of emergence to explain how larger patterns arise through a convergence of simpler entities that do not exhibit properties of the whole. At the base of the landscape

architecture is Martu burning practices to acquire food through harvesting lizards, a foraging strategy that fits expectations derived from models in evolutionary ecology. Through hunting people seek to acquire enough food to produce a surplus to share and thereby bind communities and networks of kin through possession or sharing of a common substance. Decisions driving foraging are decisions about sharing, fueled by emotions for compassion.

Martu build wealth in people rather than wealth in things (Guyere 1995), wealth that allows them to lay claims as custodians of estates inherited from the ancestors by binding together networks of co-owners. Social prestige derived from sharing confers authority to maintain the estate through ritual performance, artistic expression, and negotiations concerning social institutions such as initiation and "the Law." The landscape mosaic is thus motivated by mundane needs to obtain food, social desires and ambitions to build community and networks through sharing, and holding country through gathering co-owners and the regular performance of ritual. The ecological system that emerges is fragile. In the 1960s when the Martu were removed from their homelands, and therefore anthropogenic burning no longer occurred, the land became overgrown with spinifex grass, natural wild fires were devastating, and many species vanished.

The insights in the Bird et al. (2016) paper of how complex ecological niches arise from foraging goals, social agendas, and ritual performance come from mixed methodologies. Rigorous scientific methodology framed by both inside and outside perspectives provides quantitative data on the returns from foraging, patterns of sharing, and the impact of fire on flora and fauna in Martu estates. The vivid painting by Martu artists of a hunting ground also gives the view from both inside and out. It portrays how complex landscapes emerge from simpler individual choices, accompanying emotions, and perceptions, motivated in part by institutions and rituals that build wealth in people. It also utilizes media and values to draw an international audience. The science and art initiate a conversation between the Martu and the global community.

Essential to human ultrasociality is a cognitive capacity: the imagination. Without the imagination, groups of hundreds, or hundreds of thousands, cannot take on a common identity, and they cannot form a virtual community composed of kin, friends, and strangers as well as ancestors of generations past. Maurice Bloch (2016) combines approaches from experimental psychology and interpretive social anthropology to examine the imagination from the outside via scientific studies of cognition in children, and from the inside, through his own long-term ethnographic studies in Madagascar. He argues that despite its creative powers, the social imagination is by no means unbounded. Studies of children's pretend play show predispositions for taking on already shared imaginations. Expectation of roles and rules begins at a very early age as the child joins a preconstituted system of shared conventions and institutions; cognitive predispositions allow him or her to learn easily.

Likewise, when the kinship system of the Malagasy villagers is seen from the inside, it characterizes all internal relations as kin relations, a very real “one family” with rules and duties. Once conceived as such, these relations are indeed very real. In the Malagasy’s elaborate circumcision rituals, the first part of the rites evoke a disorganized world where only links through women, particularly mothers, are recognized. The second part of the ritual violently replaces the first by legitimizing the child’s connection to father and father’s ancestors. The ritual brings about an ordered world out of a chaotic one through denial of basic facts, for example, that children are born from women. Malagasy, like Westerners, cannot imagine a world without rules, roles of groups.

Bloch concludes by asking what views from the outside and the inside have in common, or if the chasm is insurmountable. His answer: that all humans weave narratives about the fundamentally similar physical world that make sense of the way we behave on the basis of shared motivations and understandings; “scientific imagination involves imagining the imagination of those we write about.” Consequently, what is thought of as “from the outside” is not as “outside” as science often pretends, and the inside view of the people we study cannot be as coherent and closed to a “from the outside” view as some ethnographers pretend it is. The chasm might not be as great as we think.

Benjamin Purzycki (2016) addresses how religious beliefs correspond to the problems of cooperation and coordination among nomadic pastoralists in the Tyva Republic of southern Siberia. Using systems approaches motivated by evolutionary theory, he tests hypotheses regarding the potential of religion to minimize social and ecological costs in the pastoralist niche and how religions evolve in response to shifting pressures. Humans extend their cognitive capacity for “theory of mind” to the gods, that is, their ability to attribute mental states to others in order to discern their perspectives, desires, and intentions. Purzycki proposes that the gods should be concerned about salient local problems and their resolution. Their concerns should change as new problems arise.

Via their syncretically intertwined shamanism and Buddhism, the people of Tyva engage with a practical and ritual landscape structured by the placement, creation, and renovation of cairns (*ovaa*). The *cher eezi* are the spirits who reside in areas marked by these *ovaa* and are central figures in the rituals and herding movements and landscape use in Tyva. What do people believe about the concerns of the spirit masters and how do such beliefs relate to social and ecological problems? By measuring the degree to which Tyvans’ models of morality overlap with models of spirits’ concerns, Purzycki arrives at intriguing results: that Tyvan spirit masters are believed to care about ritual and maintaining the vitality of the resources over which they lord, but not to care about the broader moral order in Tyva society. Performance of rituals at *ovaa* signal respect of boundaries to other Tyvans, thereby generating trust in a competitive

pastoralist niche. However, recent problems arising in the area, severe alcohol abuse and littering, are now being recognized as behaviors that anger the spirit-masters, indicating that representations of the god’s minds may evolve to meet new challenges.

Pierre Lienard (2016) asks the question of how humans overcome nepotistic tendencies to build large-scale social groups in decentralized societies, focusing on male age-sets that are typically found in tribal groups living in diverse ecological niches around the world. Lienard reviews the cognitive abilities that ground and motivate the cooperation of unrelated social agents in complex social groups. These include ability to grasp the “rules of the game”; to develop, adopt, and enforce norms; and to build social categories on the basis of observed characteristics such as age. Humans recognize cues of ages, show preference for peers, and tend to use the relative age difference as a proxy for competence and authority.

Among the Turkana of Eastern Africa, the primary incentive for forming large cooperative units is the defense of livestock in a niche where stores of wealth can be easily raided. The sustained pooling of individual contribution is accomplished through the grouping of male coevals in cohesive groups or sets. Members of age-sets have strong expectations about their peers’ appropriate behavior and defer to the scrutiny and judgment of their senior age-sets. Duties of age-mates in younger sets are demanding, but there are no alternative paths to secure protection and other forms of assistance offered by group membership. Age-sets play a role in the functioning of many distinct institutions: political and ritual participation, public courtship, collective dancing, marriage, and so on. Age-sets are self-organizing in that members establish effective task-oriented internal dynamics by taking into account the respective abilities of their members.

Lienard gives vivid and compelling ethnographic descriptions of the workings of age-sets and their relation to evolved psychological dispositions based on data and observations from long-term fieldwork. He closes by outlining the incompatibility between the growth of the market economy and age-based systems in Turkana. With cash, new educational opportunities, and business options, traditional hierarchies based on age ranking become inverted as youths enter a world filled with choices.

Humans construct social niches that have continuity through time, allowing for the inheritance of group membership, resources, property, and cumulative cultural traditions. Beverly Strassmann and Nikhil Kurapati (2016) address the question, what is the basis for patrilineal cooperation as opposed to other forms of human social organization? Under what conditions do humans chose patrilineal descent?

To test which factors explain patrilineal organization and cooperation among the Dogon of Mali, they bring data to bear on several hypotheses: (1) reciprocal altruism and indirect reciprocity or reputation, (2) inclusive fitness, and (3) the benefits of cooperation in defense, inheritance of land, ritual

maintenance of the land, and mate guarding. They apply meticulously collected data on genealogy, genetic relatedness, residence, and land ownership from a study population of 9,675 Dogon to seek answers to their question. Results indicate that kin selection could only be important within small, closely related clusters of kin who work and eat together, but not for the lineage as a whole. Lineage members benefit from cooperation and collective action in the defense of land under the leadership of elders who also maintain a structured system of land inheritance. Lineage members hold rituals that tie people together both within the lineage and between lineages and represent a collective effort to elicit the help of the god Ama to enhance the fertility of their agricultural subsistence base.

Among the Dogon, land, the key resource, is a heritable and defensible resource that allows males to increase reproductive success through polygyny. Therefore, Dogon parents get better payoff from bequeathing wealth to sons than to daughters if paternity certainty is high. Paternity certainty is assured through cooperation of men in the lineage through mate guarding each other's wives in menstrual huts and paying the cost of forgoing cuckoldry for more paternity security. The take-away message from this study involving years of data collection is that it takes multiple theories and a range of methodologies to develop a more effective explanatory account for patrilineal cooperation.

Most human societies express ethnic or in-group versus out-group affiliations that are marked symbolically, an essential process in defining the social landscape and structuring interaction. This process has both cognitive and cultural components. Cristina Moya and Robert Boyd (2016) use a functionalist cultural approach combined with an evolutionary approach to social cognition to uncover evolved biases for learning socially relevant taxonomies and cultural accommodations. From functionalist models, they predict that humans will have a predisposition to favor sartorial markers that allow subjects to make quick decisions without a high risk of errors, that will make detecting group membership easy, and will lead to adaptive interactions. Sartorial markers would be expected to be prioritized for signaling ethnic affiliation because they are highly visible and can accommodate cultural variation and change. If the use of sartorial markers for stereotyping has a cognitive basis, children should rely on sartorial signals for stereotyping more than adults because adults have a more nuanced sense of what sartorial markers mean from their lifetime of interactions.

Moya and Boyd look at two very different communities, one in highland Peru and one in the urban United States, to see if sartorial markers motivate ethnic stereotyping more than do body morphology, emotional expression, and socioeconomic cues. The results indicate higher reliance on sartorial markers for children than for adults, indicating a cognitive bias for guided learning in the construction of social taxonomies. However, American subjects relied on occupa-

tional status more than sartorial markers, indicating how culture and economically adaptive interests influence cognitively based learning biases.

Kinship systems provide the basis for extending cooperation beyond the local group in most small-scale societies. Alan Barnard (2016) argues that all kinship systems possess similar attributes that require explanation from the entire range of anthropological sciences. He reviews theories on the "revolutions" in human evolution, discusses the coevolution of language and kinship, and then presents his own model. True kinship, he argues, emerges with elementary structures (Lévi-Strauss 1969 [1949]) and universal kin classification typical of most hunter-gatherers today. Classification of relatives must be reciprocal: if I call a person mother, she must call me daughter. With universal kinship systems, anybody who seeks alliances by marriage or exchange can be fitted into the kinship system, greatly expanding access to surrounding social and environmental niches.

Barnard goes on to give a key example of the importance of using different subdisciplines to understand the transformation of the kinship system of the Naro Bushmen of Botswana and Namibia. Originally the Naro spoke a Kx'a language and had a Kx'a kinship system similar to the Ju/'hoansi. Subsequently they acquired a Khoe language and kinship system. To explain this shift, it is necessary to turn to understandings from other subfields. First, in small populations it is likely that most people spoke several languages, as they do in southern Africa today. Since language governs the kinship system, people would operate in different kinship systems at different times according to which language they were speaking. Consequently they would understand the social structure and institutions of surrounding groups facilitating transitions, in the Naro case from a small set of multilingual groups to an essentially monolingual one. Human predispositions for taking on already shared imaginations or cultural traditions (Bloch 2016), both of one's own society and those of others, facilitated cultural transmission and the widespread globalization we entertain today. Barnard proposes that our discipline is distinctive in that it seeks to capture truths that our informants might broadly agree with and so "we seek explanations from both the inside and from the outside."

Polly Wiessner (2016) looks at how cultural institutions shape the cognition, motivations, emotions, and responses of actors in different niches. She compares the sanctioning of aggression, in- and out-group sentiments, revenge, and reconciliation in two radically different societies: the Ju/'hoansi (!Kung) Bushmen of the Kalahari and the Enga of Papua New Guinea. She suggests that evolutionary dispositions to pursue agendas through aggression are modified by cultural institutions that adapt strategies to the needs of the local natural and social landscape. Among the Ju/'hoansi (!Kung Bushmen), the prevailing "sacred value" (Atran 2016) is the rejection of aggression and violence; violence is met with moral outrage. Eschewing violence allows people to gain access to social and ecological niches of others and thereby

distribute themselves over the resources of a vast area. However, because the Ju/'hoansi have no cultural means for dealing with violence other than dispersal, they have a higher homicide rate than would be expected given their peaceful norms. In contrast, cultural institutions regulating aggression among the Enga define sacred values as defending clan honor and property and supporting brothers but have no greater ideological cause. Nonetheless, owing to material, individual, and social interests filled through maternal and affinal ties outside the clan, the Enga have developed cultural institutions to temper violent action. Wars are contained and peace is reestablished through mediation and compensation. These conventions lead to lower homicide rates among the Enga than in many other tribal societies.

Wiessner's analysis indicates how the complimentary use of emic data, from the inside, and etic data, from the outside, is essential for understanding the impact of cultural institutions on behavior. A challenge for anthropology will be to understand how different kinds of emic data from the inside are generated, distributed, exchanged, and controlled so that they can be applied systematically in analyses.

Mary Shenk and her colleagues (2016) look at how cultural traditions governing marriage take the practice of mating far from its biological roots. In an analysis of how culture and economy govern mating, they analyze data from Matlab in rural Bangladesh, a community that is undergoing a rapid transition to a market-based economy. Drawing on the framework of intensive (consanguineous) and extensive kinship, they predict that with the shift away from intensive agriculture, marriage systems will become more extensive as people seek new social ties that open access to the resources of the modern world. The results of the analysis are mixed. Qualitative results suggest forward-looking desires for a shift to extensive marriage "to make new relatives." Quantitative data do not support the model as strongly, in part because marriage is a moving target in this rapidly changing world. One of several confounding factors is that there are increasing numbers of "love marriages." Such marriages would result in extensive kinship patterns, except that in rural areas, unlike urban ones, young people are more likely to meet and socialize with cousins and fall in love. Nonetheless, marriage patterns in Matlab are being gradually adapted with a shift from a niche involving intensive farming to one of a market economy where extensive kinship provides valuable new ties. Since marriage ties provide the foundation for a good part of social life in most traditional societies, changes in marriage patterns will redefine the extent of social niches, property rights, information flow, economic transactions, and social selection pressures.

Craig Palmer, Kathryn Coe, and Lyle Steadman (2016) revisit concepts of the "human social niche," as well the processes by which it came to be, by interlacing theories of kin selection with ideas concerning selection on cultural traditions that were initiated and reproduced over generations by the ancestors. They reject the idea that the concepts

of a group and group selection are necessary for the construction of traditions that promote cooperation and altruism. Rather, humans invented traditions that influenced offspring and their siblings to engage in cooperation and altruism and to extend such behavior to codescendants who were identified as distant kin by traditional names and other ethnic markers. Indeed, when ethnographers ask why people do something, the explanation is often "because that is what we learned from our forefathers."

Key to this process was parental manipulation during the long human childhood that suppressed selfish behavior in descendants' lifetimes, and even after death, through the transmission of traditions. Selection would have favored individuals who could most effectively influence the social behavior of their descendants through passing down traditions and codes of ethics to future generations. This enterprise required agency, social skills, and hard, sustained work if the landscape of cooperation and altruism was to be reproduced and expanded over generations. Palmer, Coe, and Steadman illustrate their arguments with examples from three very different societies: the Hewa of Papua New Guinea, the Chachi of Ecuador, and the Newfoundlanders of Canada. Their arguments do much to further understanding of construction and maintenance of the human social niche over hundreds or even thousands of years. They also clarify the role of the reproduction of traditions in defining some of the essential parameters for social selection.

Scott Atran (2016) ventures into some of the most perplexing terrain of human behavior: that of devoted actors who fuse their identities with a collective one and thereby make extreme sacrifices that are disassociated from rationally expected risks and rewards. Collective identities are formed through shared beliefs, ritual communion, and emotional bonding. There is no fact-checking of the foundation of such beliefs. Atran traces evolutionary predispositions for such identity fusion to costly commitments to sacred values, rituals, and sacrifices that may have advanced individual interests directly or may have done so by promoting the survival of the groups upon which they depended for their existence. He proposes that in the past, beliefs and values that were seen as inherently sacred may have had more materialistic origins and were transmitted vertically across generations within defined territories. Outsized commitment may have allowed smaller groups to prevail against larger ones.

Today, through media-driven campaigns, the global jihad has co-opted these evolutionary-based predispositions to construct a transcultural niche composed of members from more than 80 countries, founded largely on peer-to-peer interactions. Once committed to sacred values and imagined kin, people will not compromise, regardless of the cost to their lives or the lives of loved ones. Recently, inspired by the media, bands of brothers composed of young people have been hooking up through personal contact or via the internet, inspiring each other to undertake wanton, extreme violence in the service of the heroic jihad cause. Atran pro-

poses that this is not a resurgence of traditional culture but the result of unmoored generations seeking social identity that gives personal significance and glory. An essential take-away message for the public and the politicians is that once identities are fused and committed to a sacred cause, actors are immune to material incentives. Initiatives to offer material incentives may even backfire by intensifying refusal to negotiate and compromise.

Hammad Sheikh, Ángel Gómez, and Scott Atran (2016) examine the relationship between threats to sacred values and the willingness of those who hold the values to defend them by extreme actions. They demonstrate that people will become willing to protect sacred values through costly sacrifice (life-threatening and other extreme actions) when such values are associated with groups whose individual members fuse into a unique collective identity. While broader cultural institutions generally regulate aggression and violence in societies, the sentiments associated with “brotherhood” and “sacred values” seem more effective at leading humans to forgo material concerns and even sacrifice their own lives as devoted actors. Sheikh and colleagues test the devoted actor hypothesis (Atran 2016) experimentally by comparing interviews and surveys of Moroccans associated with militant jihad and Spaniards upholding democracy to examine what conditions, perceptions, and experiences might make people willing to make costly sacrifices. Moroccans expressed willingness to make costly sacrifices for implementation of strict Sharia—and were supportive of militant jihad—when they were most connected to a kinlike group of friends and when they considered Sharia law as sacred. The Spaniards who felt most connected with a kinlike group of friends and who considered democracy as sacred were the most willing to make costly sacrifices for the concept of democracy, especially when reminded of the threat jihadi terrorism can offer to democracy. Spaniards were also more likely to consider their own group as formidable and jihadis as weak.

The work of Sheikh and colleagues presents a picture of devoted actors who have created a set of perceptual and social expectations and cohesion, whose participants are viscerally connected with a core group of fellows, who have strong values, and who are willing to make extreme sacrifices when they believe their values are under threat. They argue that it is the personal commitment to preserve and support their core group’s specific principles and positions, preferences and privileges—and to do so regardless of apparent risks or costs—that characterizes the devoted actor. This assertion and its consequences hold important information for anthropology writ large and for our understandings of the current complexities and realities of extremism and terrorism globally.

## A Final Note

The papers in this volume run the gamut of approaches for reintegrating anthropology via the use of data, theory, and

conceptualizing the complexity of human systems. They are not all in agreement on explanatory priorities nor do all of them focus on the same approaches in developing outcomes and solutions. But this is a good thing. To develop an effective reintegration requires anthropologists to take a genuinely open and intellectually expansive approach to the exchange of ideas. We need to move away from artificial dichotomies and standing grudges toward collaboration and a respect for theoretical plurality. The unifying aspect of this collection is the sincere attempt by all of its members to involve more than a single approach and to integrate or even fuse views from the inside and outside into novel, data-driven, and theoretically hybrid anthropological endeavors. There are already many anthropologists working in this manner in a variety of intellectual niches. We hope that the papers in this issue will motivate many more.

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There are few feasts of mind and body that can match our experience with a Wenner-Gren symposium. From the outset, our ideas were met by Leslie Aiello with enthusiasm and just enough guidance to be able to explore possibilities and still make a conference doable. When we began the expected drudge of organizing the conference, we were told by Laurie Obbink that she would handle such matters. That meant no fund-raising, photocopying, mailing, or travel arrangements would land in our laps. At no point did we take her organizational skills and advice for granted, well aware of the hard work that goes into a conference from start to finish. Owing to years of Wenner-Gren experience and the warmth, competence, and graciousness of Leslie and Laurie, the conference proceeded with an ideal balance between group sessions, time for individual discussions, and outings in the glorious landscape and climate of Sintra, Portugal. We left feeling nourished from the inside out, and outside in, with a great deal of gratitude toward Leslie, Laurie, the Wenner-Gren Foundation, and all the participants who contributed to make a most congenial and inspiring group. Finally, we owe special thanks to Ashley Grimes (University of Utah) for her splendid job as rapporteur.

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# The Extended Evolutionary Synthesis, Ethnography, and the Human Niche

## Toward an Integrated Anthropology

by Agustín Fuentes

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Seeing bodies and evolutionary histories as quantifiable features that can be measured separately from the human cultural experience is an erroneous approach. Seeing cultural perceptions and the human experience as disentangled from biological form and function and evolutionary history is equally misguided. An integrative anthropology moves past dichotomous perspectives and seeks to entangle the “inside” and “outside,” methodologically and theoretically, to move beyond isolationist trends in understanding the human. In this paper I illustrate the underlying rationale for some anthropological lack of engagement with neo-Darwinian approaches and review contemporary evolutionary theory discussing how, in combination with a dynamic approach to human culture, it can facilitate integration in anthropology. Finally, I offer an overview of the human niche concept and propose a heuristic framework as a set of shared assumptions about human systems to help frame a sincerely anthropological and emphatically evolutionary approach to the human experience.

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### Providing Context

Despite recent movement reflecting cross-fertilization in the core areas of ethnography and evolutionary approaches (e.g., Andersson, Törnberg, and Törnberg 2014; Barnard 2012; Downey and Lende 2012; Hewlett and Lamb 2005; Ingold and Paalson 2013; Trevathan, Smith, and McKenna 2008; Wiessner 2014), the divisions that plague anthropology remain substantial. For anthropology to be most successful in its stated endeavor, the study of the human (writ large), we need a reintegration of diverse methodological and theoretical tool kits. Neither everyone working in anthropology nor all anthropological questions require such an integrated tool kit. However, the field on the whole severely needs such approaches as part of its normative practice if we are to be able to honestly assert that we are indeed different from other social sciences, to provide better and more holistic options than the biological sciences, and to live up to our ideals of equally valuing the humanistic and the scientific in the understanding of human being and becoming (e.g., Peregrine et al. 2012; Wolf 1964).

Key areas contributing to the lack of reintegration are the ways in which evolutionary and social anthropological approaches are conceptualized as antagonists and how this is applied in professional practice and the training of graduate students. Core

elements facilitating this standoff are the ways in which evolutionary processes are (mis)understood by many sociocultural anthropologists as incompatible with humanistic and ethnographic approaches (e.g., Segal and Yanagisako 2005) and the (over)simplification of complex dynamic human systems by many evolutionary anthropologists as they attempt to fit their analyses of the human into neo-Darwinian models (e.g., Kaplan et al. 2000).

Many anthropologists underplay or ignore the fact that evolutionary processes are ongoing in human populations. This practice is due in part to the lack of easy fit between the kinds of data that emerge from deep ethnographic study and basal assumptions about evolutionary approaches (Schultz 2009) and a lack of actual familiarity with contemporary (post-1980s) evolutionary theory on the part of many anthropologists. However, there is validity to the assertion that in “evolutionary” approaches over the past 40 years, it is common to see, for practical reasons, a prioritization of a trait-based natural selection and the use of cost-benefit analyses in explaining human behavioral action (e.g., Alexander 1987; see also Smith 2000). For many social anthropologists there are simply too many reductive assumptions in such an approach relative to the observable complexity in human systems (Ingold 2007; Schultz 2009).

To get beyond this sticking point and move to a better anthropology, we need to dismantle the conceptualization of the biological and social as distinct domains in the human and see them as intertwined processes that are not wholly separable in our models and analyses. We need to adopt an integrative approach that has as its basal assumption a system of entangled

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agents and processes involved in the human experience (Ingold and Paalson 2013; Marks 2012, 2015; Schultz 2009).

Much of what I suggest in this paper is already extant in anthropological practice (Downey and Lende 2012; Goodman and Leatherman 1998; Hewlett and Lamb 2005; Ingold and Paalson 2013; Lipatov, Brown, and Feldman 2011; Wiessner 2014, and others). However, there is no standard theoretical tool kit for such endeavors, and the bulk of anthropological practitioners are not truly up to date with contemporary evolutionary theory (e.g., extended evolutionary synthesis [EES]; Laland et al. 2015). My goal in this essay is to contribute to the ongoing reintegration of ethnographic and evolutionary approaches in anthropology by blending the inside and outside views via fostering an enhanced engagement with contemporary evolutionary theory.

I will do this by first illustrating an underlying rationale for some anthropological lack of engagement with neo-Darwinian approaches. I will then review contemporary evolutionary theory and discuss how, in combination with a dynamic approach to human culture, it can facilitate integration. Finally, I offer an overview of the human niche concept and propose a heuristic framework as a set of shared assumptions about human systems to help frame a sincerely anthropological and emphatically evolutionary approach to the human experience.

### Beyond Traditional Neo-Darwinian Assumptions

In any evolutionary analyses, organism-environment interactions are a central concern, and understanding the context in which natural selection and other evolutionary processes act is key to developing insight. However, many neo-Darwinian approaches assume that the individual and its relationship to the environment (assessed ultimately via genetic fitness trade-offs)<sup>1</sup> is the most salient feature of a system (e.g., Hawkes et al. 1998; see Smith 2000). Even when there is explicit acknowledgment of a key role for social groups and institutions, the basal assumption is that evolutionarily relevant processes ultimately result from the competition for reproductive success between individuals (as mediated by their environment and social groups; e.g., Glowacki and Wrangham 2015; Macfarlan et al. 2014). This creates a theoretical context wherein the individual and its fitness-based relationship to a given (social/ecological) environment is the basal heuristic framework for evolutionary models. Or, in a minority of cases when group-level selection is introduced, the common tactic is to model groups as units (i.e., individuals) in competition with one another as affecting the reproductive success of the individual

1. Here “fitness” is assumed to be lifetime reproductive output, or simply the number of times one gets one’s genetic makeup successfully into the next generation. Even though many nongenetic elements can be used as proxies, the standard neo-Darwinian assumption is that the evolutionarily relevant inheritance unit is that of genetic material, so neo-Darwinian fitness equals the number of times an individual’s DNA sequences are transmitted into subsequent generations relative to other individuals of the same species in the same population.

members constituting the competing groups (Choi and Bowles 2007).

In these approaches evolutionary pressures are modeled as potential effects on reproductive output, challenges to individuals’ energy budgets (and associated health risks), and the variation in future potential fitness via individuals’ actions in relation to other individuals and local environmental contexts (Smith 2000). Such approaches have provided significant contributions for the construction of models and theory (e.g., Flinn et al. 2007; Kaplan et al. 2000), but they remain incomplete. Evolutionary theory has come to a point that mandates a move away from focusing exclusively on natural selection, genetic-based fitness, and their relationships to individuals to a systems approach in analyses of evolutionary histories and processes (Bateson and Gluckman 2011; Hinde 1976; Laland et al. 2015; Lewontin 1983; Oyama, Griffiths, and Gray. 2001; Sterelny 2012).

Humans construct ecological, technical, and cultural niches that influence the structure of evolutionary landscapes.<sup>2</sup> Manipulation of plants and animals, developing tools and machines, construction of dwellings and alteration of landscapes, religious, legal, and familial institutions all affect the contexts and options available to humans (individually and communally) in regard to interactions with evolutionary processes: these structure and channel the strategies of human actors. Given the centrality of entangled physiological, social, semiotic, cognitive, historical, and institutional processes in the human niche, evolutionary approaches need to be better integrated with a broader anthropological context in order to best facilitate greater understanding of humans (Downey and Lende 2012; Goodman and Leatherman 1998; Ingold and Paalson 2013).

A core challenge to this integration is the development of a heuristic that includes an evolutionary framework that engages with cultural systems and processes including institutions and recognizes the fluid and entangled interfaces between individuals, groups, and community-level dynamics. To do this we need to take both biology and history into account. Instead of thinking of human biological and social processes as distinct, we need to see them as intertwined and integrated (and at multiple levels; Fausto-Sterling 2000; Marks 2015; Read 2012). This can be accomplished by integrating perspectives from contemporary evolutionary theory along with approaches in social anthropology. By doing so we can better equip ourselves to examine the patterns and processes that facilitated such complex creatures (us) who evolve(d) in mutually malleable relationships with their ecologies and each other and continue to do so at a rapid pace.

2. I am using the term “niche” in the contemporary ecological and evolutionary view: it is the dynamic *N*-dimensional space in which an organism exists—the totality of the biotic and abiotic factors that make up an organism’s main context for the evolutionary dynamic (the interaction between organisms and evolutionary forces; e.g., Hutchinson 1957; Wake, Hadley, and Ackerly 2009).

## Engaging the EES

“Organisms are constructed in development, not simply ‘programmed’ to develop by genes. Living things do not evolve to fit into preexisting environments, but co-construct and coevolve with their environments, in the process changing the structure of ecosystems” (Laland et al. 2014:162). Natural selection, a key process by which biological variants achieve differential representation in subsequent generations, is not the only salient evolutionary process. A neo-Darwinian theoretical orientation that places primacy on natural selection as the primary architect of evolutionary function inhibits enhanced integration (Andersson, Törnberg, and Törnberg 2014; Laland et al. 2014). Evolution is a synergy of multiple processes, and EES stresses that a range of drivers, including ones that cannot be reduced to genic levels, are relevant. Laland and colleagues (Laland et al. 2014:1) argue that “the ‘extended evolutionary synthesis’ (EES), retains the fundamentals of evolutionary theory, but differs in its emphasis on the role of constructive processes in development and evolution, and reciprocal portrayals of causation. In the EES, developmental processes, operating through developmental bias, multiple modes of inheritance and niche construction, share responsibility for the direction and rate of evolution, the origin of character variation and organism-environment complementarity.”

Our basic understanding of how biological evolution works in the early twenty-first century is as follows. Mutation introduces genetic variation that in interaction with epigenetic and developmental processes produces biological variation in organisms that may be passed from generation to generation. Natural selection is the shaping of this variation in response to specific constraints and pressures in the environment (*sensu lato*), and gene flow and genetic drift also contribute to changes (or lack thereof) in the topography of the landscape of variation from generation to generation. However, dynamic organism-environment interactions can result in niche construction that can change the patterns, foci, and intensity of natural selection and create modified ecologies that are inherited by subsequent generations. Niche construction is an organism(s)-environment relationship that is dynamic, bidirectional, and mutually malleable. Organisms responding to the ecological pressures on them can restructure the local ecology affecting the very patterns of pressures on them, creating suites of dynamic feedback relationships in evolutionary processes.<sup>3</sup>

Niche construction plays a key role in human evolutionary processes via our ability to modify our surroundings through behavioral means (e.g., O’Brien and Laland 2012). Laland, Kendall, and Brown (2007) suggest that niche construction

theory (NCT) is especially important in the context of the dynamics of human cultural processes because NCT envisions the effects of cultural contexts and actions as a key part of the human niche. For humans, constructing and inheriting ecological contexts is often mediated via material culture (tools, clothes, buildings, towns, etc.), and the actions involved in developing and utilizing this material culture are rooted in the beliefs, institutions, histories, and practices of human groups. Human cultural processes can play central roles in niche construction and are thus active components in an evolutionary dynamic (Kendal 2012; Olding-Smee et al. 2003; Read 2012; Tooby and DeVore 1987).

O’Brien and Laland (2012) use the classic biological anthropological examples of dairying by Neolithic groups in Europe and Africa and the rise of the “sickle-cell allele” among certain agricultural groups in West Africa as concrete examples of niche construction processes in the evolutionarily recent past through today. They describe the shifting behavioral actions, cultural perceptions, and ecological conditions that mutually interacted to produce genetic and physiological changes that themselves resulted in further modification of behavior, physiology, and ecologies. For the example of the sickle-cell/malaria scenario, O’Brien and Laland (2012) illustrate that a by-product of human social-ecological patterns (crop planting) promotes the spread of malaria, which leads to selection for the sickle-cell allele and an increased incidence of sickle-cell disease. This, in some contexts, favors shifting the agricultural practice toward the planting of yams and other crops with medicinal benefits, which also enables further spread of the sickling allele. This eventually facilitates the development of medical treatments (social and physiological) for malaria and more recently pesticide treatments for mosquitoes, which then creates selection for resistance to pesticides in mosquitoes. And today this entanglement continues affecting bodies (not just human bodies), behavior, and institutions.

Historical and current social schemata and behavioral actions can affect genetic and other biological patterns and the process of natural selection, which in turn can affect developmental outcomes (e.g., Henrich 2011; Richerson and Boyd 2005), which can then feed back into the cultural processes and behavioral actions continuing the dynamic interface. The use of the examples of sickle-cell and dairying/lactase retention are not new to anthropological explanations of human evolution, but the application of NCT to the examples moves us away from seeing natural selection constructing evolutionary changes in a directional, and necessarily reductionist, manner to describing multifarious feedback webs and dynamic systems of mutual interface and malleability. Evolutionary change is neither unidirectional nor unimodal; natural selection is not the sole causal agent of relevant change or the sole architect of function. Even the patterns of inheritance that underlie natural selection—the transmission of variation across generations—are dynamic.

Jablonka and Lamb (2005) demonstrate that evolutionarily relevant information, the variation that is the fuel for evolu-

3. See <http://lalandlab.st-andrews.ac.uk/> and Odling-Smee, Laland, and Feldman (2003) for basic overviews, O’Brien and Laland (2012) for applications to classic biological anthropological scenarios, and Fuentes, Wyczalkowski, and MacKinnon (2010) for integrations between basic population growth equations and the niche-construction equation applied to human evolutionary scenarios.

tionary change, is transferred from one generation to the next by many interacting inheritance systems: genetic, epigenetic, behavioral, and symbolic (see also Bonduriansky and Day 2009; Ledón-Rettig, Richards, and Martin 2012). Genetic inheritance, the system of primary interest for neo-Darwinian approaches, is the transmission of genetic material (including both DNA and various RNAs) from generation to generation. Epigenetic inheritance (EpgI) is the inheritance of molecular processes, enzymatic actions, protein activity, and/or developmental sequences that affect developmental and/or physiological processes but do not emerge as a result of causal action of specific DNA/RNA systems. EpgI gives rise to morphological, structural, and functional variations at multiple levels in the organism that do not stem from variations in DNA but are still transmitted to subsequent generations of organisms (Jablonka and Raz 2009; Lock 2015).

Behavioral inheritance involves the behavioral actions, patterns, or particulars that are transmitted horizontally (within generations) and vertically (across generations), and it is found in many organisms, with increasing presence and importance in highly social vertebrates. The fourth form of inheritance, symbolic inheritance (SI), is likely only found in humans. SI is the cross-generational acquisition of symbolic concepts, ideologies, and perceptions. This mode of inheritance can have substantive influence on human action, agency, and perception, feeding back into and shaping the other types of inheritance (Andersson, Törnberg, and Törnberg 2014; Kendall 2012; Read 2012). Jablonka and Lamb (2005) also remind us that variation is constructed. Whatever the origin of a variant (genetic, epigenetic, behavioral, or symbolic), the variants that are actually inherited and what final forms they assume depend on various filtering and editing processes that occur before and during transmission at all levels (see also Laland et al. 2014).

Related to the expansion in types and processes of evolutionarily relevant inheritance is the recognition that plasticity in development and behavior is widespread in organisms (West-Eberhardt 2003). Humans displayed substantial plasticity in behavior and physiology in response to evolutionary pressures across our evolutionary history (Aiello and Anton 2012; Kuzawa and Bragg 2012; Potts 2012; Wells 2012). This variation has increased in contemporary contexts (Marks 1995). From early in our history as a species (and genus), there is increasing evidence that morphological and physiological plasticity is accompanied, and even superseded, by behavioral and cognitive flexibility in response to ecological and social challenges (Andersson, Törnberg, and Törnberg 2014; Anton, Potts, and Aiello 2014; Fuentes 2015). It is likely that behavioral/cognitive plasticity facilitated the development of our modern capacity for extensive shared intentionality, metacoordination, and language, and this proclivity for cultural complexity is increasingly invoked as a key to evolutionary explanations of human behavior (Henrich 2011; Kendal, Tehrani, and Olding-Smee 2011; Marks 2015; Richerson and Boyd 2005; Sterelny 2012; Tomasello 2014).

## “Cultural Complexity” and the Human Niche Approach

As Margaret Lock (2015) notes, “individual bodies are not mere containers stuffed with biological entities that age and die over a lifetime; rather, they are products of human evolution; the *longue durée* of history; environments expansive and local; the communities that people live in; the diets they eat; the toxins, insults, and abuses they are exposed to; and the good times too” (171–172).

The human capacity for and expression of culture,<sup>4</sup> however one defines it,<sup>5</sup> is a key element in the human niche, and in the context of EES, it is thus central to evolutionary processes in humans (Andersson, Törnberg, and Törnberg 2014; Deacon 2011; Dean et al. 2012; Read 2012). I expect that most anthropologists (if not all) agree with this assertion. However, this agreement rarely results in serious efforts to link the human cultural experience in all its complexity and dynamism to evolutionary models. Why is that? The lack of linkage is probably due to (a) the immense complexity of human systems, which makes them difficult to fit onto existing evolutionary models based on an individual-fitness-focused natural selection paradigm, and (b) the lack of concordance between the experiences and insights of ethnographers and many neo-Darwinian explanations for human action.

I have published elsewhere (Fuentes 2015) that if we are to take human cultural processes, in all their complexity, as part of our evolutionary approaches, we cannot treat them as a social, material, historical, and perceptual veneer laid over a basal set of physiological capabilities. In human evolution the biological and social cannot be seen as distinct entities (Marks 2015). Nor can we assume “culture” operates in an equivalent nature to the “genome” in regard to natural selection process (Charney 2012; Claidière, Scott-Phillips, and Sperber 2014). Human relationships to evolutionary processes cannot solely be understood via patterns of genetic or cultural fitness costs and benefits (regardless of the proxy or actual fitness measure used) constrained and afforded by behavior, material technologies, socioeconomic and behavioral contexts, and ecologies.

The webs of action and perception, memory and history, items and ideas that humans are entangled in is a dynamic

4. I am avoiding the “do animals have culture” debates here. Yes, there are substantial commonalities and shared patterns between humans and other animals, and many mammals (and birds) have social traditions and regional variants in their behavior and vary even in their perceptions of the environment. However, that particular assemblage of traits that characterize all human societies—language, institutions, moral codes, symbolic and existential belief processes, etc.—is a discontinuity with other forms of life and thus relatively distinctive of our species.

5. Anthropologists have been debating a specific definition for the entire history of our field (e.g., Kroeber and Kluckhohn 1952). Here I use the term as shorthand for what anthropologists often study: the observable, inferable, or otherwise assessable ways in which humans engage with, perceive, construct, and generally participate in the world.

and fundamental constituent of a human niche that is simultaneously constructed by and constructing of this human experience and is thus highly evolutionarily relevant. This is not a novel concept; it is a central theme in any attempt at an integrated anthropology (see Andersson, Törnberg, and Törnberg 2014; Dean et al. 2012; Downey and Lende 2012; Fuentes 2009a, 2009b, 2015; Geertz 1973; Kendall 2012; Read 2012; Richerson et al. 2016), and it needs to be embedded as a basal component in evolutionary approaches to the human.

Taking the EES outlined above and the last century of ethnographic studies seriously mandates that we cannot see human “culture” as just a cluster of measurable traits or culture units/variants. Human cultures are more than perceptions, beliefs, and behaviors—they are also rules, organizations, and so forth, with concrete structures and specified consequences. Cultural systems are interlaced with patterns of social constraint and facilitation, and this is potentially an evolutionary force. A contemporary evolutionary approach has to treat what humans do and experience as a complex system that has specific histories, has inherited ecologies and institutions, and includes a myriad of categories of action and perception as they relate to the interactions between individuals, groups, and the communities in which they exist.

For example, a cultural element of “honor” (often used in gene-culture coevolution scenarios; see Cohen et al. 1996; Richerson and Boyd 2005) has particular histories, symbolic referents, experiential contexts and alterations, and may have varying implications and effects at the individual, group, and community levels. If we are interested in the institutions, processes, and behaviors related to “honor,” we need a system that includes at least these aforementioned processes and variables. These varying implications and interpretations of the concept of “honor” (because it is a concept and not a discrete trait) can play out in different manners in regard to the way it is perceived and embodied and the potential actions it facilitates and influences. These actions might have different, even conflicting, effects on niche-constructive elements and thus evolutionary landscapes at the level of the individual, group, and community. We need to place all of these patterns into an interactive system and accept the complex problems that causes in establishing the origin, function, and role(s) of such cultural elements and practices. It may be that practices have clear functional effects at one level and either none or contradictory ones at other levels.<sup>6</sup> This kind of dynamism has to be taken into account if we are to create comprehensive and more accurate descriptions of evolutionary processes in humans (Claidière, Scott-Phillips, and Sperber 2014).

In developing an integrated framework for thinking about evolutionary processes in humans, we need to break down the

assumptions about boundaries between physiology/morphology, biological development, behavior, perception and embodiment, cultural institutions and history, social experience, and symbolic life. We need to focus on the myriad processes that constitute the moving target that is human existence rather than on the state of being human or of having become human in any one isolated context or manner. Doing this requires some way to, at least conceptually, integrate neurological, behavioral, morphological, ecological, material, and ethnographic elements at multiple levels.

### Toward an Integrated Conceptual Framework

Both theoretical and practical research strongly suggests that we need to develop a framework that includes substantive feedback components involving behavioral, cognitive, material, and ecological components when trying to conceptualize the patterns and processes of human evolution from at least the mid-Pleistocene though today (Aiello and Anton 2012; Andersson et al. 2014; Anton, Potts, and Aiello 2014; Coward and Gamble 2008; Coward and Grove 2011; Kendall 2012; Kuhn and Hovers 2013; Sterelny 2014; Tomasello 2014; Whiten and Erdal 2012). It is also increasingly accepted (at least theoretically) that multilevel selection is an actual pattern in evolutionary processes (Laland and Brown 2011; Laland et al. 2014; Wilson and Wilson 2007).<sup>7</sup> Thus, any basal framework should include the possibilities of evolutionary processes influencing the individual, the group, and even the regional population in similar or different ways and intensities (Andersson, Törnberg, and Törnberg 2014; Richerson et al. 2016; Smaldino 2014; Wilson and Wilson 2007). Therefore, contemporary evolutionary approaches to examining human variation and behavior should be increasingly interested in the role of kinship, economic, religious, and political groups and institutions as they construct and influence the social and perceptual processes and contexts that structure the patterns and strategies for human action.

Despite the emerging trends toward complex systems as core in evolutionary analyses, it remains common for evolutionary approaches to focus on the interconnection between a few specific traits and their interactions with one another. For example, in many evolutionary approaches to contemporary foragers and small-scale societies, it is common to examine the relationship between caloric energy balance, foraging patterns, and the distribution of foraged and hunted goods or to examine marriage patterns, reproductive cycling, and one or two markers of socioeconomic status. These assessments are often undertaken in the context of the traditional neo-Darwinian framework, which mandates connecting these elements to a model wherein the basal explanation for the patterns being observed is derived via the potential effects on individual fitness (e.g., Hawkes et al.

6. Here, as in most evolutionary approaches, “functional” implies that there are evolutionarily relevant outcomes from the focus of interest (the concept of “honor” and all that it entails in this example).

7. Natural selection, as a process, can be modeled as functioning at the genetic, individual, and group levels.

1998; McFarlan et al. 2014; Tooby and DeVore 1987). This can lead to insightful but highly incomplete explanations.

A more anthropological framework would enable the inclusion of some of the key social, historical, perceptual, and institutional variables in which these elements of focus are entangled as a relevant part of the system producing the outcomes, not simply as emergent from or irrelevant to the underlying patterns driven by natural selection (see Atran 2016; Bird et al. 2016; Downey 2016; Gettler 2016; Lipatov, Brown, and Feldman 2011; Wiessner 2016).

If we take this approach seriously, then the range of evolutionary processes in the EES become valuable tools as an expansion on the traditional neo-Darwinian individual fitness framework (Fuentes 2015; Kendall 2012; O'Brien and Laland 2012). The inclusion of multiple modes of inheritance (Boyd, Richerson, and Henrich 2011; Jablonka and Lamb 2005) and the possibilities of significant plasticity in response as process itself (Kuzawa and Bragg 2012; Wells and Stock 2007; West-Eberhardt 2003) become necessary. Trying to include such a diverse suite of inputs, interfaces, and feedback cycles, while potentially quite "messy," enables a more dynamic role for a broader interpretation of cultural behavior and perception: cultural processes (and institutions) must also be part of such a system (Henrich 2011; Kendal 2012; Read 2012).

### The Human Niche

Drawing on Andersson et al. (2014), Deacon (2011), Donald (1993), Flynn et al. (2013), Laland, Kendall, and Brown (2007, 2015), Marks (2012, 2015), Smaldino (2014), Sterelny (2012), Trevathen, Smith and McKenna (2008), Worthman (2010), my previous work (Fuentes 2009a, 2009b, 2014, 2015), and others, I propose a heuristic framework for what the human niche looks like as a way to help integrate evolutionary and anthropological approaches. The primary goal here is to provide a starting point that is more representative of human evolutionary systems than those assumed in most standard neo-Darwinian models.

This framework emphasizes the roles of mutual mutability between agents, collective action, social perceptions, and the roles of experiences and institutions in structuring human behavior as well as encompassing what we know about evolutionary processes (via EES). In envisioning such a context, I acknowledge the influence of Bourdieu's (1977, 1990) conceptualizations of habitus and the framing of "structured structures predisposed to function as structuring structures" (Bourdieu 1990:53; see also Fuentes 2009a, 2009b; Kendal 2012). However, the challenge in developing such a framework is that it has to be reductive enough to meet basal needs of evolutionary approaches (there must be quantifiable elements and predictable outcomes/patterns) but not so reductive that it can only engage with human cultural and cognitive complexity through the lens of individual fitness and natural selection.

"The selection of units for any particular analysis is, of course, only in part a function of the theory that informs it. It is also

a function of the problem at hand, in both its details and its magnitude" (Rappaport 1984:371). The human niche framework I propose consists of three components (or nodes) that interface with evolutionary processes and that have mutual influence on one another: the individual, the group, and the community. These are "units" in the sense proposed by Rappaport (1984), designations useful for the purpose of this heuristic framework, and I direct the reader to his discussion of units and their implications for a robust explanation of this approach.<sup>8</sup> I fully acknowledge that the definition of a human individual (or person) is a multifarious, dynamic, cross-culturally complex, and often contentious topic (e.g., Strathern 1988). However, in the heuristic I am proposing, the "individual" component is literally a single human. In the same vein, the "group" component is explicitly the main social unit for that single human as defined by the questions being asked (extended family, peer group, primary social interactors, etc.). The "group" then is the collection of individuals that form the core social network for the individual in the system of interest. This usage reductively bypasses complexities in definitions of "self" and "individual" for practical modeling reasons, but because what constitutes the "group" is defined by what questions are being asked of the system, it highlights the critical need for ethnographic and/or sociohistorical baselines at the start of any evolutionary modeling.

The component "community" deserves a bit more clarification. Drawing on evolutionary approaches in Rodseth et al. (1991), Gamble, Gowlett, and Dunbar (2011), and Smaldino (2014; see also Deane-Drummond and Fuentes 2014; Fuentes 2014, 2015), I define "community" for the purposes proposed here as the spatial and social context that includes the majority of social partners and the primary settings and ecologies with/in which an individual interacts. It is a collection of individuals/groups with shared "kinship" and social and ecological histories, which is the primary source of shared knowledge, security, and development across an individual's life span. The community has fluid boundaries and multiple possible subgroupings across space and time, but all members share cognitive, social, and ecological bonds even in the absence of close spatial proximity. It is within the context of this "community" that humans interface, interact with, modify, and are modified by social and ecological worlds during the course of our evolution and through today. The community is more than the local group and may range from a small extended network of affiliated groups to a much larger regional entity dependent on the system of interest and the questions being asked (see Richerson et al. 2016; Smaldino 2014).

Each core component in the human niche has its own evolutionarily relevant internal feedback processes. Within the individual, this feedback is across the life span between morphology, development, and behavior. For the social group, it is the feedback created by social relationships between members

8. Also found in sec. 10 of the second edition.

of the group, sexual interactions, and behaviors that occur at the group level via the coordination and relationships of the members. For the community, it is the feedback processes inherent in the relations between demography, institutions, beliefs, norms, and shared knowledge characterizing the community of interest. All three of these aspects of the human niche are also simultaneously in interaction with one another in both directional and feedback relationships. All of the interfaces within and between the three core components are highly dynamic and malleable, and the human niche is indeed a moving assemblage.

To illustrate this framework and its potential to provide a basal context for linking EES processes and anthropological approaches, I will walk through a very brief example of “human sexual partnering.” Usually termed “mating” in neo-Darwinian evolutionary approaches, I use the term “sexual partnering” because in humans, as in many other complex social animals (e.g., Bailey and Zuk 2009), sexual bonds and alliances are not always related to reproduction. Therefore, a focus solely on mating (sexual activity related to reproduction) overly limits the analysis and ignores abundant anthropological knowledge. Sexual partnering per se is neither a trait nor an independent system; rather, it is a pattern of relationships between individuals in groups and communities, a part of human sexuality, and evolutionarily relevant.

### Sexual Partnering and the Human Niche Framework

The biologist Anne Fausto-Sterling (2000), in a broad overview of neurobiology, behavior, and physiology, asserts that sexuality is a somatic fact related by a cultural effect. She and many others (e.g., Tolman and Diamond 2001) demonstrate that understanding patterns of adult sexual behavior cannot be effectively detailed without acknowledging the extreme entanglements and mutual mutability between developing bodies of individuals; the social and ecological experiences they have in groups; the structure, beliefs, and sexualities present in the groups; and the historical, economic, and political ecologies of the larger communities that shape the patterns of those groups. This same outcome is seen in ethnographic and psychological approaches to sexuality wherein individuals’ expression of sexuality and desire, experience, embodiment, and agency are entangled with elements of groups and larger communities (see Donnan and Magowan 2010; Nanda 1999).

Sexual partnering is a common focus of evolutionary questions about humans. It is something that is found in all human societies, and our understandings of biology and the ethnographic record leave no doubt about the thorough and intricate entanglement of biological, behavioral, economic, historical, symbolic, experiential, and perceptual constituents of the processes involved. So, when seeking to understand sexual partnering in a given group of humans, we need minimally to include the following: (1) patterns of choice of sexual partners; (2) the possibility that there is a history of sexual selection that has influenced the morphologies, behaviors, and sexual processes we are

observing; (3) the structural constraints and facilitators provided by specific reproductive physiology in humans; (4) individual variation (behaviorally, experientially, physiologically); (5) local ecological contexts; (6) group and community demography; (7) individual and group perceptions and display of gender roles and sexual activity; and (8) institutions, traditions, and technologies that promulgate and limit gender roles and sexual activity (marriage, laws/morals, kinship associations/regulations, economic constraints, medical interventions, etc.).

All of these elements are interactive, mutually malleable (with varying degrees of plasticity), and have a history that is both structured by and structuring of the ways in which humans navigate and interact with each other and their niche(s)—they are part of an evolutionary dynamic.

Figure 1 shows the component “individual” with its internal feedback process and the external pressure of ecologically mediated selection. This, by itself, reflects the basic model used in most standard neo-Darwinian approaches. Within the individual, the feedback processes involve structural constraints and facilitators of reproductive physiology, individual variation (behaviorally, experientially, physiologically), and physical and social development, and all are shaped via interfacing with local ecological contexts. In the case of sexual partnering, physical development (growth and maturation) and its relationships to morphology and physiology is central in establishing the basal parameters and is contingent on external factors related to nutrition, disease ecology, and social cues. As the individual matures physiologically (i.e., passes through puberty/menarche), endocrinological shifts can combine with behavioral options and ecological inputs/challenges in feedback relationships to prime or suppress physiological and perceptual/cognitive options for attempts, failures, and success in sexual activity (see Gettler 2016).

Figure 2 illustrates the addition of the second core component, the social group, to the framework. The group is the core social context in which the individuals interact with one another. Thus, it affects the patterns of evolutionary forces (bio/ecological and social) on the individuals, and by their actions the individuals can influence the structure and intensity of processes on/in the group. The same ecological context placing pressure on the individuals is also placing pressures on the group. This stage of the framework is common in many descriptions of group-level selection dynamics and in many approaches in human behavioral ecology, particularly in the context of intragroup competition (Fuentes 2009a, 2009b; Laland and Brown 2011).

In the context of sexual partnering, the group is the core social structure that provides the context in which the individual experiences and responds to evolutionary pressures. The age/sex makeup (demography) and subgrouping patterns within the social group, the frequency and tenor of social interactions, and the structure of social bonds between individuals within the group provide the central landscape (the social ecology) in which the internal feedback processes of the individual play out. This landscape shapes variables such as

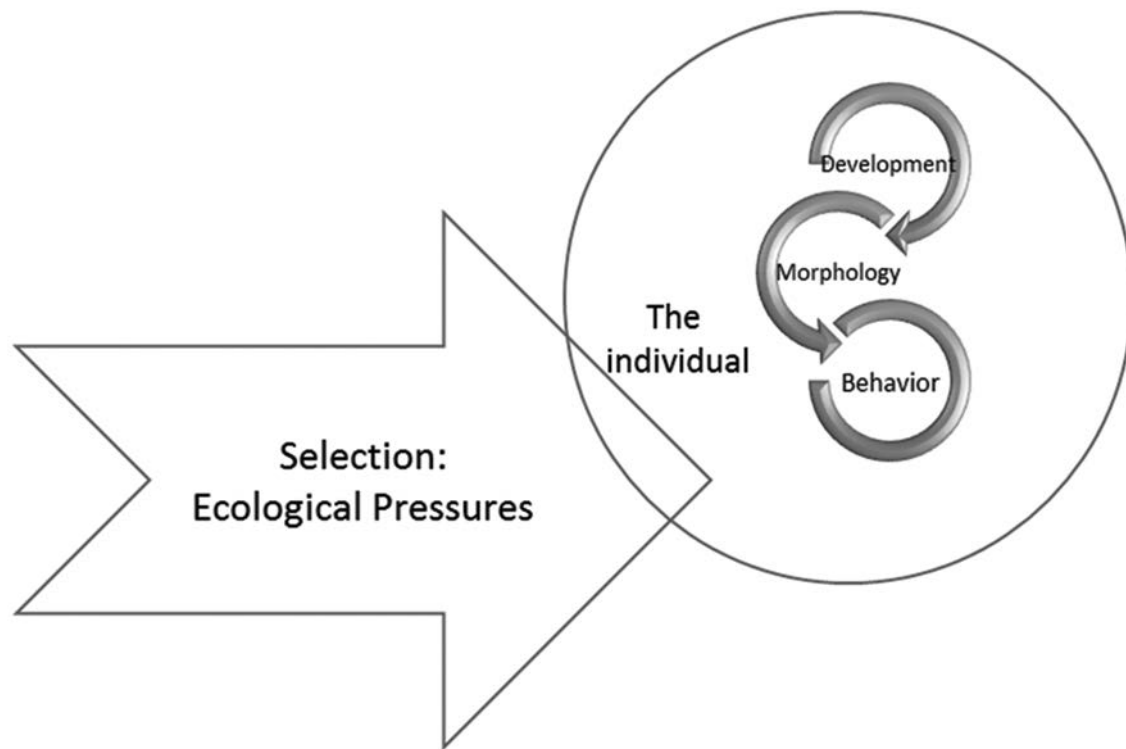


Figure 1. Component “individual” with its internal feedback process and the external pressure of ecologically mediated selection. A color version of this figure is available online.

opportunities for sexual activity, potential partners, and potential competitors for those partners. The social history of the group as it relates to sexual practices is a key inherited feature of the evolutionary landscape for individuals within the group.

While each individuals’ trajectory in relation to sexual partnering is structured by the patterns present in the group, each individual also influences the very structures of the group that they are navigating. This is a dynamic process that has group-level outcomes shaped by the interfaces between individuals in the group, which can result in the first major aspect of niche construction in this framework.

Figure 3 includes the actions of individuals and collective action by the group as part of the processes that can modify both external ecological pressures and the internal feedback systems within the niche. Collective action by the group can alter the ecological pressures on the individuals, which can affect the feedback between their internal processes (development, morphology/physiology, and behavior), and the interactions between individuals potentially alter the internal feedback patterns at the group level (patterns of social bonds and sexual activity, group-level behavior). In humans, this pattern of interactive feedback in response to ecological pressures is particularly salient because it can be accomplished via a much

wider array of elements and outcomes than in other animals: complex and multifaceted tool use, shared (collective) intentionality, and complex coordinated action between individuals resulting in large-scale modifications to local environments structured and facilitated by created/shared/inherited beliefs and perceptions, and so forth.

In the case of sexual partnering, group-level responses to external pressures can structure the kinds and intensities of basal pressures on individuals. For example, group-level actions in response to the ecological challenges of food availability and food collection and processing can affect energetic status of individuals influencing the internal feedback systems at the individual level and potentially patterns of physiology related to sexual activity—which in turn can alter the dynamic between individuals and the social group. Group-level landscape manipulation processes such as agriculture, food and livelihood procurement patterns, the structure and distribution of residences, and so forth can directly affect options for sexual behavior, access to potential partners, and energetic context for the individuals in the group. The choices and actions we observe in individuals are shaped via the group structuring of age and gender differences in daily activity patterns, social restriction of sexual activity, and gender role variation and the constraints on access to sexual partners that emerge from them.



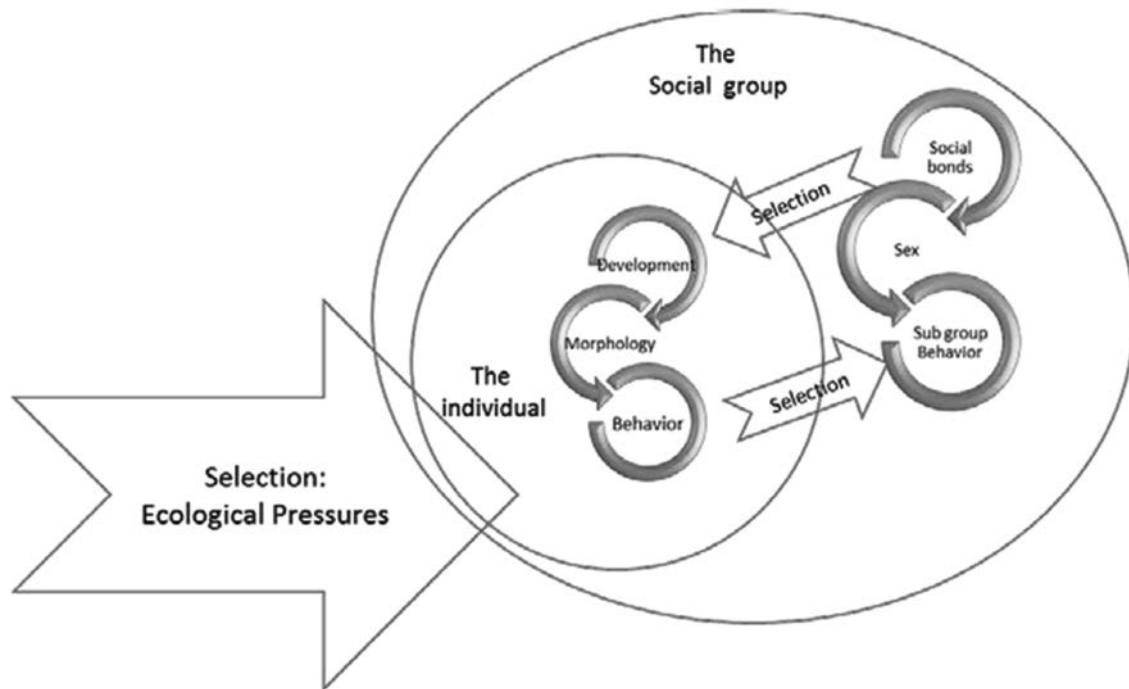


Figure 2. Social group. The social group is the core social context in which individuals interact with one another; thus, it affects the patterns of evolutionary forces (bio/ecological and social) on those individuals, and by their actions the individuals can influence the structure and intensity of processes on/in the group. The same ecological context placing pressure on individuals is also placing pressures on the group. A color version of this figure is available online.

If we add individuals' perceptions and display of gender roles and sexual activity to these structuring effects, one can see that just by thinking about the individual and the group as part of mutually interactive components in the niche, there is a dense entanglement of social and biological processes embedded in multiple feedback systems. Also, group-level processes in the form of traditions that may have been causally related to past ecological and/or social contexts can continue to structure elements of sexual behavior via shared histories and beliefs even in the absence of any of the original structuring contexts. The niche includes an inherited social ecology that can have very specific effects on future generations.

Figure 4 adds the final aspect of the framework, the community, and diagrams the internal and external feedback loops that complete this skeletal outline of the human niche. At the level of community, we add a potentially increased range and density of shared knowledge leading to an expanded, cross-groups effect of shared intentionality and coordinated action. In the community, multigroup demographic patterns and processes come into play, and behavior that reflects multigroup, community-level actions can also play a role in the structuring processes of the niche.

Community-level effects on sexual partnering are obvious: the larger pool of potential partners creates a different set of

options than we have at the group level. The spatial and social structuring of access to those partners shapes the patterns of action, and social relationships between groups can then shape the within-group dynamics that in turn affect individuals' behavior and their own internal feedback systems.

It is at the community level that the final niche-constructive element appears: joint feedback by the actions of individuals and groups at the level of the larger community that can modify the external ecological pressures on all three core components of the system. It is in this context that the distinctively human cultural processes of social, political, and economic institutions and large-scale intergroup behavior (such as warfare, extensive trade, market economies, religious organization, complex residential patterns and systems, coordinated landscape modification, marriage traditions, etc.) become especially salient. While it is easy to envision how the large-scale intergroup behavior plays a role in modifying ecological pressures and processes, these human institutions also directly affect perceptions, expectations, behavior, relationships, and thus physiologies of individuals resulting in concomitant feedback effects at the group and community levels. Community-level social processes (institutions) create social landscapes and contexts that become their own structured and structuring feedback systems, creating biological and social selective pressures and being reinforced or

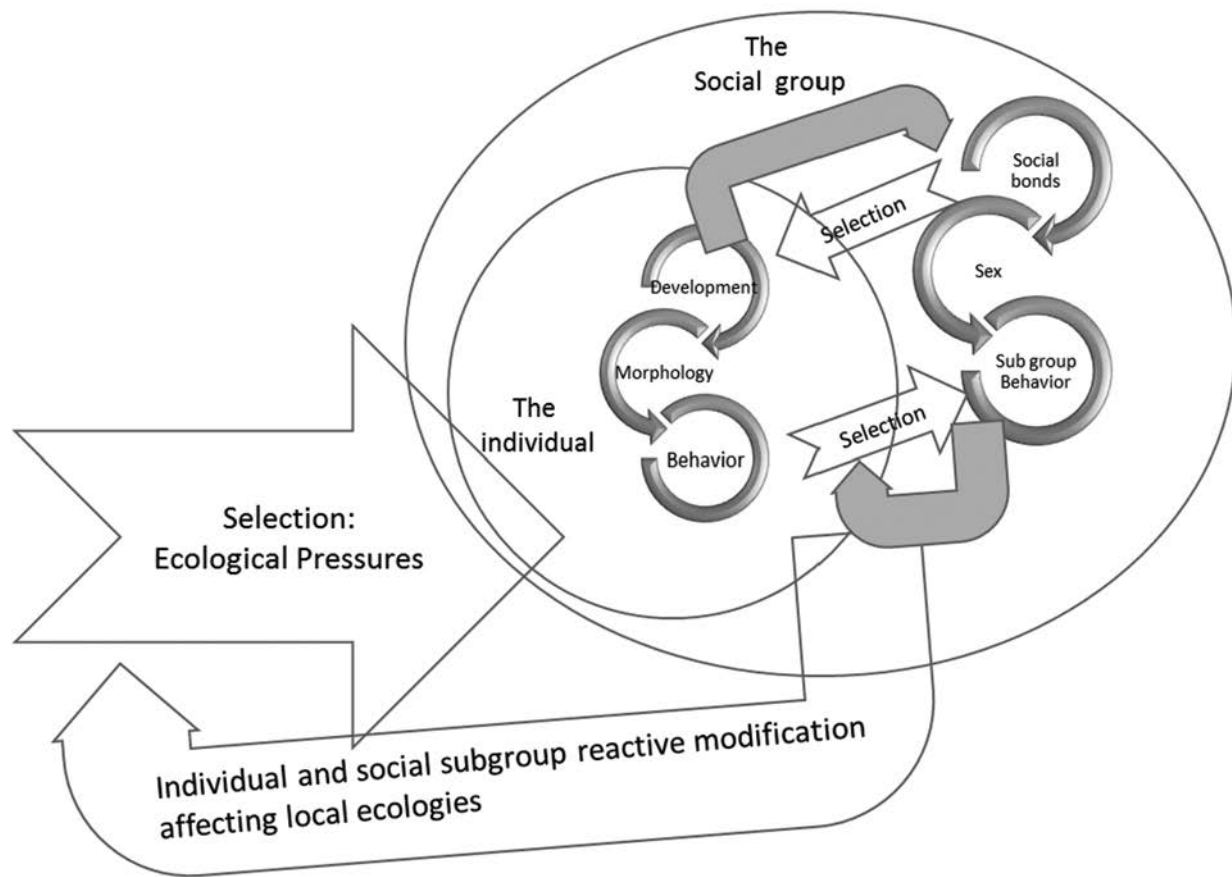


Figure 3. Actions of individuals and collective action by the group acting as part of the processes that can modify both external ecological pressures and the feedback systems within the individual and group levels. A color version of this figure is available online.

reshaped by the individual and group responses to those very pressures.

### Aspects of This Conceptual Framework Are Already in Practice

The framework and the various factors in the human niche and the potential places and processes of interface between them enable anthropologists to take a multilevel view that inherently intertwines evolutionary and ethnographic approaches. Starting from the basal assumption that the human niche is the overarching system in which humans are evolving, one can then hone in on specific components (nodes), relationships, and feedback loops and conduct quantitative and qualitative assessments. Beginning with a framework of systemic complexity and dynamism, our baseline enables us to ask targeted questions about specific aspects of the human niche in order to develop more effective and integrated anthropological answers.

For example, Lee Gettler (2016) investigates socioendocrinological processes and patterns associated with male parent-

ing. He and his colleagues' work with the men of Cebu demonstrates that "conceptualizing interplays and feedbacks between individual development (behavior-cognition-biology), family systems, and cultural institutions" is a valuable model for thinking about the niches occupied by these men. Further, he suggests that "we need to push the boundaries on our thinking in terms of how developmental experiences become embodied and the way in which those culturally constructed neurobiological-endocrine pathways enable individual behavior-cognition and social interactions, which are at least contributing factors to the emergent phenomenon of cultural complexity." Gettler and colleagues illustrate this by using long-term data to show that both psychosocial stressors and childhood nutritional status, via their effect on energetic constraints on the individual during development, influence entry into parenthood for men in the Cebu study and draw some causal inferences by connecting the feedback processes between individuals, their group (families), and community (urban Cebu; Gettler et al. 2015).

In a related vein, Doug Bird and colleagues (2016) demonstrate how landscape alteration and the use of fire by the Martu in Australia "operates as a form of dynamic cultural and eco-

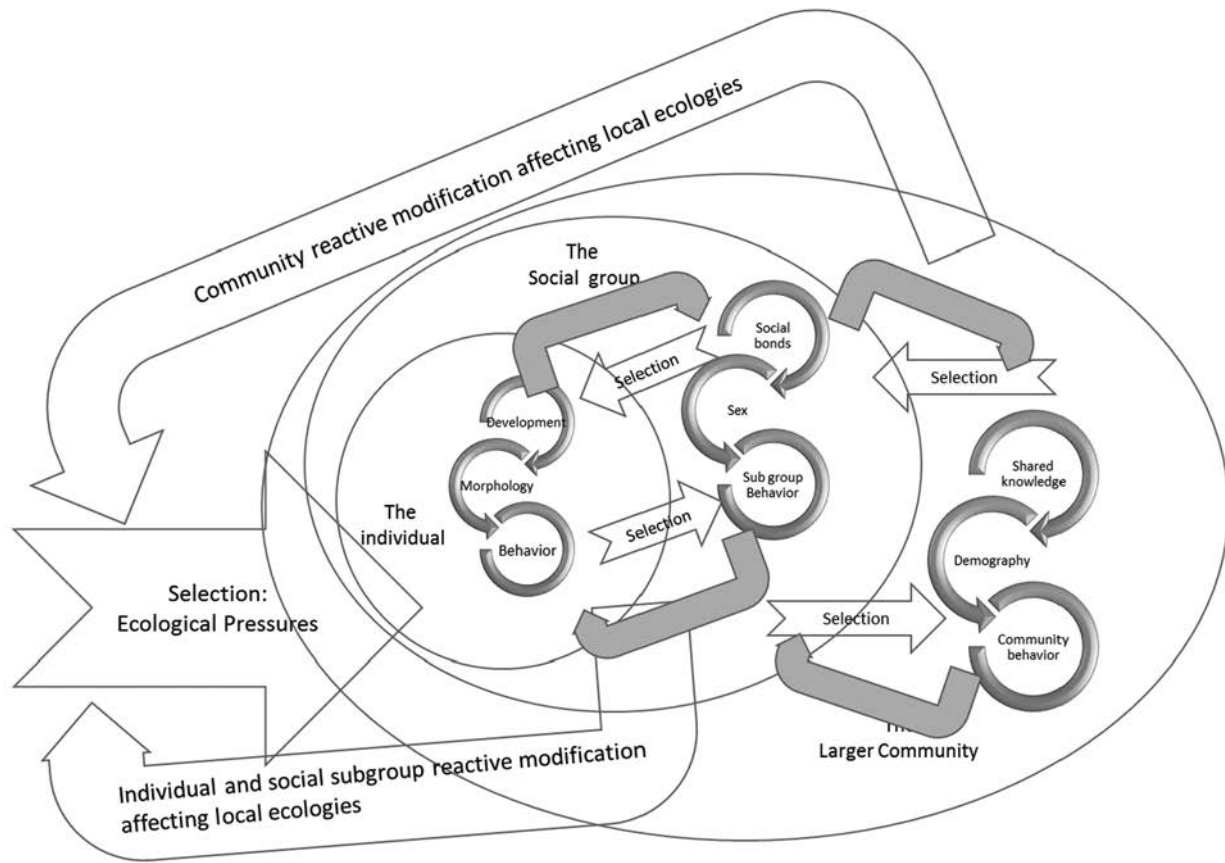


Figure 4. Community and internal and external feedback loops that complete the skeletal outline of the human niche. A color version of this figure is available online.

logical niche construction, shaping systems of sociality among people and their interactions with other species.” In this system, individuals and social groups of Martu interface with their local environments, family members, the larger landscape, their social communities, and regional and local institutions in a suite of feedback relationships. These relationships are with landscapes, fire, bodies (Martu and their prey), history, and cultural traditions all interfacing with contemporary economic and political contexts. Bird and colleagues (2016) focus simultaneously on individuals, social groups and larger communities, and the interlacing of the physical, cultural, and ecological in order to work toward “explaining the processes of the social and material interdependencies that construct human niches” in the Martu.

Greg Downey (2016) integrates NCT, concepts of “enskillment” and “de-skillment,” and ethnography of street children in Brazil to propose that we envision the urban niche as a behavioral-ecological-historical conjunction. Downey describes cities as a developmental niche where feedback between factors such as nutrition, locomotion, and activity patterns at the levels of individuals, youth peer groups, and the structures of the urban landscape are integral in the processes of shaping the hu-

man phenomenological experience (physically and perceptually). Downey proposes that the mutual mutability between bodies, behavior, and the urban landscape has created a distinctive urban phenotype, or a variety of urban phenotypes, as the result of these niche-constructive processes.

### Parting Thoughts

The framework I present here is an oversimplification and provides only a basic skeleton of the dynamics of the human niche. Most of what I have argued is not new, and many of the elements are in practice, in one form or another, across multiple approaches in anthropology. However, they are rarely connected across subareas and theoretical divides.

We need an integrated anthropological framework for asking evolutionary questions about humanity—one that is inclusive of ethnographic and sociocultural theory and data as well as evolutionary approaches. I believe our challenge is to figure out how to effectively engage human cultural systems, individual actors, and group and community-level dynamics with biology, history, and human niche complexity. If we can do so, we will be better equipped to examine the patterns and processes at play in hu-

mans who evolved in, shaped, and are shaped by complex dynamic niches and who continue to do so at a rapid pace.

The human niche heuristic proposed here encompasses individual bodies, face to face interactions within social groups, interactions among social groups, and dynamics at the community levels as relevant in evolutionary inquiry. Selection exerts pressures at various nodes in the system, and responses to those pressures emerge at individual, group, and community levels. This pattern of reactive response to social and ecological pressures and contexts at various levels creates a local ecology of interactive material, social and cognitive aspects that are passed from one generation to the next; it creates an inherited ecology, a cultural context.

Using the human niche as a basal framework enables us to include the salient features, forces, and processes at multiple levels of feedback systems or at least be a part of an approach that acknowledges the interfaces across the levels as a core facet in the system of interest. It is a set of “structured structures predisposed to function as structuring structures” (Bourdieu 1990:53). In an evolutionary approach, this means adding social complexity and reducing reliance on simple or linear causality. Such a complex and dynamic approach requires a diverse anthropological tool kit, one that includes ethnography, social theory, and a serious engagement with human culture and human biology for effective inquiry. By explicitly joining contemporary evolutionary approaches (the EES) to an integrative basic framework for human evolutionary inquiry (the human niche heuristic), we are able to develop a more fertile and inclusive landscape for evolutionary approaches in an integrative anthropology.

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# Evolutionary Cultural Anthropology

## Containing Ebola Outbreaks and Explaining Hunter-Gatherer Childhoods

by Barry S. Hewlett

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In this paper I outline an integrated framework for the study of culture, called evolutionary cultural anthropology, that highlights culture and its interactions with biology and ecology. Applied research during Ebola outbreaks and several decades of research with hunter-gatherer children of the Congo Basin are utilized to illustrate evolutionary cultural anthropology.

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Many contemporary evolutionary approaches dismiss or minimize the role of culture as an explanatory factor for human behavior, whereas most cultural anthropology orientations assume it plays a significant role in explaining human behavior but seldom address or denigrate the role of biology. In this paper I introduce a framework for the study of culture, called evolutionary cultural anthropology (ECA), that emphasizes integrative approaches and methods. ECA focuses on understanding the nature of culture, how culture influences human action, and culture-biology-ecology interactions. ECA encompasses a broad range of topics and theories, but in this paper I illustrate the importance of (1) cultural models and niche construction, (2) culture-biology-ecology interactions, and (3) the complementarity of informal, open-ended interviews (i.e., qualitative data) and structured behavioral observations or accounts of behavior (i.e., quantitative data). Research and experiences with Ebola outbreaks and hunter-gatherer children are utilized to illustrate these components of ECA.

### What Is ECA?

Evolutionary cultural anthropology (ECA) integrates theoretical and conceptual orientations that focus on understanding the nature of culture (explained below) and culture-biology-ecology interactions. From the evolutionary and biological anthropology side, this includes contributions from cultural transmission (Cavalli-Sforza and Feldman 1981), dual transmission (Boyd and Richerson 1985), coevolution (Durham 1991), social learning (Whiten et al. 2012), niche construction (Laland, Odling-Smee, and Feldman 2000), cognitive science and developmental psychology (Csibra and Gergely 2011; Tomasello 2001), neuroanthropology (Lende and Downey 2015), and

cultural phylogenetics (Lipo et al. 2006). From the cultural anthropology side, it includes concepts and theories from cognitive anthropology (Shore 1996; Strauss and Quinn 1998), embodied learning (Marchand 2010), and the anthropology of learning (Lancy, Bock, and Gaskins 2010; Rogoff 2003).

ECA is inherently transdisciplinary and emphasizes that culture has properties of its own that profoundly influence human behavior and that culture is best understood in terms of interactions with biology and ecology. Consistent with classic cultural anthropology, ECA highlights how culture influences human behavior and primarily describes and explains human diversity. But it is relatively distinct from cultural anthropology in that ECA is explicitly interested in understanding the nature of culture and assumes that culture and human behavior are best understood in relation to biology and ecology.

The area of study is called “evolutionary” because (1) it draws heavily on the recent theoretical and empirical contributions to the study of culture from evolutionary-minded researchers, (2) culture is dynamic and evolutionary (can change very slowly or rapidly and has evolutionary properties such as the production of diversity and inheritance), and (3) it emphasizes that human behavior is best understood as interactions between culture, biology, and ecology. “Culture” is of course referenced because it is the primary interest of study, and “anthropology” is included because the perspective focuses on understanding culture in humans. Nonhuman animal studies of culture are valuable in their own right, but ECA is primarily interested in what cross-species perspectives contribute to an understanding of culture in humans. An “evolutionary” perspective is also preferred because, like some cultural anthropology approaches (Bourdieu 1977), it stresses the importance of agency in individuals. Hypothesis testing is emphasized (but not to the exclusion of qualitative data and analysis), and the evolutionary perspective is broad enough in its concepts to include contributions from biological and some social sciences, but the reverse is generally not true; that is, concepts and approaches in social sciences have a difficult time incorporating perspectives from biological sciences.

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Many cultural anthropologists are unaware that geneticists and biologists are interested in the nature of culture in part because of the way these studies are represented in the literature. The early evolutionary studies of culture by Cavalli-Sforza et al. (1982), Boyd and Richerson (1985), and Durham (1991) are often characterized as gene-culture or coevolutionary approaches to human behavior. Boyd and Richerson call their approach “dual transmission,” and Durham uses “coevolution” in the title of his book. The characterizations are misleading because their theories and empirical research focus almost entirely on understanding culture, not genes. These studies demonstrate that culture can influence genes, such as how changes in farming methods influenced the evolution of the sickle-cell trait in regions of West Africa with malaria, but culture-gene interactions are just one type of culture-biology interaction of interest in ECA. ECA is also interested in how culture influences epigenetics and interacts with neural systems, hormones, and other biomarkers (see Downey 2016, Gettler 2016, and other papers in this volume).

Why a new term? Within evolutionary circles, some refer to these orientations as dual transmission approaches (Smith 2000), but this refers specifically to the theoretical contributions of Richerson and Boyd (2005) and their students (Henrich and McElreath 2003). Some evolutionists use the term “cultural evolution” (Mesoudi 2011) to refer to several of these new approaches, but as described below, the term is problematic, and the way it is currently used is narrower than the framework outlined here. ECA provides a broader, integrated framework for the study of culture and encourages greater collaboration and communication across disciplines.

## Culture

Introductory anthropology textbooks often state that culture is the core concept, but anthropologists have struggled for decades to reach a consensus definition. Some contemporary anthropologists completely reject the concept of culture (Brightman 1995) or want to change the word and keep the concept (Trouillot 2003) because of its racial and political economic history. Early anthropologists often gave the impression that peoples in the developing world had static traditions and that their societies were thought to be isolated and without a history. Others reject the concept because it is too vague, with some researchers using it as an explanatory variable and failing to distinguish the components of culture (e.g., social norms, kinship, political-economic system) responsible for behavioral variability (Kuper 1999). A few leading cultural anthropologists staunchly defend the concept (Sahlins 1999; Shweder 2003). Anthropologists at a Wenner-Gren conference on the culture concept concluded that we should not worry about trying to define “culture” because it is so contentious, and anthropologists should instead “move beyond such arguments and get on with doing anthropology” (Fox and King 2002:12).

I agree to a point with Fox and King and recognize that the word “culture” in North American cultural anthropology carries enormous conceptual baggage because of the misleading ways it has been used in the history of the discipline. Whatever definition is proposed, it will receive extensive criticism. However, it is a key concept in ECA, and it is necessary to provide at least a tentative working definition in part because the concept cuts across several disciplines, such as evolutionary biology, cognitive and neurological sciences, developmental psychology, cultural and biological anthropology, and archaeology. Several of these disciplines already have definitions of culture, so it is useful to present a definition that is recognized across disciplines.

The tentative working definition of “culture” is knowledge and practices socially transmitted and acquired, shared with others, and patterned in time and space. E. B. Tylor pointed out more than 100 years ago that culture has many elements, and the “knowledge and practices” part of the definition intends to capture as many of these as possible: cultural models, social norms, habits, institutions, and technology. The definition has three “nuggets” (Trouillot 2003): socially acquired and learned (i.e., nongenetic transmission), shared with others, and persists long enough to exhibit distribution patterns in time and space. Social-cultural learning is a key feature of the definition and a central research topic in ECA. The number of people or the size of the group with whom culture is shared can vary, from ethnic groups to different types of international development agencies. The minimal number of individuals or group size has not been studied systematically, but clearly learning from a single other, even if a parent, is not enough to be considered cultural (Enquist et al. 2010).

Culture has patterned distributions across time and space; it may not be bounded by ethnic groups or nation-states, and it may persist for hundreds of thousands of years (e.g., Acheulean hand axes) or only a few months. Some definitions of culture use “generation to generation” as the time measure, but with the Internet and other technologies that enable rapid one-to-many transmission, cultural variants can emerge and disappear within a generation. The minimal amount of time to be considered “cultural” has also not been studied. As suggested by Shweder (2003), the culture concept as described above does not imply (1) that whatever is, is okay (not a theory of the good), (2) passive acceptance of practices and lack of agency, (3) the absence of debate, contestation, or dispute among members of a group, and (4) that other kinds of people are “other” in the sense of being less than human or possessing qualities that entitle us to intervene in their way of life.

A key contribution of the culture critique is that it is essential for researchers to disaggregate or unpack the cultural variable (Fox and King 2002; Kuper 1999). When talking about culture as an explanatory variable, it is vital to precisely identify what aspect of culture—cultural models of illness, kinship networks, religion—is the focus of study. This is why Fox and King (2002) and Kuper (1999) suggest that we forget about



contentious debates about defining culture and move on to conduct good systematic anthropological studies that clearly define variables.

### Cultural Niche Construction

Cultural niche construction is a relatively new (Laland and O'Brien 2012; but see Durham 1991 for a similar concept) and important theoretical contribution to ECA because it emphasizes the feedback nature of niches that humans culturally construct. Humans are extraordinary from a cross-species perspective in that they construct diverse social, political-economic, or technological environments to which they then have to adapt. These culturally constructed niches become part of the ecology in which humans try to navigate. The cars we drive, the houses we build, the political-economic systems we establish contribute to climate change, shortages of water, and inequality that we in turn try to modify, leading to further modifications and adaptations. Cultural niche construction has an issue similar to that of culture—it is necessary to unpack the cultural niche variable and specify precisely what components of a constructed niche lead to further adaptations (see Fuentes 2016 [in this volume] for more details about niche construction).

### Domains of Study

ECA encompasses a broad range of topics. All highlight the importance of culture, and many but not all are a part of the definition of “culture.” A limited number of some topics of interest to ECA researchers are described below.

#### *The Nature of Culture*

*Features of Culture.* Many introductory anthropology textbooks provide a list of characteristic features of culture, such as culture is conservative and dynamic, integrated, and adaptive. ECA is interested in a detailed understanding of these and other features of culture. If culture is both conservative and dynamic, when, why, and how do cultures persist and change? If culture is integrated, which parts of culture are integrated and which are not, and why? Is culture always adaptive, and if so why? Can it be maladaptive, mediocre, or neutral?

Anthropologists have identified several other relatively distinct features of culture in humans: it is embodied, each cultural variant has a history, it is embedded in the landscape, it is cumulative, it is ethnocentric by nature (especially in particular domains such as edible foods, types of marriage, parent-child relations), it patterns how people think and feel, it is intersubjective and public, and it is meaningful and interpreted. ECA is interested in understanding the contexts and variability in these features and how transdisciplinary approaches that include biology and ecology help to provide a comprehensive view of them.

*The Transmission and Acquisition of Culture.* The acquisition of culture is a key topic within ECA and a consistent component of definitions of culture across several disciplines. While cultural learning occurs throughout a life span, this area of study means that children will often be the focus of research. It also means that a developmental or ontogenetic understanding of culture is essential. Some of the questions within this topic area include, for example, from whom do children of various ages prefer to learn? Those who look and speak the same language as them? Those with whom they have emotional attachment? Those of the same gender? People with greater knowledge or skills? Successful people? In which contexts is it useful to copy cultural variants of the majority of people in a group, and when it is useful to do the opposite of everyone else? How do individuals acquire culture from others? Observation and imitation? Teaching? Participation in adult activities? Narratives? What are the contexts, effects, and implications of these alternative patterns in the acquisition of culture? Are particular forms of cultural learning more adaptive or efficient than others? Are various domains of culture acquired in different ways?

*Innovation.* The study of innovation and creativity is also central to ECA because these are the sources of cultural modifications and adaptations. Innovation involves other types of learning, such as by trial and error. Questions include what are the different types of innovations? Where and why do they originate? How are they transmitted and acquired? How are they affected by culture history?

*Patterns of Culture in Time and Space.* This topic is integral to the definition of culture and an important area of study for ECA researchers. Why do people from various ethnic groups share particular cultural variants (from sounds in a language to types of artifacts) across a broad landscape? What are the roles of cultural history, movements of people taking cultural variants with them, or local adaptations? Archaeologists, historical linguists, biologists, and some cultural anthropologists use new phylogenetic and other methodological approaches to better understand these patterns (e.g., Lipo et al. 2006).

#### *Culture-Biology-Ecology Interactions*

ECA highlights the roles and importance of culture, but it assumes that it is essential to understand how it interacts with biology and ecology; that is, it influences and is influenced by biology and ecology. This leads to the transdisciplinary nature of ECA. For instance, in order to understand the acquisition of culture, it is essential to understand how evolved cognitive capacities such as theory of mind (Tomasello 2001), natural pedagogy (Gergely and Csibra 2006), overimitation (Lyons, Young, and Keil 2007), and attachment (Bowlby 1983), as well as neurobiology (e.g., children's brain

development), influence social learning. On the other hand, ECA is also interested in how culture (cultural models, mode of production, etc.) affects the expression of evolved capabilities. The view that human nature or biology shapes culture is the leading approach in the evolutionary studies of human behavior. For example, evolutionary psychology emphasizes how evolved cognitive modules evoke culture, and human behavioral ecology stresses that cultural behaviors are the result of humans trying to maximize reproductive fitness in given environments. These approaches have made significant contributions to our understanding of human behavior, but the ECA integrated framework is somewhat different and consistent with the inside-out metaphor because it emphasizes that culture has properties of its own and that the reverse also occurs; that is, culture can effect biology, including genes, physiology, and hormones. The case studies below, as well as papers in this volume by Downey (2016; i.e., the acquisition of cultural skills changes the body) and Gettler (2016; i.e., cultural patterns of parenting affect male endocrinology), provide examples of such interactions.

### What ECA Is Not

It is difficult to use the words “evolution” and “culture” as descriptors of this integrative framework without automatically thinking of “cultural evolution.” I try to stay away from the term because it carries so much ethnocentric baggage (see Laland and Brown 2011 for a review) and the term “cultural evolution” does not capture the transdisciplinary and integrated aims of ECA. ECA is not interested in describing the major stages of cultural evolution, but researchers may be interested in identifying cultural factors, such as changes in cultural niche construction or processes of social learning, that contribute to changes in human evolution.

It is also important to point out that ECA does not always focus on change or evolution. For instance, Cavalli-Sforza and Feldman’s (Cavalli-Sforza and Feldman 1981) models indicate that aspects of culture transmitted vertically, acquired from parents, contribute to high intracultural variability in those traits while concerted many-to-one transmission, such as in adolescent initiation ceremonies, lead to low intracultural variability. Henrich and MacElrath (2003) build on the work of Boyd and Richerson (1985) and identify conformist transmission (copying aspects of culture that are most common) and prestige bias (copying individuals with culturally based measures of prestige) as important forces that help to identify aspects of culture acquired by the next generation. The studies are evolutionary minded and contribute to an understanding of the nature of culture regardless of whether you agree or disagree with evolutionary approaches to human behavior.

The following sections provide two examples of an ECA framework from my own field experiences working with the World Health Organization to contain Ebola outbreaks and explaining hunter-gatherer childhoods in the Congo Basin.

Space does not allow a description of the full range of topics and perspectives in ECA. The case studies aim to highlight the importance of (1) culture, (2) culture-biology-ecology interactions, and (3) the complementarity of qualitative informal, open-ended interviews and quantitative behavioral observations or accounts of behavior.

### Containing Ebola Outbreaks

I have been interested in the anthropology of infectious and parasitic diseases for decades and have worked on projects to control schistosomiasis, river blindness (onchocerciasis), and other diseases in Africa. In the last 15 years I have also participated in efforts to contain Ebola outbreaks in the Congo Basin and East Africa (Hewlett and Hewlett 2008). Ebola is a deadly (mortality rate of 50%–90%) filovirus transmitted by bodily fluids and is without a known cure (antiviral treatment). Over 28,000 people were infected and 11,000 people died in the recent West African outbreak. Data from previous Ebola outbreaks are utilized to illustrate various aspects of ECA.

#### *Culture Matters: Knowledge, Practices, and Niche Construction*

An understanding of local beliefs and practices is essential for controlling Ebola outbreaks. How local people view, understand, and explain the outbreak (i.e., their cultural models) and local burial practices can dramatically diminish or amplify disease transmission, mortality rates, and the ability to contain an outbreak.

*Local Explanations of Illness.* At the start of the Ugandan outbreak in late 2000, local people, primarily Acholi, quickly turned to Western medicines for the treatment of symptoms; aspirin and antimalarials for fever or antibiotics for suspected bacterial diarrhea. During this initial period they also utilized several indigenous explanations or cultural models similar to sorcery to explain the symptoms, but after several months of unexplained deaths, the Acholi began to realize that this outbreak was more than a regular kind of illness, and they shifted to another local cultural model and classified it as *two gemo* (*two* [illness] *gemo* [epidemic]). *Gemo* is a bad spirit (a type of *jok*, or spirit that comes suddenly and causes a mysterious illness and death in many people within a very short period of time). *Gemo* reportedly comes like the wind in that it comes rapidly from a particular direction and affects many people, but the wind itself does not necessarily bring it. Acholi have experienced other types of *gemo* (e.g., measles and smallpox).

*Gemo* is said to be mysterious in that it comes on its own, but several people indicated that it comes because of lack of respect for and lack of honor toward nature spirits. Elders indicated that in the past, lack of respect for *jok of tura* (hills, mountains, bodies of water) was the major cause of *gemo*. People talk about *gemo* catching you, so if someone is close

to a person with *gemo*, it is easier for *gemo* to catch you. Once an illness is identified as *gemo*, a protocol for its prevention and control is implemented that is quite different from the treatment and control of other illnesses. Elements of the protocol include (1) quarantine or isolation of the patient in a house at least 100 m from all other houses and with no visitors allowed, (2) feeding and caring for the patient by survivors of the epidemic (if no survivors are available, an elderly woman or man should be the caregiver), (3) identification of houses with ill patients, as well as the entrance to villages, with two long poles of elephant grass, (4) limited movements of individuals, that is, staying within their households and not moving between villages, (5) avoidance of patients by pregnant women and children, (6) increased harmony within the household (i.e., no harsh words or conflicts within the family), (7) in case of death, a person who has survived *gemo* or has taken care of several sick persons and not become ill should bury the person. The burial should take place at the edge of the village.

From a biomedical perspective, this protocol constitutes a broad-spectrum approach to epidemic control. The local cultural model also recognizes that it is a disease of contact, which is key to outbreak control efforts. Elders were adamant that this protocol existed before the arrival of Europeans in the late 1800s. Although historic research is needed to verify this claim, the facts that an indigenous term (*gemo*) is associated with the behaviors, that the belief is integrated into the religious system (*jok*), and that the protocol is common knowledge to children who do not learn it in school all suggest that many rules existed in precolonial times.

The international and national teams trying to contain the outbreak were unaware of how Acholi people thought and felt about the Ebola outbreak and missed many opportunities to mobilize communities and build on these beliefs to control the outbreak. An anthropologist was not invited to participate in control efforts until the middle of the outbreak, when the number of cases started to increase.

*Funerals.* The description of *gemo* above is an example of local beliefs that can decrease transmission and mortality rates and help contain an outbreak. Burials and funeral practices, on the other hand, can be health lowering and rapidly amplify Ebola outbreaks because they often involve contact with the bodily fluids of the deceased. Common features of central African burials include washing and dressing the deceased for observation and burial; placing the deceased on a bed for 24 hours while family members kiss, hug, and lie next to the loved one; wrapping the deceased in a sheet before being buried; performing a communal washing of hands after the burial; and participating in social interactions, such as dancing and sleeping together, that occur for several days after the burial. Burials are major cultural events that can last for days, depending on the status of the deceased. Women in the family cry and wail for hours while men respectfully offer condolences

and visit with family and friends. Funerals honor the deceased as well as promote harmony and well-being in the community, but if not conducted properly, the deceased spirit can cause harm and illness to the family.

It is essential to understand burial practices to contain Ebola outbreaks. Several options usually exist to ensure safe burials, such as having Red Cross workers in protective gear be responsible for the burial process. Local people are generally open to modifying burial practices during deadly outbreaks. As mentioned above in the *gemo* protocol, burials take place outside of the village during outbreaks rather than the usual position next to a family home, but it is also critical that the international and national teams show respect and offer condolences to the family as they discuss these modifications with the community.

*Cultural Niche Construction.* The above items focus on local beliefs and practices, but cultural niche construction also dramatically affects Ebola control efforts. The international and national teams held community meetings, provided health education, and sometimes provided protective gear (gloves or bleach) for burials, but because of the gender hierarchy common to most of the groups affected by the outbreaks, women received less information and fewer material resources. Women survivors in Uganda experienced stigmatization more intensely than men, and women were significantly less likely than men to have resources to go to the local clinic and purchase medications while they were sick with Ebola. The gender division of labor also affected control efforts. Men are seldom involved in childcare, and women are the primary caregivers for sick family members. In Uganda, women experienced substantially greater mortality rates than men because they were responsible for washing and preparing the deceased for burial in addition to being the primary caregivers when people were sick. Men were at greater risk in some outbreaks because they were responsible for transporting the sick to the clinic or were involved with game hunting, a likely source of many outbreaks.

The above description of cultural models of illness, burial practices, and cultural niche construction demonstrates ways in which culture can expose or protect individuals from disease (i.e., affects the distribution of the disease) and influences mortality and morbidity patterns, selection, and biology. The ECA approach is consistent with Trostle's (2005) cultural epidemiology and other biocultural approaches to public health.

#### *Culture-Biology-Ecology Interactions*

While culture matters during Ebola outbreaks, it is best understood in relation to interactions with biology and ecology. Three common features of Ebola outbreaks—fear, fleeing, and stigmatization—are described below and discussed in relation to culture-biology-ecology interactions. Figure 1 illustrates some of the interactions discussed in this section.

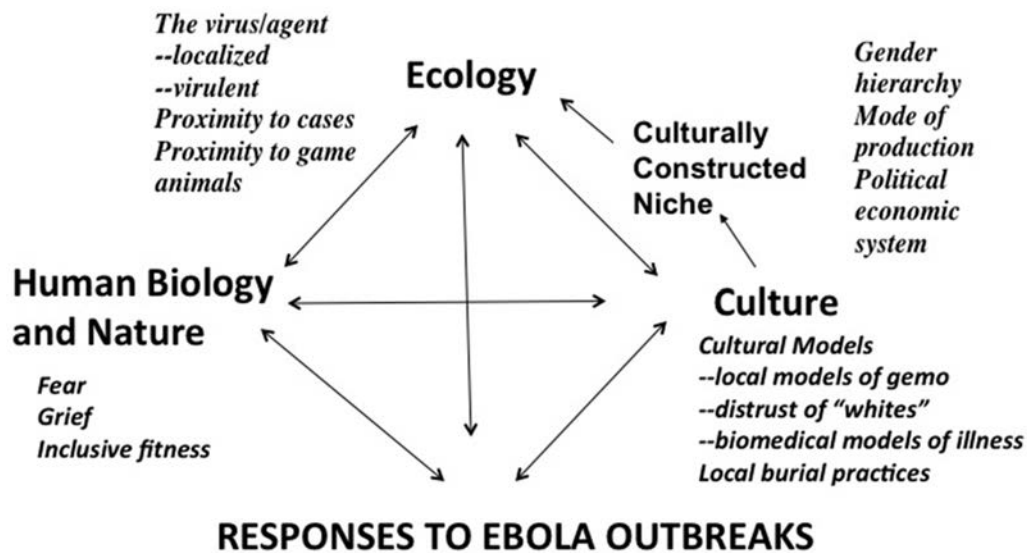


Figure 1. Integrative ECA framework to human responses during Ebola outbreaks.

*Fear.* Fear is a nearly universal response during Ebola and other rapid-killing epidemics and is part of humans' evolved psychology. Epidemics were likely recurring problems in the environments of evolutionary adaptation (i.e., the long period of foraging in human history), although their cause was probably bacterial rather than viral due to hunter-gatherers living in small groups with a low population density. An individual who became fearful and attentive after watching other people's rapid death was likely to survive and leave more descendants than others who were not afraid and thus took no precautions to avoid illness. Observing one or two rapid deaths was probably not enough to evoke fear, but observing three or four rapid deaths within a week or two likely evoked fear of death that in turn generated a number of behavioral responses, such as seeking information or fleeing.

Fear in these contexts is part of human nature and our evolved psychology, but it is mediated by culture and ecology. I felt relatively safe participating in Ebola outbreak-control efforts because I had particular knowledge and material support (food, trucks) that made me feel secure. I was still concerned and vigilant, especially when I was with Ebola patients or their relatives, but cultural knowledge and access to resources mediated the fear. Knowledge obtained through experience with other epidemics and diseases can also mediate fear. International health-care workers often complained that local people seemed to be complacent: "People are not interested in what we have to offer and do not see this as an urgent situation." Part of the reason for this is that local people may not feel the same level of fear and urgency as international health-care workers because they may have experiences with other epidemic diseases. They may have other more pressing issues, such as children sick with malaria. Also, as described

above with *gemo*, local people have also accumulated cultural knowledge about epidemics and may not feel the same level of fear as international health-care workers.

Local communities in Africa have other cultural models that can increase or decrease fear during epidemics. Many local peoples have had a long history, often in which they were exploited, of relations with and accumulated knowledge of "whites" (any international outsiders and not limited to peoples of European origin). Local peoples' cultural models generally distrustful of whites, several people dying every day, the establishment of isolation units with dark tarps all around them, and health workers dressed in level-four containment suits amplified fear in local people. Lack of other information was also crucial for local people because the international teams did not explain what they were doing in the isolation units. Family members could not communicate with patients inside isolation, and when a person died, their body was placed into a body bag and taken to a burial ground near the airport without informing loved ones. In Uganda, Gabon, and areas of the current West African outbreak, the cultural models distrustful of whites and the lack of transparency by the international teams led to local people blaming international teams for introducing the disease and thinking that the isolation units were European body-parts businesses. In Uganda and Congo, fear diminished after we recommended that the tarps be taken down and a fence or open barrier be built so family members could see and communicate with their loved ones in isolation as well as making the activities of the international teams transparent.

The above discussion also provides an example of how external (vs. internal, such as gender hierarchy mentioned above) culturally constructed niches such as the isolation units and equipment of the biomedical teams becomes part of the ecol-

ogy to which local people try to adapt. In these cases the external niches amplified fear, decreased treatment seeking, and led to greater risk of mortality.

Fear is also mediated by the social ecological setting. If deaths are frequent and nearby, fear will increase, but if the deaths are not observed or are far away, fear will diminish.

*Fleeing.* The desire to flee is evoked by fear and is common during deadly outbreaks. McGrath's (1991) cross-cultural review of ethnographic accounts of human responses to acute high mortality epidemics found that fleeing or migrating to new areas was by far the most commonly mentioned response.

Whether or not individuals, families, or groups flee depends on several cultural, biological, and ecological factors. In terms of the disease itself, Ebola is more localized and virulent, and its case fatality rate is much higher than many other epidemic diseases, such as influenza or smallpox, which means people are much more likely to flee during an Ebola outbreak than during an influenza outbreak.

Cultural niche construction, such as mode of production, affects fleeing as well. Hunter-gatherers are more likely to flee an outbreak because the costs of moving are much lower for them than they are for farmers tending fields or for urban industrialists holding down jobs and living in houses full of material items. This is precisely what we observed; foragers in Congo went into the forest within days after hearing there was an Ebola outbreak. By contrast, if people in farming communities leave the area, they cannot tend or protect their fields, and they risk damaging their social network of people with whom they share and cooperate, a social network essential to survival and well-being. This is one reason why fleeing is not part of the indigenous epidemic protocols for farmers described above.

Access to resources also influences who flees during an outbreak. If one has access to resources—such as money, status, a car, or a plane—it is easier to flee. Unfortunately, physicians and others with wealth are often the first to leave areas with deadly outbreaks. During the recent Ebola outbreak in Liberia, president Ellen Johnson Sirleaf fired 10 top government officials because they refused to return to Liberia to help with the Ebola outbreak. This pattern is not unique to the developing world; during a yellow fever outbreak in Memphis, Tennessee, in the 1800s, all physicians left the city.

Fleeing is common during Ebola outbreaks, and it is best understood in the interacting contexts of human nature (e.g., fear), cultural niche construction (e.g., mode of production, isolation units of international teams), and ecology (proximity to disease, access to resources).

*Stigmatization.* Stigmatizing and ostracizing survivors, family, health-care workers, or groups suspected of being associated with the disease are common during Ebola and other deadly outbreak situations and are likely because of interactions of biology, ecology, and culture. Several elements of human nature may contribute to stigmatization during an outbreak:

threatened inclusive fitness, fear, and the ability to distinguish sick from healthy individuals. Stigmatization rarely occurs among close biological kin; other clans, ethnic groups, neighbors, or even spouses (in-laws) are more likely to be stigmatized. Cultural information or knowledge can amplify or mitigate these propensities. For instance, Ugandan survivors of Ebola often suffered intense stigmatization in the community when they first returned home, but when respected and trusted (key features of cultural transmission in this context) health-care workers visited the community and explained that the survivors were no longer contagious, the stigmatization declined. Stigmatization decreases over time as people observe and learn that others are not getting sick by touching or being close to the survivors.

Cultural niche construction also influences stigmatization. I have lived with Aka hunter-gatherers in central Africa for four decades and have observed and tried to contain a deadly measles epidemic in the early 1980s. Sick individuals were isolated, and people kept some distance from infected patients, but sick individuals were never ostracized or stigmatized during the epidemic. Aka live in small groups (twenty-five to thirty-five people in a camp), many people are related, and people can and do leave the camp anytime they want. Farmers and urban industrialists, on the other hand, live in larger groups and are tied to the land and permanent structures; they are less mobile and flexible. In a context where it is hard to move away, population densities are high, and strangers are more common, stigmatization may emerge as a cultural strategy to protect the family and community in order to minimize contact with potential sources of infection. The barriers local villagers set up and maintain during Ebola outbreaks are examples of cultural responses to protect people with a sedentary way of life; the hunters and gatherers do not have such barriers or cultural protocols to keep others away because they can simply move to another area.

Local people often fear stigmatization during Ebola outbreaks because it often leads to isolation and a breakdown of essential social networks necessary for survival. This is in part why families, communities, and even nations in all outbreaks that I am familiar with at first deny or conceal that Ebola exists. When I was a first responder to a Congolese outbreak, local people yelled, "No Ebola here," as we drove by. Being identified as "Ebola people" means isolation and rapid decline in social capital. Social networks of sharing and cooperation are less important in urban-industrial cultures because a person who experiences stigmatization can move to a new area to establish social networks and make a living. Navarrete (2005) shows that people in rural Costa Rica fear scenarios of being isolated more than they fear scenarios where they have to face their own death; the reverse was true for U.S. college students.

Culture (knowledge about disease, niche construction) can increase or decrease levels of stigmatization during an outbreak, but it is best understood in terms on interactions with human nature and ecology. The "Culture Matters" section above is consistent with some existing approaches in applied medical

anthropology. The added value of the ECA perspective in our Ebola work was that it encouraged us to systematically consider the effects and interactions with human nature and biology, such as fear and inclusive fitness, as well as the natural and social ecology.

#### Research Methods

Epidemiologists have an exceptionally sophisticated tool kit of quantitative methods. Epidemiological data during the Ebola outbreak in Uganda indicated that dozens of the early Ebola deaths were associated with contact with traditional healers traveling in the region. Most of the local healers were female. This led the international and national teams to ban all traditional healing activities and led to the stigmatization of healers. When asked by the World Health Organization to participate in control efforts, they asked me, "How are traditional healers amplifying the outbreak?" Health officials were under the impression that traditional healers (often called "witch doctors" by health-care workers and the media) were using razors and knives to cut and suck out poisons or to vaccinate (cut and insert medicines) people for various illnesses.

Social-cultural anthropologists also have complex tool kits that include both quantitative and qualitative methods. In-depth, open-ended interviews with many individuals in the various villages affected by Ebola indicated that healers were not transmitting Ebola during treatments. First, because of rampant HIV/AIDS in Uganda in the late 1990s, the government provided excellent multidimensional health education. Consequently, healers stopped using razors or knives during treatments (healers are always modifying and updating their treatments) and no longer sucked out supernatural poisons sent by sorcerers. They now used a particular type of grass mixed with water to extract poisons. Second, the specific healers implicated in spreading Ebola to the greatest number of victims did not even have their healing equipment (e.g., special divination spear) with them when they traveled in the region. Many Ebola cases were associated with local healers because many people came to take care of them when they got sick, and when they died, many people came to their funerals, touched their bodies, and gave them love touches and kisses. Powerful female healers were associated with Ebola not because of their practices but because when they contracted the disease, people from their large social networks came to care for them and attended their funerals when they died.

Open-ended, in-depth discussions provided useful insights into the quantitative epidemiological data. It was a missed opportunity because healers were very interested in working with the international and national teams to help contain the outbreak. They clearly understood *gemo* described above and had a variety of ideas about how to help control the outbreak. Instead, they were put out of work and often stigmatized.

Overall, the discussion of Ebola outbreaks illustrates the importance of culture (cultural models of illness, burial practices, niche construction). It describes some of the ways in

which cultural, biological, and ecological factors interact and effect human behavior, and it describes the complementarity of qualitative and quantitative methods.

#### Hunter-Gatherer Childhoods

This section builds on the last part of the previous discussion of Ebola and illustrates the importance and usefulness of complementary research methods while conducting evolutionary and developmental psychology studies on hunter-gatherer childhoods. Most of my anthropological research has involved collecting extensive quantitative behavioral data on African forest hunter-gatherer (sometimes known as "pygmy") children (Hewlett 2014). For years, my students and I have collected behavioral observations and conducted experiments with Aka and other hunter-gatherer infants and young children. Topics that we have covered with quantitative data include infant-father attachment (Hewlett 1991), infant care (Hewlett et al. 1998), co-sleeping (Hewlett and Roulette 2014), weaning (Fouts, Hewlett, and Lamb 2005), social learning (Hewlett et al. 2011), and allomaternal nursing (Hewlett and Winn 2014).

Table 1 summarizes some of the quantitative results of studies that compared Aka foragers and Ngandu farmers. The Aka and Ngandu live in the same natural environment and are exposed to similar infectious and parasitic diseases, have similar mortality and fertility rates, speak similar languages (both from C10 Bantu group) as well as speaking each other's language, and see each other on a daily basis because of their multiple social-economic relationships. They share several features of the natural and social environment, but they have substantially different ways in which they care for children.

The quantitative data from our studies were often used to test evolutionary and developmental psychology hypotheses, but frequently the theoretical predictions were not supported. For instance, some behavioral ecologists (Belsky 1997; Draper and Harpending 1982) hypothesized that the forager-farmer differences in childcare were due to variations in reproductive strategies; foragers emphasized parenting effort while farmers emphasized mating effort. Foragers were predicted to have fewer children but to spend more time and effort with each child and have high father involvement, such as fathers frequently holding an infant. Farmers were hypothesized to have more children and spend less time with each child. This does not help to explain Aka and Ngandu differences, because total fertility in both groups was similar (about 6.0 live births per woman). The Aka had just as many children as Ngandu, but they invested highly in each child, such as Aka caregivers holding infants almost twice as long as Ngandu caregivers. Other evolutionary researchers (Kaplan and Dove 1987) suggested that hunter-gatherers held infants more because they were mobile and were exposed to more dangers, such as snakes and other predators. This hypothesis was also problematic, because a study of Aka causes of death (Hewlett, van de Koppel, and van de Koppel 1986) did not identify any cases of infant death due

Table 1. Selected features of childcare among Aka hunter-gatherers and Ngandu farmers

Childcare feature	Hunter-gatherers	Farmers
Infant care:		
Percentage of time held	96	54
Percentage of time fussing and crying	5	12
Percentage of time no one responded to an infant's cry	4	27
Mean number of breast-feeding bouts per hour	4.0	2.0
Mean length of breast-feeding bout (min.)	2	4
Percentage of time infant initiated breast-feeding	68	2
Percentage of infants that received allomaternal nursing	90	5
Co-sleeping:		
Mean size of beds (sq. ft.)	11	22
Mean size of sleeping space per individual (sq. ft.)	4	13
Percentage of middle-aged children who slept with parents	82	33
Who decides where children sleep	Child	Parent
Weaning:		
Age of weaning (yr.)	3–4	1.5–2.0
Who decides when to wean	Child initiated	Mother initiated
Child emotions	Substantial fussing and crying associated with weaning	Fussing and crying seldom associated with weaning
Other:		
Percentage of time fathers held infant in camp or village	22	1
Corporal punishment	Rare	Common

to snakebite or predators, and there were no such cases of infant death observed during decades of field study. In addition, interviews with Aka and Ngandu parents indicated that just as many deadly snakes and biting insects existed in the village as in forest camps and that snakes or predators were not perceived as threatening to infant survival. Aka parents also allowed their infants to play with “dangerous” sharp instruments such as digging sticks, spears, and machetes, while Ngandu parents did not.

To obtain alternative explanations for the behavioral data, we used open-ended and in-depth interviews with forager and farmer parents and children to try and understand their cultural models for the behavioral data. For instance, when asking Aka forager parents why children slept where they did, parents consistently responded, “This is where the child wants to sleep.” One 10-year-old boy said, “I prefer to sleep with my grandmother because I love her; she gives me a lot and takes care of me.” Infants do not decide where to sleep, so parents use the “keep children close” and “keep babies warm” cultural models and usually place the infant between mother and father; a father explained, “I put our baby between us so he can get the smell of his mother and can turn and get my smell.” When Ngandu parents were asked about why their children slept in particular beds the previous night, they regularly said this is where they told the children to sleep. Ngandu children were more likely than Aka to sleep in their own beds, and when parents were asked about why this was, they said their children kept fighting with each other, so they put them in separate beds (Hewlett and Roulette 2014).

Parents provided similar responses when asked about when is a good time to wean a child. Forager parents unanimously

said the child decided. For instance, when a forager mother was asked, “When will nursing end for your son [4-year-old]?” she laughed and said, “Only he knows. Ask him. I cannot know how he thinks and feels” (Fouts, Hewlett, and Lamb 2005). According to the foragers, denying a child the breast will lead to the child contracting a deadly illness. By contrast, Ngandu farmers said the mother decides when to wean her child and uses several techniques (e.g., painting nipples with red fingernail polish to look like blood) to ensure that it happens. Ngandu did not want to breast-feed their children too long because the child would become “lazy,” whereas early weaning would lead her to become more “active.” Similarly, foragers felt that if they did not respond to a crying infant that she would get sick, whereas the farmers felt it made infants more active. Farmers also believed that if their infants were held all the time, like the foragers, that their children would be short (not desirable) and weak. By contrast, the Aka said their infants would get sick if they were not held.

The cultural models for specific childcare behaviors were useful for understanding quantitative behavioral forager-farmer differences noted in table 1, but over time we noticed commonalities across the cultural models. Brad Shore (1996) uses the term “foundational schema” to refer to relatively simple and easy-to-remember ways of thinking that pervade many domains of daily life. Foundational schemas are key cultural values, or what Hallpike (1986) calls “core principles.” Three foundational schema pervade Aka forager life: an egalitarian ethos, respecting the autonomy of others, and the importance of giving. The Aka egalitarian ethos devalues hierarchical political, gender, or age ranking, and the Aka have several cultural mechanisms, such as rough joking and demand sharing, that reinforce

this foundational schema. Respect for individual autonomy is also a core value. One does not coerce or tell others what to do, including children. Generous giving of everything from food and childcare to information and medical care is also highly valued. As anthropologists might suggest, the foundational schema are related. An egalitarian ethos keeps everyone relatively equal, so when it comes time to share, nobody can demand more than others, and respect for autonomy reinforces the sense that everyone is of equal worth.

By contrast, a key foundational schema among the Ngandu farmers is gender and age hierarchy. Ngandu believe that women should show deference and respect to men and that individuals should be respectful of and listen to those older than they are, whether they are older siblings, parents, or other adults. Hierarchies are reinforced through a variety of ways, including corporal punishment of children, domestic violence toward women, and other features of the constructed niche, including patrilocality, patrilineality, a strict gender division of labor, and strong clan organization.

The cultural models and broader foundational schemas that were generated from the open-ended and in-depth interview methods helped to explain the links between several of the forager-farmer contrasts listed in table 1. Forager children decide when to nurse, when to wean, and when and where they want to sleep. They play with machetes, knives, axes, hot pots and pans, or travel to other camps alone or with other children when they want. Child agency is pervasive in foragers. By contrast, Ngandu parents are viewed as having more authority, and mothers decide when and for how long they want to nurse their infant and when to wean. Parents decide where their children should sleep, and they are also more likely to place children in beds with their siblings rather than have the children share a bed with them. Ngandu mothers wean earlier, in part because they say it is harder to work with a nursing infant, and it is painful to breast-feed once the child begins teething. Aka mothers seldom mentioned these issues as being problematic. The Aka giving ethos, which includes the giving of childcare as well as food, helps to explain their practice of multiple childcare (including from fathers), why infants feed for as long and frequently as they want, and why women other than the mother regularly nurse young infants, especially when the mother is working, out of camp, or sick. Allomaternal nursing rarely occurs among the Ngandu.

An understanding of cultural models was useful, but as with other behaviors, biology and ecology also played significant interactive roles. Biological forces such as inclusive fitness, attachment, and incest avoidance influenced several of the items in table 1. Children almost always coslept with biological relatives (none of the Ngandu and only 4% of Aka children slept with nongenetic relatives), the majority of allomaternal caregivers were biologically related to the children, and parents never coslept with their sexually mature adolescent children of the opposite sex.

Allomaternal nursing also appears to be influenced by culture-biology-ecology interactions. Ninety percent of Aka

women who nursed infants were related to the infant (i.e., inclusive fitness). The humid tropical forests have a high prevalence of infectious and parasitic diseases, and all of the foragers in the world who regularly practice allomaternal nursing live in tropical forests; foragers that live in arid environments are less likely to practice it. A working hypothesis is that infants obtain more diverse immune compounds from allomothers (Hewlett and Winn 2014) and that the benefits of obtaining these compounds is greater than the risks to both the infant and the allomother of being exposed to a disease from their contact. But farmers that live in the very same environment have cultural models that forbid allomaternal nursing because they fear other women may have poisons in their breast milk. The forager foundational schema of giving amplifies allomaternal nursing in these high-disease environments while farmer cultural models limit the potential benefits.

A point of the discussion above is to emphasize the importance of culture (i.e., cultural models, foundational schema) in evolutionary studies of childhood, complementarity of diverse research methods, and the importance of culture-biology interactions. Behavioral observations and open-ended interviews have their own strengths and limitations, but a combination of both provides a more comprehensive understanding of the behaviors, that is, how cultural norms or niches interact with fitness-maximizing factors.

## Concluding Remarks

The general features of ECA are consistent with the inside-out metaphor for reintegrating anthropology presented by contributors to this volume Fuentes (2016) and Wiessner (2016). ECA is inherently integrative and transdisciplinary and incorporates contributions from disciplines such as evolutionary biology, cognitive sciences, neurobiology, and developmental psychology. The various disciplines and anthropological subdisciplines bring particular research methods to the table, and each have their own strengths and weaknesses. It is necessary to respect the diversity of methods, understand their potential complementarity, and use or modify alternative methods to better understand human behavior and the nature of culture. ECA also emphasizes that human behaviors are best understood as interactions between culture, biology, and ecology. Anthropologists often indicate that holism is a characteristic feature of the discipline, and ECA provides one framework that can make this possible.

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# Becoming DADS

## Considering the Role of Cultural Context and Developmental Plasticity for Paternal Socioendocrinology

by Lee T. Gettler

Men have the capacity to respond to the transition to fatherhood and nurturant investments in their partners and children with shifts in neuroendocrine function (such as decreased testosterone production). This capacity may be adaptive, reflecting fitness benefits accrued by some hominin males who responded to partnering and parenting with neuroendocrine shifts promoting cooperation and investment. These patterns are not uniform inter- or intraculturally, suggesting that cultural dimensions and norms that shape men's developmental experiences as well as their social and economic roles in adulthood are potentially paramount in the expression of diverse biological responses to fatherhood. Here, I draw extensively on animal models and human studies demonstrating the effects of early-life parenting experiences on the function of neuroendocrine systems in adulthood. Based on my team's research in Cebu, Philippines, and other anthropological studies, I propose a new model (dedication, attitude, duration, and salience [DADS]) that provides a framework for interpreting diverse human paternal biological profiles by integrating across multiple explanatory scales. Specifically, I use this model as an exemplar to highlight the utility of integrating evolutionary and phylogenetic perspectives with those focusing on the developmental niche, early-life influences on neuroendocrine system function (developmental plasticity and programming), and the broad influence of cultural processes and political economy.

Virtually since the dawn of our discipline, there has been interest in the cultural institution of "fatherhood," particularly societal differences in the primacy placed on father-child biological relatedness and other forms of kinship ties that encourage (and delimit) diffuse forms of male investment in children. Indeed, Lévi-Strauss (1963) famously proposed that to fully understand and classify kinship systems, one needed to characterize the web of relationships between mothers, fathers, their children, and maternal uncles, including the "attitudinal" qualities of the father-son and maternal uncle-nephew bonds. Paralleling the emergence of fathers as a focal topic in US-European developmental psychological studies of child well-being (Lamb 1975), anthropological research on the role of fathers has continued to serve as a corrective to fixed ideas about the sanctity and centrality of the nuclear family, including whether fathers are in any sense ubiquitously critical to child morbidity and mortality in addition to "optimal" development (Hewlett 1992*a*, 1992*b*, 2000; Sear and Mace

2008). In particular, anthropologists have shown that fathers' investments facultatively vary based on ecological factors such as residence status, paternity certainty, the presence of other alloparents, and male-female equity in subsistence contributions (Hewlett 1992*a*, 1992*b*, 2000; Marlowe 2000). Fathers' roles are also shaped by cultural institutions and shared beliefs, with prominent examples being partible paternity among certain South Amerindian societies and hegemonic masculine models of male behavior in many Westernized societies (Beckerman and Valentine 2002; Gutmann 1997; Lancaster and Di Leonardo 1997; Walker, Flinn, and Hill 2010).

Thus, there is a diversity of contexts in which men's roles as caregivers, disciplinarians, advocates, providers, and so forth, come to fruition, and cultural institutions such as "fatherhood" can be circumstantially intransigent or malleable in the face of shifting political economic landscapes, such as reconfigurations of familial responsibilities or roles when mothers migrate transnationally for employment opportunities (Hondagneu-Sotelo and Avila 1997; Parreñas 2001) or when US men increasingly serve as stay-at-home dads during economic recessions (Kramer and Kramer 2014). The long-standing (Frisancho 2009; West-Eberhard 2003) but growing interest in the effects of early environments (i.e., the "niche" in which behavior and developing biology interdependently emerge) on adult phenotypes might represent one framework through which our understanding of these processes of individual difference and

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change/stasis of cultural institutions and social roles might be enhanced. In particular, one of the proposed purposes of this special issue of *Current Anthropology* is to further conversations about “integrated” anthropology in such a way that we operationalize frameworks for modeling human behavior that more richly engage across different explanatory scales (evolutionary, ontogenetic-developmental, ecological, and cultural as well as mechanisms of transmission and feedback that apply across those overlapping landscapes).

In this spirit, anthropologists have led the way in applying evolutionary-theoretical and cross-species comparative approaches to understand how becoming a father and the context in which men are socialized to be parents affect the functioning of their neural and endocrine systems. Here, I draw on this example, “the biology of fatherhood” in humans, to provide an initial exemplar of what such an “integrated” anthropological approach to this research area might look like moving forward (Gettler 2014). In particular, my collaborators and I have focused on the intersection between men’s hormones (especially testosterone), longitudinal transitions to marriage and parenthood, and fathers’ parental care and partnering behaviors in the context of Metro Cebu, Philippines (Gettler et al. 2011, 2012, 2013, 2015). I will draw on the work my collaborators and I have produced on that subject, particularly in my concluding remarks.

### Testosterone and the Biology of Fatherhood

It is hypothesized that the capacity for human males’ testosterone to decline in conjunction with male-female partnering and direct paternal care may have emerged evolutionarily because of fitness benefits related to enhanced offspring well-being or continuity of male mating opportunities with the mother (Gettler 2010, 2014; Gray and Anderson 2010; Rilling 2013). Much of the research on the biology of human fatherhood has focused on testing hypotheses derived from the ornithological “challenge hypothesis,” which predicts that males will have low testosterone during time periods in which they partner with females and cooperate with them to raise young (Gettler 2014; Gray and Anderson 2010; Gray and Campbell 2009; van Anders 2013; Wingfield et al. 1990). For the purposes of developing the model I propose here, I am focusing rather narrowly on this existing research on testosterone and the biology of human fatherhood and partnering. It is important to bear in mind that testosterone’s behavioral effects occur through synergistic and antagonistic interactions with other neuroendocrine signals in the body (e.g., vasopressin, oxytocin, cortisol, serotonin, and dopamine; Remage-Healey 2014; van Honk et al. 2010) rather than in isolation, as highlighted in recent reviews on primate paternal psychobiology (Fernandez-Duque, Valeggia, and Mendoza 2009; Gettler 2014; Rilling 2013; Saltzman and Ziegler 2014). This is particularly true for the purposes of thinking about evolutionary or developmental processes affecting the physiological pathways

through which complex behavior, such as paternal nurturance, is expressed.

That said, broadly consistent with the premises of the challenge hypothesis, a number of early human studies found that fathers had lower testosterone than nonfathers in societies around the world, although macrolevel cultural institutions related to partnering (e.g., monogamy vs. polygamy) affected these psychobiological patterns (Flinn et al. 1998; Gray 2003; Gray, Ellison, and Campbell 2007; Gray, Yang, and Pope 2006; Gray et al. 2002; Mazur and Michalek 1998). Muller et al. (2009) were the first scholars to integrate intercultural variation in fathering behavior into a single study design by measuring men’s testosterone in two neighboring East African groups with samples drawn from Hadza foragers and Datoga pastoralists. Marlowe’s (2000) extensive analysis of paternal investment using the standard cross-cultural sample showed that fathers in foraging societies tend to be in close proximity to their children at much higher rates than fathers in pastoralist societies. In keeping with this general pattern, Datoga cultural institutions related to age- and gender-based divisions of household and pastoralist labor contribute to adult men spending much of their time herding and away from camp. They are rarely in spatial-sensory proximity to infants, and children and spend little time interacting with them. Adult males have only some infrequent contact with older juveniles and adolescents when they take on roles with the herds (Klima 1970, in Muller et al. 2009; Sieff 1997). Meanwhile, extensive ethnographic and behavioral observation studies conducted among the Hadza have shown that fathers are often routinely involved with day-to-day childcare, frequently holding and interacting with infants and children and watching over toddlers while women are foraging. They also often cosleep with and are involved with caring for and soothing their children at night (Marlowe 2010). While a number of factors affect Hadza men’s involvement as parents, such as the presence of maternal grandmothers and children’s gender (Marlowe 2010), Muller et al. (2009) hypothesized that the role of fathers as direct caregivers would moderate whether nonfathers and fathers differed for testosterone in their Datoga and Hadza samples. Consistent with their predictions, among the Datoga, fathers and nonfathers did not differ for testosterone, whereas the Hadza fathers had lower testosterone than nonfathers. These results indicate that parenting norms and, specifically, fathers’ routine involvement with direct care contributed to variation in male testosterone based on life history status (Muller et al. 2009).

Building off this insightful work, multiple studies have shown that fathers who engage in more childcare or who are rated as more highly invested (by their child’s mother) have lower testosterone than less involved fathers (Alvergne, Faurie, and Raymond 2009; Gettler et al. 2011, 2012, 2015; Mascaro et al. 2013; Weisman, Zagoory-Sharon, and Feldman 2014). Although this correlation between low testosterone and high paternal care has emerged in diverse cultural contexts around the world and was recently confirmed with longitudinal, within-

individual data (Gettler et al. 2015), we have few insights as to why (i.e., what is it about childcare that affects testosterone or in what ways does low testosterone influence paternal inclinations to care) or specificity (i.e., whether some types of care behaviors matter more than others).

These data appear to support a model in which human fathers' physiology is responsive to their involvement in childcare (Gettler 2014). Combined with results from laboratory-based studies showing low testosterone correlates with more sensitive responses to infant cues (Fleming et al. 2002; Storey et al. 2011; van Anders, Tolman, and Volling 2012) and recent evidence that some expectant fathers' testosterone declines during their partners' pregnancies (Edelstein et al. 2015), these data are consistent with the prediction that low testosterone might facilitate paternal nurturance when fathers engage with their children. They also align with the hypothesis that low-testosterone, nurturant hominin fathers could have had higher fitness than high-testosterone, low-investment fathers under specific ecological and social conditions (Gettler 2010, 2014). Importantly, given demographic, ecological, subsistence, and cultural variability in the evolutionary past, this was probably not ubiquitously the case (i.e., low paternal testosterone as adaptive). Indeed, rates of direct paternal care across cultures are generally quite low, especially compared with mothers (Geary 2000; Hewlett 1992*a*). Moreover, alternative (nonadaptationist) explanations for correlations between low testosterone and high nurturance are similarly possible. For example, this phenomenon may reflect broader primate socioendocrine plasticity (Gettler 2014). Olive baboons who form "friendships" with females and interact positively with their infants have lower testosterone than other males (similar to partnered men and fathers) despite this friendship-nurturant behavior often reflecting mating effort rather than true paternal care (Shur 2008). It is also plausible that the relationship is confounded by a third variable, such as disturbed sleep in involved fathers (but see Gettler et al. 2011, 2012, 2015) or declines in male-male competition that (likely) coincides with heightened fatherly direct care (see discussion in Gettler et al. 2015). As I will explore below, considerations of cultural meaning and developmental niches (Super and Harkness 1986) are critical to advancing our understanding of the pathways through which cross-cultural and between-individual variations in paternal biological profiles come to fruition.

### Do Cultural Institutions and Norms Merely Shape Father-Child Proximity? Or Does Cultural Specificity Matter?

Prior studies of paternal testosterone and childcare involvement have generally focused on broad measures of paternal care and do not provide insights as to the specifics of which care behaviors might be related to low testosterone (Alvergne, Faurie, and Raymond 2009; Gettler et al. 2011, 2012, 2015; Mascaro, Hackett, and Rilling 2013; Weisman, Zagoory-Sharon, and Feldman 2014). A recent study of Israeli father-

infant pairs comes the closest to providing insights in this regard, finding that fathers with lower testosterone specifically directed more affectionate touch and "motherese" toward their infants during laboratory-based parent-child interactions (Weisman, Zagoory-Sharon, and Feldman 2014). In total, many questions remain about the direction of the effects between testosterone and paternal care and the specifics of how they emerge in different cultural and family system contexts.

At an intracultural level, we do not know the mechanism by which becoming an invested, caring father downregulates testosterone in some cultural settings (or whether the mechanism varies across cultures; Gettler 2014). Is it sensory, such as exposure to cues from one's pregnant partner or infant? Is it cognitive, reflecting the mental processes of fathers developing paternal identities, forming social-emotional bonds with their children, and/or accommodating other psychosocial demands of parenting a young child? Does it reflect a shift in fathers' status or social interactions within the broader community? One hypothesis is that caregiving fathers in the United States, the Philippines, Israel, and Senegal show lower testosterone than noncaregiving fathers because the societies have overlapping fathering domains that include father-child physical proximity and positive interactions. I will refer to this as the "generic interaction hypothesis," which suggests that the mere occurrence of positive, potentially nurturant father-child interactions is paramount to a low-testosterone paternal phenotype, whereas the influence of specific cultural norms and the "meaning making" associated with the interactions' contents is comparatively unimportant.

Alternatively, it is also plausible (and testable) that responses to encompassing, broad-based questions regarding paternal care, such as "How many hours of physical care do you provide to your children per day?" or "Do you share a sleeping surface with your partner and child?" (i.e., Gettler et al. 2011, 2012), simply capture aspects of stronger relationships between fathers' testosterone and specific care behaviors. Similarly, broad-based measures that account for the sheer quantity of paternal care might be imprecise proxies for a more important component of father-child interactions: quality or content of care. These factors might help account for the fact that effect sizes for paternal childcare-testosterone relationships are often small. For example, in Weisman and colleagues' (Weisman, Zagoory-Sharon, and Feldman 2014) recent study, they found that fathers' self-reports of day-to-day caregiving only moderately and nonsignificantly correlated with testosterone. Meanwhile, they found a larger effect size indicating that fathers with lower basal testosterone engaged in more affectionate touch during direct observation of father-child interaction. Here, I propose an alternative to the generic interaction hypothesis: the dedication, attitude, duration, and salience (DADS) hypothesis. This model incorporates the individual motivations, cognitive perceptions, and psycho-emotional interpretations (dedication, attitude) that fathers bring to their interactions with their children (Mar-

siglio 2004), the frequency with which and the opportunities they have to engage (duration), and the degree to which their behaviors have implications for their children's well-being and are consistent with the broader valorized roles for fathers in their cultural group or community (salience).

Although fatherhood is still relatively understudied in the social sciences, including anthropology, there are sufficient data from other research domains to state that cultural institutions and beliefs about gender, masculinity, parenting, and child development affect what mothers, fathers, and alloparental caregivers do and the interpretative framework they and those around them bring to bear on interactions with children. On a global scale, ecological factors (e.g., mortality rates), political and economic dynamics (e.g., subsistence practices, employment opportunities, migration), and marriage-fertility patterns (e.g., the likelihood that fathers reside with or near their children) also intersect with cultural beliefs to affect fathers' possible or probable roles (Hewlett 2000; Marlowe 2000; Quinlan 2007; Shwalb, Shwalb, and Lamb 2013; Super and Harkness 1986). Incorporating ethnography and/or more nuanced behavioral observation into studies of paternal socioendocrinology will enable us to test hypotheses aimed at differentiating between the generic interaction and DADS models by providing insights on whether paternal psychobiological changes are linked to men's participation in culturally valorized care behaviors, their own cognitive interpretations of their fathering roles, or both (or neither).

As an example, Hewlett conducted pioneering ethnographic research in the Central African Republic on Aka fathers, who have been famously declared "the world's best dads" by the media because they are more involved in daily childcare, on average, than fathers in any other known culture. Hewlett's findings showed that Aka fathers did not primarily engage with their children via rough-and-tumble play (Hewlett 1992*b*). Until then, such play had been construed (by some) as a fundamental component of fathering behavior (Hewlett 1992*b*), based primarily on studies of US fathers, who often engage in play as a major component of time spent in parenting (Sayer, Bianchi, and Robinson 2004). Thus, one could hypothesize that similar to or more so than US fathers (Mascaro et al. 2013), Aka fathers would likely have lower testosterone than nonfathers, and caregiving fathers might have lower testosterone than noninvolved fathers. However, one would hypothesize that if cultural domains related to fatherhood, family life, and gender roles affect the manifestation of paternal socioendocrinology, the specific care behavior of rough-and-tumble play would only have hormonal implications for US fathers, particularly if it is expressed in a nurturant manner (van Anders et al. 2013). According to the DADS model, one would hypothesize that US fathers who are socialized to value this play behavior and who consider it an especially rewarding component of fathering and frequently engage in such play would be likely to show low testosterone (Feldman 2003; Kazura 2000; Weisman, Zagoory-Sharon, and Feldman 2014). Moreover, under the DADS model, considering the implications of reduced

testosterone for men's sensitivity and efficacy as fathers, one would hypothesize that low paternal testosterone would increase the quality of men's interactions with their children in culturally specific domains rather than in more generic nurturant or interactive categories.

The framework I am proposing (with rough-and-tumble play as my exemplar) would be grounded in an approach that considers the influence of the "cultural developmental niche" through the life course (Super and Harkness 1986). For example, new US fathers might be apt to recapitulate rough-and-tumble play based on their own parents' behaviors, that is, the likelihood that their own fathers focused on rough-and-tumble play with them and were encouraged to do so (Lindsey, Mize, and Pettit 1997). US boys also receive validation of roughhousing as a gender-appropriate social behavior from childhood and beyond, a pattern that is common in many cultures and likely reflects, at least in part, cross-primate tendencies for these physical play behavioral patterns to emerge among young (preadult) males (Pellegrini and Smith 1998; Poirier and Smith 1974; Whiting and Edwards 1973). While a review of masculinity, culture, and socialization are well beyond the scope of this article, as males move through childhood, transition to adulthood, and become fathers, cultural institutions and shared beliefs help shape men's perceived capacities as parents and are reinforced through pathways such as their family systems, community interactions, political economic factors (e.g., subsistence practices, paternity leave policies), and media messages (Bronfenbrenner 2009; Gentry and Harrison 2010; Hewlett 2000; Lancaster and Di Leonardo 1997; Marlowe 2000).

The idea here is not only to consider the types of behaviors (in this case, specific forms of fathering) and interpretive frameworks thereof that are influenced by one's cultural developmental niche but also to incorporate an understanding of the ways in which those early-life experiences become "embodied," "encultured," or "enfolded" within one's neural and endocrinological systems (Ingold 2004; Lende and Downey 2012), helping to shape the very biological pathways through which the "biology of fatherhood" emerges and the implications it might have for men's behaviors as they transition to parenthood and develop relationships with their children. To do so, we must evaluate whether the importance of cultural domains (for these questions) is simply in the degree to which they shape the opportunities for fathers to be physically near and/or engaged with children (the generic interaction hypothesis) or whether there is a more substantive effect of cultural specificity on paternal socioendocrinology (the DADS model) from the developmental period, when neural plasticity is highest (Lende and Downey 2012), to adulthood, when parents can actively recapitulate or deviate from their own familial experiences and the cultural norms of their group. Importantly, while there is great potential to enhance our understanding of the ways in which developmental (biological) plasticity interrelates with individual and cross-cultural variability in beliefs and behavior, it is imperative to

recognize that no neural-endocrine system is infinitely malleable. Some pathways, such as the hypothalamic-pituitary-gonadal (HPG) axis that produces testosterone (Bribiescas 2001; Hau 2007), likely have phylogenetically ancient, evolutionarily conserved limits to their responsiveness and malleability due to their critical roles in nonbehavioral physiological functions. In the subsequent sections, I will draw primarily on a comparative (animal) approach to provide a preliminary foundation for thinking about paternal neural-endocrinological plasticity across the life course, which is a key complement to evolutionary and cultural niche perspectives in this research domain.

### Animal Models for the Developmental Niche: Paternal Effects on Offspring Development

In monogamous mammalian species that have evolved biparental care, paternal investment is often obligatory for offspring survival under natural conditions and not readily or fully substitutable (Gubernick and Teferi 2000), unlike among humans, for whom this is less often true (Sear and Mace 2008). Experimental, laboratory-based animal models examining the behavioral and biological outcomes associated with variation in paternal care often remove the fathers entirely and compare offspring from father-present groups with offspring from father-absent groups. Thus, it is important to recognize these human versus nonhuman species differences and research design issues when drawing on these data. However, these comparative studies do serve as a useful launching point to discuss developmental influences on human paternal socioendocrinology.

A number of recent studies have assessed the effects of paternal deprivation on offspring neurodevelopment using the degu (*Octodon degus*), a rodent species that exhibits biparental care. These studies have found differences in synaptic density and neural organization between father-present and father-absent offspring in prefrontal and anterior cingulate cortices and limbic regions (Braun et al. 2013; Helmeke et al. 2009; Ovtscharoff, Helmeke, and Braun 2006; Seidel et al. 2011). This is not especially surprising, as a father-absent context is a “semi-deprived social environment” for this species (Braun et al. 2013). It is likely that these prefrontal cortical and limbic system neurodevelopment differences have effects on later social behavior (such as degu paternal care; Helmeke et al. 2009), as they have been linked to parenting in many mammalian species, including humans (Swain et al. 2012, 2014). To my knowledge this has yet to be tested.

In the mandarin vole, a species in which males and females pairbond and fathers help care for young, males who experienced paternal deprivation during the neonatal period had elevated corticosterone (rodents' functional equivalent of human cortisol) and showed increased aggressive and reduced affiliative behaviors when interacting with females. Following cohabitation with a female, males raised without fathers also showed reduced dopamine receptor expression in a brain region that is integral to reward pathways (Yu et al. 2012) that

likely facilitate fathers' preference for and motivations toward their pups postpartum (Wang et al. 2012). While the effects of deprivation on paternal care were not assessed, pairbonding and biparental care behaviors are closely linked among monogamous voles.

Indeed, in a separate study, mandarin voles who were raised without fathers engaged in less huddling, licking, and grooming of their pups when they became fathers themselves when compared with their peers raised by two parents (Jia et al. 2011). The authors suggested this may have been due to paternally deprived males also having significantly less estrogen receptor expression in limbic and hypothalamic regions of the brain that play critical roles in social behavior. Recent research from the same scholars showed that early paternal deprivation also affected adult offsprings' hypothalamic production of vasopressin (AVP) and oxytocin (Wang et al. 2014), which have been widely studied for their importance to vole pairbonding and fathering (Young 2011; Wang et al. 1999). Finally, a behavioral study of prairie voles found that when paternally deprived males became juveniles, they engaged in less alloparental care of their younger siblings compared with those raised by both parents (Wang and Novak 1994).

Using a novel study design to assess the effects of California mice fathers on their sons, Gleason and Marler (2013) compared the offspring of castrated and gonadally intact fathers. Testosterone is necessary for normative expression of paternal care in this species (Trainor and Marler 2002; Trainor et al. 2003). Thus, castrated fathers performed less-than-typical amounts of care, but in this study fathers were not removed entirely, unlike those I described above. In adulthood the sons of castrates recapitulated their fathers' behaviors (even though they, themselves, had functioning testes and normative testosterone levels) by engaging in less pup huddling and grooming compared with sons who had been raised by (gonadally) intact fathers. These results suggest that there are nongenomic pathways through which behaviors are transferred from fathers to sons that can skew behaviors away from species norms and the physiology underlying them (Gleason and Marler 2013). Other experimental research on this species indicates that the frequency with which fathers retrieve their pups (an important paternal care behavior) predicts the adult offsprings' later AVP production in the limbic system (specifically, the bed nucleus of the stria terminalis [BNST]) and their aggressive responses to intruders (Frazier et al. 2006), which is a form of indirect paternal care (Trainor, Finy, and Nelson 2008). Prior research in which California mice pups were cross-fostered to a related species in which mothers solely raise young showed that lack of exposure to paternal investment during development impaired males' fatherly behavior when they became parents as adults (Bester-Meredith and Marler 2003). Thus, when taken together, these studies suggest an integrated developmental-neurobiological-behavioral framework through which paternal phenotypes can be nongenomically inherited and modified by early environments.

These animal models provide a baseline for thinking about the ways in which culturally mediated aspects of gender socialization and paternal roles help to shape boys' developmental trajectories from infancy through adolescence and the effect those experiences may have on their neurobiological and endocrine systems. The nonobligatory (in the sense of offspring survival, at least) nature of human paternal care (Sear and Mace 2008) adds tremendous complexity to the question of how early experiences of parental and alloparental care might affect developing neurobiological and endocrine systems in ways that have few clear analogies in the animal literature. That said, this line of thinking could allow us to develop richly nuanced "biocultural" hypotheses by, for example, integrating my DADS model, including concepts of developmental plasticity, to assess the interface between the evolutionarily ancient, relatively conserved HPG axis that produces testosterone (Bribiescas 2001; Hau 2007); boys' social interactions with their parents, alloparents, and other members of their community during childhood; and their own fathering behaviors in adulthood.

### Early Environments Shape Primate Neurobiology and Behavior

While to my knowledge there are no studies of primate fathers that are equivalents of the intergenerational rodent biobehavioral studies I describe above, there are relevant primate models for maternal effects on offspring biobehavioral profiles in adulthood. Research exploring the effects of early environments on rhesus macaque neurobiology has shown that the context in which macaque infants are reared (by their mothers vs. in peer groups) interacts with their genotype to affect their central nervous system function and behavior in juvenility and adulthood. These questions have been extensively studied for the neurotransmitter serotonin, low levels of which have been linked to reactive aggression and negative affect in humans (Flory et al. 2004; van Honk et al. 2010). Compared with maternal-reared monkeys, peer-reared macaques showed reduced overall central serotonin receptor expression (Spinelli et al. 2010). They also had lower central serotonin levels but only if they were heterozygous for a serotonin transporter genetic polymorphism that affects central serotonin function (Bennett et al. 2002). Meanwhile, recent evidence suggests that peer-reared and mother-reared monkeys also differ for epigenetic regulated expression of the serotonin transporter allele (Lindell et al. 2012). Finally, these researchers (Champoux et al. 2002; Jedema et al. 2009) and others (McCormack et al. 2009) have found a number of significant serotonin transporter gene X rearing environment interactions that predict monkeys' behaviors from infancy through adulthood. As an example, male monkeys who were carriers of the "short" serotonin transporter allele and were peer reared were more likely to engage in "high-risk aggression" compared with other monkeys (Schwandt et al. 2010).

Other rhesus macaque research has similarly examined the importance of early rearing environments for offspring neurobiological-behavioral development but has focused on naturalistic variation in maternal care. Notably, in a study in which he cross-fostered offspring between abusive and non-abusive mothers, Maestripieri (2005) found that abused offspring had a high likelihood of becoming abusive mothers themselves, in adulthood, regardless of cross-fostering, whereas none of the females raised by nonabusive mothers were abusive to their offspring in adulthood. This showed that a significant component of the intergenerational transfer of mothering behavior (at least for abuse) was nongenomic (Maestripieri 2005). In a similar subsequent study, rhesus monkeys who were frequently rejected by their mothers during infancy had lower central serotonin throughout juvenility and into adulthood compared with infants who experienced less maternal rejection. In adulthood, females who were abused by their own mothers and who had low central serotonin production were more likely to become abusive mothers themselves (Maestripieri et al. 2006). Adding to these findings, other researchers have also found impaired serotonin function and disinhibited impulsive behavior in young rhesus macaques that experienced maternal aggression early in life (Kinnally et al. 2010).

Elsewhere, Hinde's recent research has shown that rhesus mothers convey signals to their offspring via breast milk's energy and hormonal constituents, which influence offspring behavior and temperament, calibrated to align with maternal experience and condition (Hinde et al. 2015). The specific mechanism of intergenerational, nongenomic information via breast milk is obviously not directly applicable to mammalian fathers. However, Hinde's work highlights the complexities of parent-to-offspring biological signaling and suggests we must be creative in our considerations of the early developmental environmental and social factors that might influence or program the neuroendocrine substrates that later underlie parenting.

Although the collection of equivalent data is challenging in light of human's comparatively long generation times, there are a few similar studies assessing parent-to-offspring transfers of mothering behavior and its neurobiological correlates. Using functional magnetic resonance imaging (fMRI) to assess mothers' brain structure and activity in the early postpartum, Kim and colleagues found that new mothers whose own mothers were invested caregivers had more gray-matter volume in a variety of prefrontal cortical regions compared with mothers who received low care (Kim et al. 2010). Some of these regions play critical roles in the processing of emotional stimuli and in assessing the intentions and mental states of others. Along those lines, many of these same regions became particularly active among well-cared-for mothers when they listened to recorded infant cries, suggesting they were primed to react empathetically. In contrast, new mothers who received low maternal care showed activation in the hippocampus when hearing cries. Activation of the hippocampus is critical to the body's control of HPA responses to psychosocial stressors. This suggests that these mothers found infant cries stressful or

challenging during this early postpartum period and, possibly, that they might respond less sensitively to their infants (Kim et al. 2010).

In a similar brain-imaging study, mothers who had experienced attachment-relationship-related trauma showed different neural responses to negative emotions in their infants compared with mothers who had healthy attachment-relationship histories (Kim et al. 2014b). In particular, mothers with no attachment-related trauma showed high amygdala responsiveness to images of their own infants' distressed facial expressions and low amygdala responses to their infants' happy faces. In contrast, those who had negative attachment-relationship histories had blunted amygdala responses to their infants' distressed faces and heightened amygdala activity when viewing their babies' happy facial expressions. Elevated maternal amygdala activity in response to infant distress, specifically, may help mothers attune to their children's needs more vigilantly and optimally (Swain et al. 2012), and the authors hypothesize that this lack of maternal responsiveness among traumatized mothers could contribute to cross-generational transfers of such attachment-related experiences (Kim et al. 2014b).

Other recent fMRI research on nulliparous women also indicates that subjects who did not have secure attachment relationships during early life show hyperactivation of the limbic system in response to images of emotional faces (Lenzi et al. 2013) and recorded infant cries (Riem et al. 2012) compared with securely attached nonmothers. Finally, a small study of both male and female college students found that subjects who perceived that they received low-quality maternal care early in life showed heightened dopamine release and elevated cortisol in response to an acute psychosocial stressor compared with those reporting high-quality care (Pruessner et al. 2004). Thus, unsurprisingly, these results suggest that the effects of early attachment and parenting contexts might shift neurobiological development broadly rather than being circumscribed strictly to parenting-related stimuli and across the life course, not being limited to neural shifts that occur only at the transition to motherhood.

As applied to my focus here, the major limitations of the research I have reviewed above should be fairly apparent: most of the data focus on extreme negative forms of maternal care (abuse, trauma) and how they relate to later neurobiological-endocrine and behavioral phenotypes in the adult offspring (Barrett and Fleming 2011). Indeed, even the widely known, elegant rodent models developed by Meaney, Champagne, and colleagues for the nongenomic transfer of rat dams' mothering behavior and stress profiles across generations, which highlights mechanisms at various levels of the organisms and mother-infant dyad, from behavioral to neurobiological to epigenetic, focuses explicitly on behavioral extremes. Imagine maternal care as a normally distributed trait; the scholars compare rat mothers who fall either at the left tail (low care) or right tail (high care) rather than those in the middle of the distribution (e.g., Champagne et al. 2004). Moreover, heretofore, in terms of understanding how early experiences shape human psychobi-

ology and behavior, many of the nonhuman primates studies I discuss above have been construed primarily as useful animal models for intergenerational recapitulation of child maltreatment or cycles of suboptimal parenting (e.g., Maestripieri et al. 2006).

While an imperfect analogy for potential pathways through which cross-cultural and individual differences in paternal physiology emerges, the data I review above do provide a critical foundation for modeling the ways in which early social relationships can affect neurobiological developmental trajectories. On average, mothers are human infants' primary attachment figures and/or caregivers across cultures. Fathers are capable of playing these primary roles but are more often secondary figures. Other alloparents (e.g., grandmothers) can and do complement and substitute in those roles (Hewlett 2000; Hrdy 1999; van IJzendoorn, Bakermans-Kranenburg, and Sagi-Schwartz 2006). Developmental trajectories for male neurobiology/endocrinology might vary intra- or interculturally because of differences in fathers' availability as attachment figures (e.g., father presence vs. father absence; e.g., Flinn et al. 1996). However, reducing the effect only to paternal presence/absence implies that there are nonsubstitutable, unique effects of fathers on the developing human brain (in all cultural contexts). Although we are only at the beginning stages of being able to address these possibilities, I would argue that the process is likely to be more complex. In addition to importance of parental and alloparental attachment figures, we need to incorporate other cultural and family system corollaries of socialization and variation in gender roles into models of neurobiological development while bearing in mind (and exploring) the limits of plasticity in neural-endocrine systems such as those producing oxytocin and AVP as well as the HPG axis.

### Plasticity Later in Life: Do New Dads' Brains Structurally Change?

Evidence for the ways in which fathers' brains structurally adjust to parenthood once again emerge from studies of *Peromyscus* and *Microtus*. In a recent review of this literature that far exceeds my scope here, Lambert (2012) discusses the physical changes and altered functioning of both maternal and paternal brains and also highlights that much of our knowledge of mammalian parental brains stems from studies of rodent species with maternal care only. Studies comparing *Microtus* species have demonstrated that prairie vole males show changes in the density of AVP neural fibers in specific nuclei of the limbic system days after they become fathers and engage with their pups. These fiber density patterns differentiate new prairie vole fathers from sexually naive, nonfather prairie voles (Wang et al. 1999). While still notable, these changes probably reflect altered AVP production and release rather than neural structural change in new fathers. In contrast, new meadow vole fathers do not show comparable AVP fiber changes and do not differ from sexually naive conspecifics thereof. New mothers of



either species do not show equivalent AVP neural activity shifts (to those in new prairie vole fathers; Wang et al. 1999). Moreover, these AVP neural shifts in pairbonded prairie vole fathers appear to be impermanent, suggesting plasticity that is specific to the mating and gestation periods, facilitating paternal responsiveness (Bamshad, Novak, and de Vries 1994).

In a study of marmoset neurobiology that directly measured neural plasticity and structural change, fathers were found to have higher levels of AVP dendritic spining and elevated expression of AVP receptor 1a (AVPR1a) in their prefrontal cortices compared with nonfathers. Marmoset fathers with young infants, who require the most care, had the greatest AVPR1a expression, suggesting infant contact may have contributed to upregulation of these pathways and that this paternal neuroplasticity might be transient. These effects were specific to AVP, as fathers did not show similar neural reorganization related to oxytocin or prolactin pathways (Kozorovitskiy et al. 2006).

There are few available studies that offer potential insights on changes in men's neural structure following the transition to fatherhood. Mascaro et al. (Mascaro, Hackett, and Rilling 2014) recently compared fathers' and nonfathers' brains while viewing children's photos as well as a separate set of sexual images. In response to child visual stimuli, fathers' brains showed higher activity than nonfathers in areas related to facial processing (such as evaluating others' emotions) and reward pathways. Meanwhile, nonfathers showed enhanced activity in motivation and reward pathways when presented with sexual imagery when compared to the neural activity among fathers. While the study tested for brain activity (not neural structural) differences and was cross-sectional, its results are consistent with neural mechanistic shifts we would predict would occur across the transition to fatherhood, based on human life history, as men's reproductive and social priorities shift and they navigate time and behavioral trade-offs (Gettler 2014; Mascaro, Hackett, and Rilling 2014).

To my knowledge, Kim and colleagues' (Kim et al. 2014a) recent research is the only study that has evaluated within-individual, longitudinal changes in fathers' brains. When assessed in the first and fourth months postpartum, fathers showed gray-matter growth in areas of the brain that have been previously linked to parental experiences of reward and attachment as well as complex decision making, including areas of the limbic system, reward regions, and the lateral prefrontal cortex. As the authors point out, their results offer some continuity with the nonhuman primate findings I discuss above, in which marmoset fathers of young infants showed AVP dendritic spine density growth in the prefrontal cortex (Kim et al. 2014a; Kozorovitskiy et al. 2006). Kim and colleagues (Kim et al. 2014a) showed that fathers with gray-matter growth in cortical and subcortical brain regions had lower depression symptomology, suggesting the neural changes have implications for parental coping and efficacy. In contrast to prior findings from mothers, new fathers showed gray matter decreases in brain regions of the "default mode network" and those related to heightened anxiety. Fathers with larger reductions in one of

the latter domains (the orbitofrontal cortex) engaged in greater stimulatory, challenging play with their infants during observation. The authors suggest these neural-behavioral patterns might indicate decreasing paternal anxiety and increasing familiarity with their infants as fathers gain experience in the postpartum (Kim et al. 2014a).

These few available studies of males in species with biparental care indicate that fathers' brains not only have the capacity to adjust functionality and activity (with potential downstream effects on endocrine systems, e.g., the HPG axis) in connection with parenthood but that the structure of paternal neural networks are potentially reshaped in conjunction with the fatherhood transition. Neural plasticity is clearly lower in adulthood than during early stages of development (Lende and Downey 2012), but this does indicate neurobiological flexibility later in life, which is especially commensurate with behavioral plasticity (and tendencies away from canalization based on developmental exposures) in humans.

To date, most of the (few) imaging studies of human fathers' brains focus on neural activity patterns in response to specific sensory stimuli (Swain et al. 2014), not restructuring or reorganization in neurobiological pathways. For example, Mascaro et al. (Mascaro, Hackett, and Rilling 2013) showed that fathers who were highly involved in childcare showed greater brain activity in dopamine reward networks compared with fathers who performed less care; elsewhere, Kuo et al. (2012) found that fathers' prefrontal cortical activity in response to recorded video of their own infants varied based on how sensitively the fathers engaged with their children during observed interactions. In a separate study, fathers with "restrictive" parenting attitudes (e.g., less nurturant, more punitive) showed lower neural activity in brain regions connected to empathy compared with less restrictive fathers when listening to infant cries (Mascaro et al. 2013). Thus, unsurprisingly, we see that between-father differences in parenting attitudes and behaviors correlate to variations in neural function.

Given that humans have the potential to consciously deviate from their own parents' behaviors, creating novel developmental niches for their own children (van IJzendoorn 1992), it leaves open the question as to whether the magnitude of human parental neural restructuring might be moderated by one's early experience. That is, neural restructuring might depend on the extent to which one's parenting behaviors and constructed developmental niche (for one's children) deviate from one's own rearing/social experiences. A few related, open questions and testable hypotheses that could help us better understand the intersection between early environments and adult parental capacities and decision making are (a) do larger deviations (from one's own upbringing) facilitate and/or require more substantial neural recalibration in adulthood, (b) do certain early forms of experience provide less opportunities for later life plasticity (i.e., more canalization; Wells 2014), and (c) because not all neurobiological systems are likely to show the same range of "sensitivity" to early influences or plasticity in adulthood, which pathways or systems (e.g., HPG axis, dopa-

mine, serotonin, oxytocin, AVP) are shaped by what experiences and when?

### Toward DADS as Integrated Anthropology

Two useful heuristics for thinking about my DADS model, the neuroendocrine behavioral models I review above, and “integrated anthropology” are Lende and Downey’s (2012) “encultured brain” paradigm and Ingold’s “unfolding-enfolding” depictions of organism-environment relationships. Specifically, Ingold (2004), paraphrasing Lehrman (1953:345), writes, “The interactions from which the development of an organism proceeds are not between genes and environment but between organism and environment, and the organism is not a constant but the continually changing embodiment of a whole history of previous interactions that have shaped its life course to that point.” Ingold goes on to add, “Nor is the environment a constant for it, too, exists only in relation to the organisms that inhabit it, and embodies a history of interactions with them” (Ingold 2004:218). I will draw on one final exemplar from my own research on paternal socioendocrinology to demonstrate the relevance of these ideas.

In our research in Metro Cebu, Philippines, my collaborators and I found that single men with higher testosterone at age 21 were more likely to be partnered fathers at age 26. During that 5-year time frame, men who transitioned from being single nonfathers to being newly partnered fathers experienced significantly larger declines in testosterone than men who remained single nonfathers (Gettler et al. 2011; fig. 1). The new fathers showed particularly large declines in testosterone if they resided with their children (Gettler et al. 2015). Fathers who were highly involved in day-to-day care and who coslept had lower testosterone than less involved fathers (Gettler et al. 2011, 2012). We recently showed that men’s caregiving involvement and their testosterone change in tandem, longitudinally, so as fathers increase their caregiving through time, their testosterone declines (and vice versa; Gettler et al. 2015; figs. 2, 3). Thus, in Cebu, elevated testosterone among single nonfathers positions men to perform their subsequent roles as partners/parents, which, to the extent that they embrace opportunities for nurturance, leads to lower testosterone. Framed within my DADS model, our data illustrate intersections between fathers’ “duration” of childcare and their testosterone and provide indicators of the contextual “salience” while shedding less light on “dedication” and “attitude.”

From a historical perspective, what is potentially taken for granted in that brief synopsis is that “opportunities for nurturance” (salience) only recently became somewhat commonplace for fathers in Metro Cebu. There has been a nontrivial increase, on average, in paternal involvement in childcare from the early 1980s (at least) to the present in Metro Cebu (Gettler et al. 2015; Liu, Rubel, and Yu 1969; Tiefenthaler 1997). This general shift in parenting practices, in which some men (“generation two”) are providing substantive direct care to their children (compared with their own fathers, “generation one”),

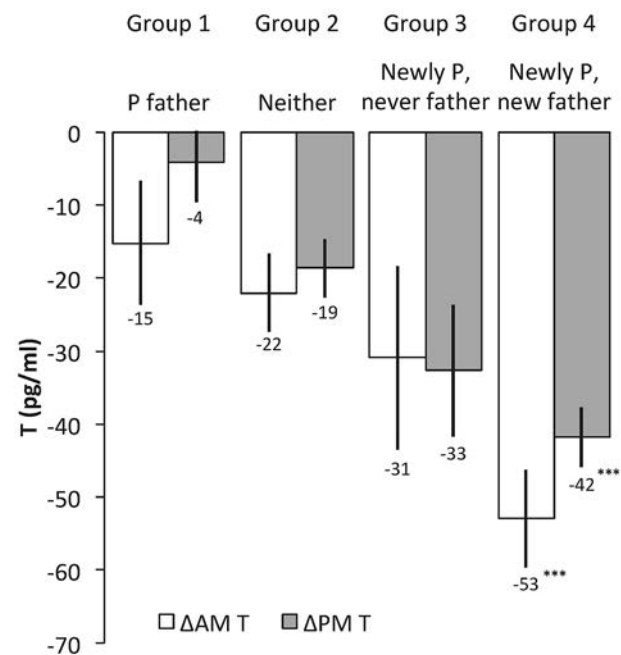


Figure 1. Changes in Cebuano males’ waking (AM) and evening (PM) testosterone (T) between ages 21.5 years and 26 years, based on partnering and parenting status. Figure and legend (adapted) from Gettler et al. (2011). P = partnered. Group 1 ( $N = 83$ ), men who were partnered and fathers at both time points. Group 2 ( $N = 257$ ), men who were not partnered or fathers at either time point. Group 3 ( $N = 46$ ), men who became partnered between ages 21.5 and 26 years but were never fathers. Group 4 ( $N = 162$ ), men who became partnered and first-time fathers between ages 21.5 and 26 years. Values derived from regressing change in testosterone on changes in partnering and parenting status with group 2 as the comparison group. Group 1 is included for visual comparison but was not part of the regression analyses. \*\*\* =  $P < .001$ . Error bars indicate SEM. Copyright (2011) National Academy of Sciences, USA.

conflicts with long-standing cultural models related to family life, gender roles, and concepts of masculinity (Dumont 1993; Medina 2001; Tan 1994). Traditionally, such hands-on care behaviors are ascribed to Filipino mothers, whereas fathers’ roles in the family have historically aligned with breadwinning and instilling moral values and behaviors (Harper 2010; Medina 2001; Tan 1994). The root causes of this shift in paternal involvement are not clear and have not been explicitly studied to my knowledge. However, the historical trajectory coincides with the implementation of neoliberal economic policies in the Philippines, which increased female labor opportunities/participation (particularly through growth in urban service sectors), as well as financial crisis in East Asia, which disproportionately increased male unemployment and underemployment relative to females (Lim 2000). This period in time also saw high rates of females migrating from the Philippines for international labor opportunities to send home remittances (Porio 2007). Pingol (2001) has specifically argued that female migration leads to a “remaking” of masculinities for Filipino

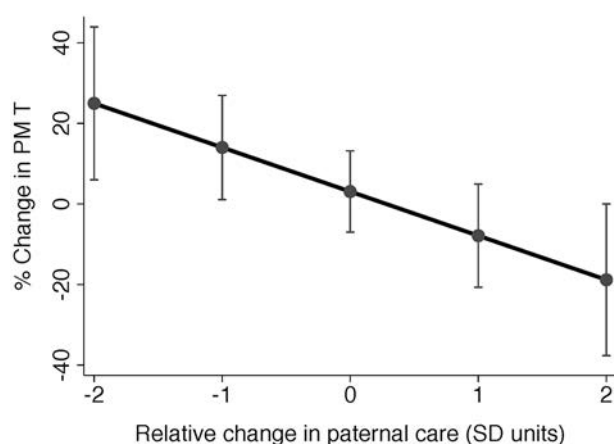


Figure 2. Percentage change in Cebuano fathers' evening (PM) testosterone (T) based on relative change in paternal care between ages 21.5 years and 26 years. Results and figure adapted from Gettler et al. (2015). Change in paternal care (z-score) between ages 21.5 and 26 years indicates a change in care effort relative to peers. Black line = linear relationship between percentage change in T and relative change in paternal care ( $\beta -10.95 [-18.94, -2.96]$ ;  $P = .008$ ). Error bars indicate 95% CI.

fathers who stay behind and care for their children. While it is speculative, the effect of neoliberal economic policies and heightened female labor participation may have contributed to shifts in family life and fathering roles in the Philippines. While in the case of Cebu, our contemporary data do not show a continuous, negative relationship between fathers' work and caregiving hours (Gettler et al. 2015), unemployed fathers are significantly more involved in day-to-day caregiving than are those with jobs (Gettler 2012).

Whatever political economic or cultural processes precipitated increased paternal caregiving in recent decades in Cebu, my argument here is that the children (generation two) experiencing the nascent increases in paternal care (by generation one) could have been developmentally and neurobiologically affected by that novel familial and social context. The outcome of such developmental plasticity programming could be (or could have been) intergenerational variation in the expression of the "biology of fatherhood," with direct implications for (generation two) men's cognitive and emotional processing of parenting roles and opportunities and contributing to lower thresholds for paternal nurturant behavior with implications for general shifts in cultural domains related to fatherhood and family life (salience). In terms of considering how such early exposures could affect men's testosterone as fathers in adulthood, the very brain nuclei in the hypothalamus (and their downstream targets in the pituitary and gonads) that ultimately control testosterone production and the other brain areas that synapse on those nuclei are potentially modulated in part through developmental processes and social experiences before reproductive maturation. For example, animal models indicate that prenatal hormonal exposures can affect neural

function related to regulation of the HPG axis (Sullivan and Moenter 2004). In other research emerging from Cebu, Philippines, Kuzawa et al. (2010) showed that early infancy experiences, such as breast-feeding duration and morbidity, can affect men's HPG function in adulthood. Additionally, Flinn and colleagues (Flinn et al. 1996, 1998) have shown that men who, as children, grew up in father-absent households in Dominica have lower testosterone (as well as higher cortisol) in adulthood than do men who grew up in father-present households. While the human HPG axis is largely quiescent through childhood until adolescence approaches (Bribiescas 2001), the neural networks upstream of the HPG axis, which eventually control it or interface with it, could still be subject to environmental/social effects. Specifically, gonadotropin-releasing hormone (GnRH) neurons, which initiate production of testosterone by the HPG axis, receive afferent neuronal input and/or are downstream of neural circuits involving a large number of neuropeptide and monoamine systems (Hrabovszky and Liposits 2013) that are active throughout development (e.g., Guerriero et al. 2012; Gunnar and Vazquez 2001; Kalin, Shelton, and Lynn 1995; Kinnally et al. 2010). While focused on a different neuroendocrine system, recent research on the intergenerational transfer of oxytocin function and social behavior within Israeli family systems provides preliminary



Figure 3. Cebuano father playing with his child. The father is a participant in the Cebu Longitudinal Health and Nutrition Survey, the project through which my collaborators and I have studied male life history, behavior, and physiology. Photo by Fe Largado. Photo taken with subject's permission. A color version of this figure is available online.

support for aspects of this hypothesized model (Feldman et al. 2013).

Returning to my DADS model, I am suggesting that developmental experiences have the potential to affect neuroendocrine circuits in such a way that they have implications for the “dedication” and “attitudes” aspects of the model in addition to the “duration” component that my colleagues and I, as well as other researchers (Alvergne, Faurie, and Raymond 2009; Mascaro, Hackett, and Rilling 2013; Muller et al. 2009), have more clearly linked to paternal socioendocrinology to date. Although it is admittedly no small task to operationalize what I have outlined here, this specific example from Cebu provides a dynamic framework for conceptualizing interplays and feedbacks between individual development (behavior-cognition-biology), family systems, and cultural domains.

On the one hand, this approach embraces the effects of developmental and cultural context on human neural and endocrine systems (Lende and Downey 2012). Such a model suggests that the social behaviors or reproductive outcomes that come to be correlated with testosterone (e.g., in Cebu, high testosterone → partnering/fatherhood → paternal care → low testosterone) might not strictly reflect a phylogenetically conserved effect of testosterone on competitive- or mating-oriented behavior or an adaptation-based responsiveness to fathering behaviors (Gettler 2014) but also the neurobiological embeddedness of development processes in other neural centers that then become coordinated with testosterone production as males mature as children and into adolescents and adults.

On the other hand, such an approach is not a permissive vehicle to dismiss the relevance of our evolutionary past (and selection on our neurobiological systems) to human behavior. We must also remember that evolutionary perspectives and phylogenetic history provide the foundation for thinking about integrated systems, biological constraints, conserved traits, and convergence (Gettler 2014; Simpson 1967). The HPG axis is a highly conserved physiological network across vertebrates (Hau 2007); by no means is it infinitely malleable. On the contrary, one could make the argument that high degrees of HPG axis plasticity might be selected against and constrained. For example, we must account for testosterone’s critical developmental, reproductive, metabolic, and somatic roles in addition to its interfaces with the immune system, all of which affect homeostatic processes, health, and survival, as well as behavior and cognition, to shape reproductive fitness (Bribiescas 2001; Gettler 2014; Hau 2007; Muehlenbein and Bribiescas 2005). For example, based on a cross-species perspective, it is not surprising that elevated testosterone among young Cebuano men predicts reproductive success (Bribiescas 2001; Hau 2007). Similarly, the fact that the human male HPG axis appears to be responsive to fatherhood and childcare might reflect selective pressure on human neurobiological substrates that emerged with the coevolution of modern human life history and new niches for allomothering (Gettler 2014; Gray and Anderson 2010). It might also reflect physiological plasticity that has

deeper evolutionary history among Old World primates (Gettler 2014).

When viewed within both an “encultured brain” and evolutionary-phylogenetic framework, there is value to understanding the neurobiological-endocrine underpinnings of individual behavior for models of change/stasis in cultural domains. We need to push the boundaries on our thinking in terms of how developmental experiences become embodied and the way in which those culturally constructed neurobiological-endocrine pathways enable individual behavior-cognition and social interactions, which are at least contributing factors to the emergent phenomenon of cultural complexity. If we can accept the idea that the cultural niche (Super and Harkness 1986) and the ontogenetic effects of lived experience and social interactions are literally embodied in the evolved neurobiological-endocrine networks through which behavior is mediated, it becomes much less divisive or problematic or even reductionistic to talk about, for example, the role of the HPG axis in the expression of contemporary paternal roles in Cebu and possibly the historical processes that have shaped them.

The application of such a perspective will depend on the research question. It can provide a rich avenue for asking why and how some nodes of shared values/beliefs or cultural institutions shift, sometimes rapidly, while others remain intransigent despite changing ecological and social demands. While I hope the potential for this sort of integrative approach to anthropological research on extant human sociality is clear, these sorts of integrative questions are also imperative to more richly modeling the dynamics of hominin evolution as incipient culture, language, cooperative sociality, and dramatic neurobiological growth and reorganization coalesced with the emergence of modern humans.

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# Being Human in Cities

## Phenotypic Bias from Urban Niche Construction

by Greg Downey

Cities are sites of intense investment in niche construction, substantially altering ecological dynamics. Although novel in evolutionary terms, cities have distinctive epidemiological and demographic effects on human mortality and phenotype. Cities, however, do not affect all of their inhabitants identically, especially with a trend toward greater inequity with increased urbanization; the urban landscape offers a set of stratified behavioral niches to inhabitants. An examination of *meninos de rua* (street children) in Brazil highlights the opportunities available in urban landscapes and the demands placed on residents: a radically simplified foraging landscape, availability of energy-dense food resources, decreased activity levels, and challenges to mental health. Considering urbanization as niche construction highlights the embodied and psychological consequences of urban life not just on individuals but also over generations as urbanization creates phenotypic and developmental bias. The niche construction perspective blurs the divide between biological and cultural approaches to human variation and draws attention to the biological consequences of the built environment and socioeconomic structures underpinning urban life. Using street children in Brazil as a case study, this paper outlines the theoretical implications of urban adaptation as an example of niche construction dynamics leading to rapid changes in diet, morphology, and mental health.

One disturbing social phenomenon in Brazilian urban life, as in many developing cities, is what Brazilians call *meninos de rua*, or “children of the street,” young people inhabiting public space and exposed to opportunistic predators and, at times, the systematic violence of the state (Caldeira 2000; Scheper-Hughes 2006).<sup>1</sup> While conducting research in Brazil in the 1990s, I worked with a community-based group in Salvador da Bahia that provided basic meals and training to impoverished youth. Some were homeless; others were intermittently driven out of homes in the favelas, the informal shanty communities crowded onto otherwise unusable land, by poverty or a parent’s illness, drug use, or domestic violence. Still others were lured into the street by friends suggesting that an independent existence was better than life at home (Abdelgalil et al. 2004). Most had a residence part of the time, staying with family or friends. They suffered from high rates of addiction, bullying, and a host of psychological and developmental issues (Abreu, Alves de Oliveira, and Xavier 2009; D’Abreu, Mullis, and Cook 1999, 2001; Raffaelli, Araujo de Moraes, and Koller 2014).

In spite of difficulties, the *meninos de rua* extracted sufficient resources to live on the margins of urban social networks, begging, collecting recyclables, doing odd-jobs such as

watching parked cars or selling candy on buses, or committing petty theft (Scheper-Hughes and Hoffman 1994). They navigated dangerous traffic, picked their way through unmapped favelas, evaded police and private security, and organized themselves for personal safety and conflict resolution. They found enough food by foraging, social negotiation, or visiting a circuit of charity kitchens and meal programs (Campos et al. 1994). In sum, the children were resilient urban survivalists, evidence of our species’ extraordinary developmental and adaptive capacity but, more importantly for this paper, a limit case showing the challenges of living in the city as an ecological niche. Although their survival skills built on our species’ evolutionary endowment, they were fine-tuned to urban affordances, to opportunities offered by novel ecosystems. Studying them helps us to understand how difficult—or easy—it is to live in cities as well as the behavioral and phenotypic adaptations demanded.

Urban life insulates humans from some selective pressures faced by our ancestors, such as interspecies predation. At the same time, cities pose challenges to survival and reproduction all their own. The *meninos de rua* demonstrate that niche construction and occupation, especially on the scale of cities, generates a complex variety of behavioral-resource niches for humans to inhabit, not all of which are intended by their builders or are socially sanctioned. Urban spaces are

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1. Panter-Brick (2002) reviews the literature on “street children,” including substantial evidence that children in a wide variety of contexts often move in and out of “the street” in a variety of ways.



stratified so that not all inhabitants suffer the same stresses, and elite social niches are oversupplied with food and other resources, some of which cascades into other niches as waste or low-status resources.

Many of the effects of urban environments on their inhabitants are analogous to what John Tooby and Leda Cosmides (1992:115–116) refer to as “evoked culture.” That is, they are patterns of adaptive behavior “evoked” by the structure of the constructed niche rather than transmitted “epidemiologically” from other individuals. For example, cities involve patterns of social interaction that expose residents to endemic pathogens; these lead to particular mortality patterns from infectious disease and modes of avoiding disease (Dye 2008). In this sense, cities as constructed niches blur the division between “cultural” and “phenotypic” adaptation, “obviating” some of the disciplinary divides that mark anthropology (Ingold 1998). The use of niche construction theory (NCT) to analyze contemporary urban environments holds out the promise of better understanding the biologically based capacity for enculturation as well as the imbrication of culture in developmental biology (Fuentes 2015).

This essay reviews data on the phenotypic effect of living in cities, especially evidence of how life in Brazilian cities affects their poorest and most vulnerable residents: children who sometimes flee or are forced from their homes. In particular, the review considers research on children’s foraging, urban diet and activity patterns, and mental health consequences of urban sociality. This evidence suggests that the urban landscape is resource rich and that it requires less skill to forage there than in less heavily constructed niches. However, the types of resources available influence the way that the human body develops, especially in recent decades with the spread of industrialized diets. The consequence for at least some urban residents is a phenotype—or a variety of phenotypes—prone to obesity, less skeletal robusticity, and certain psychological disorders. The *meninos de rua* help us to understand how cities shape their inhabitants, biasing the human phenotype, perhaps even in ways that can inflect the gene pool of our species.

### Niche: Bridging Evolutionary and Cultural Theory

Humans are the “ultimate” niche constructors, according to Bruce Smith (2007). We are an animal, geographer Yi-Fu Tuan observes, “congenially indisposed to accept reality as it is. Humans not only submit and adapt; they transform in accordance with a preconceived plan. That is, before transforming, they do something extraordinary; namely, ‘see’ what is not there. Seeing what is not there lies at the foundation of all human culture” (1998:6).

Niche construction theory, at its most basic, is concerned with the relationship between environmental alteration and evolutionary dynamics. NCT examines “the process whereby organisms, through their metabolism, their activities and

their choices, modify their own and/or each other’s niches” (Odling-Smee, Laland, and Feldman 2003:419). Crucially, the organism-altered environment acts as either a selective or developmental pressure shaping an organism’s descendants—niche-organism feedback—to close the loop.<sup>2</sup>

NCT departs emphatically from evolutionary accounts of culture as “extra-somatic adaptation,” with the implication that culture makes physiological adaptation unnecessary (White 1959). In contrast, an NCT-based account recognizes that culture and technology become—simultaneously—means of adaptation, part of the selective environment, and a component of the developmental niche with phenotypic consequences (Downey and Lende 2012). For anthropologists interested in the biological consequences of enculturation, NCT is an area of evolutionary theory particularly amenable to a biocultural synthesis (Fuentes 2015). One prediction of NCT, for example, is that genetically diverse individuals might be successfully canalized into uniform outcomes by a strongly determinant developmental niche: niche-phenotype overdetermination. Another prediction, one explored in this essay, is that heavily constructed milieus stress individuals, as the developmental pathways they demand are especially arduous.<sup>3</sup>

Across the literature on NCT, a divide might be made between projects that demonstrate the efficacy of niche construction by neo-Darwinian measures—gene frequency in a population—and those theorists that model niche construction as an alternative, nongenetic channel of inherited developmental bias.<sup>4</sup> The former projects—showing niche feedback on population genetics—serve to demonstrate the potency of niche construction as evolutionary process: if a constructed niche can skew a species’ gene pool, then it certainly must be counted significant.

Most exemplary cases of human NCT, intentionally or not, appear chosen to pass this neo-Darwinian litmus test, illustrating population-level genetic consequences of human behavior, technology, or environmental modification. For instance, NCT theorists cite the coevolution of dairy herding with mutations of the LP allele linked to lactase persistence in adults (e.g., Gerbault et al. 2011; see also Bersaglieri et al. 2004; Durham 1991; Holden and Mace 1997; Simoons 1970). Another key case study is the cultivation of rice and the copy number of gene *AMY1*, which leads to the production of salivary amylase, the enzyme responsible for breaking down starch into simpler, digestible sugars (Laland, Odling-Smee,

2. I am grateful to an anonymous reviewer for suggesting this clarification.

3. Individual difficulties in adapting, including developmental delays, might allow us to map the particularly challenging parts of these niche-designated developmental pathways and where individuals might not have sufficient phenotypic plasticity—or have too much—to successfully enculture.

4. Some theoretical discussions combine both streams. Conversations with Karola Stotz especially clarified this distinction.

and Myles 2010; Perry et al. 2007). Finally, another paradigmatic illustration is the conjunction of yam cultivation, environmental alteration, mosquitoes as a vector for malaria, and the prevalence of HbS allele or sickle-cell genes (Durham 1991; O'Brien and Laland 2012).<sup>5</sup>

Focusing so frequently on feedback between changes in modes of production and human population genetics, however, is a limited set of what most anthropologists consider "culture." Reliance on essentially Neolithic innovations, examples of intergroup variation evoked by agriculture, runs the risk that many anthropologists will see niche construction as a minor addendum to evolutionary thought, largely irrelevant for cultural theory (Scott-Phillips et al. 2013).<sup>6</sup> The neo-Darwinian litmus test neglects most of the niche-organism dynamics that characterize human cultural activity and highlights only our longest-established niche modification techniques. And yet even by this measure, cities may constitute a selective pressure, a form of "heritable information" with organism-shaping effects especially on behavior, cognition, and health.

According to Marlowe (2005:54), a "niche" is not simply an environmental location but a behavioral-ecological conjunction. How the environment affects organisms varies because they inhabit ecosystems in diverse ways. Predator and vegetarian species living in the same landscape occupy quite different niches. The biologist Conrad Waddington (1959:1636) highlighted this active role of organisms in shaping their niches, writing that "the animal by its behavior contributes in a most important way to the nature and intensity of the selective pressures which will be exerted on it." While most discussions of NCT focus on how organisms materially affect the "nature and intensity of the selective pressures," a more integrated developmental scale would also note that behavior patterns pick out the niche that influences ontogeny as well.

Humans' selective behavioral occupation of the resource landscape is especially varied. The human *Umwelt*, or "lifeworld," to borrow from Jacob von Uexküll (1992:320), is shaped by skill, technology, and culture. Enculturation can lead to quite exotic extractive capabilities: hunting with projectiles such as atlatl or bow and arrow, for example, makes game available that is inaccessible without the cultural tool kit. At the same time, cultural blinders cause humans to fail to exploit potential resources; for example, learned resistance to eating specific types of food limits available calories. In this sense, "niche" is not simply a material reality but a form of living in relation to an environment, and human niche change includes shifts in the way we inhabit ecosystems or behavior-based niche reconfiguration (Fuentes 2015). This active role ascribed to organisms in their own evolution in

5. These NCT cases of feedback loops from environmental intervention, agriculture, or animal husbandry to the human gene pool offer a way to rethink the dynamics of domestication (e.g., Smith 2007).

6. Counterexamples include Lansing and Fox (2011) and Lipatov, Brown, and Feldman (2011).

NCT accords better with understandings of human agency in the social sciences and thus can serve as a conceptual bridge between studies of cultural embodiment, technology change, and phenotypic adaptation (Flynn et al. 2013:298; Kendal, Tehrani, and Odling-Smee 2011).<sup>7</sup>

Behavioral variability leads to niche stratification when organisms can inhabit the environment in diverging ways depending on behavioral inventory and social access. As social complexity grows, individual members of a species may occupy distinct behavioral-ecological niches with overlapping ranges and even complementary functions; certainly urban societies function this way, with diverse phenotypic consequences for participants. In a hierarchical society, all niches will not be equally available to every individual, as social barriers exclude some.

### Urban Niche Construction

An expanding proportion of humanity dwells in cities. Increasingly, cities are our species-typical ecological niche. In the past century, the world's urban population multiplied tenfold, from less than 300 million to 3.2 billion, and the overall percentage of our species living in cities grew from 14% to over 50% (Davis 2006:2; United Nations 1999). In the wealthiest countries, and in highly urbanized countries such as Brazil, urbanization rates exceed 80%. World population in rural areas will likely peak in 2020: all subsequent human population growth will be urban (Davis 2006:2). The demographic dominance of cities is all the more striking given that they only take up about 1% to 6% of the earth's surface, although their wide-ranging catchments appropriate a large proportion of the planet's resources (Alberti 2005:169; Rees 1997).

Nowhere is the human capacity for environmental alteration as pronounced as in cities. Odum (1997) emphasizes that nonurban ecosystems have energy budgets on the order of 1,000 to 10,000 kcal/m<sup>2</sup>/year; urban ecosystems in highly developed countries can be invested with 100,000 to 300,000 kcal/m<sup>2</sup>/year. In this context, cities are, as Reader (2004:31) writes, the "defining artefact of civilization," the niche most shaped by human investment in environmental engineering. At the same time, cities are extraordinarily novel in evolutionary terms, no more than about 6,000 or 7,000 years old.

To understand niche-human developmental dynamics globally, we must recognize the economic condition of urban ex-

7. Elsewhere, Daniel Lende and I (e.g., Downey 2010, 2011; Downey and Lende 2012) argue that enculturation processes make use of human phenotypic plasticity, such as skill acquisition affecting gross anatomy, skeletal structure, and neural architecture (see also Sterelny 2012). The behavioral components of a niche—the skills necessary to inhabit it—may reliably affect phenotypic development and thus constitute a stable channel of developmental bias susceptible to Darwinian analysis (although not some forms of neo-Darwinism). On this, see also Laland and O'Brien (2012) and West-Eberhard (2003).

pansion. Currently, approximately one-third of all people living in cities worldwide, or about 1 billion people in all, are living in slums (United Nations 2007). Slums result not just from poverty and urban-to-rural migration but also from political failure, including structural adjustment in developing countries that strip rural regions of their capacity to absorb population growth (Davis 2006:15). With cities in the developing world expanding explosively—much faster than the historical growth of Euro-American centers—the formal construction of new housing simply cannot keep pace. Oberai (1993:13) estimates that new formal stock can only supply 20% of the demand.

In this environment, people are forced to build their own shanties in irregular urban settlements. In Brazil, “niche construction” is realized quite literally in the favelas or urban slums. There, residents assemble their own houses with no planning or central control on land too steep, inconvenient, or unstable to allow the construction of residences favored by wealthier inhabitants. As Teresa Caldeira (2000) describes in detail, changes in urban residency in Brazil have broken down a simple center-periphery division of wealthy and poor (where that existed) and led to the development of walled, luxury enclaves for the richest, often in new suburbs. These enclaves specifically exclude the homeless and the poor, except those who work in wealthy households, and stifle normal channels of resource leakage from elite to impoverished families.

### The Ecological Consequences of Urbanization and Poverty

Ecologists have documented how intensive human settlement affects environmental dynamics (see, e.g., Alberti et al. 2003; Collins et al. 2000; Pickett et al. 2008). As Marina Alberti summarizes,

Urbanization significantly influences the functioning of local and global earth ecosystems and the services they provide to humans and other life on earth. Urban development fragments, isolates, and degrades natural habitats; simplifies and homogenizes species composition; disrupts hydrological systems; and modifies energy flow and nutrient cycling. (Alberti 2005:169)

Urbanization results in a complicated landscape with small, disjointed ecological parcels, unnaturally clear breaks between zones (destruction of transitional zones), and a complex mosaic of vegetation and other surface covers. These changes lead to an overall biological homogenization of flora and fauna: the number of invasive exotics increases and biodiversity of native species decreases in cities (McKinney 2002).

Urbanization does not produce a niche so well tailored to our use that it releases humans from selective pressures. Rather, urban residence correlates with a series of challenges to health and fertility, some unprecedented in our evolution. The development of permanent settlements in the Neolithic, with

growing population density and proximity to domestic animals, was increasingly conducive to zoonotic and infectious diseases, including dysentery, measles, cholera, smallpox, plague, tuberculosis, and leprosy. Chronic malnutrition exacerbated endemic disease susceptibility. In fact, the advent of the Neolithic constructed niche likely led to a spike in selective pressures on the human genome (Barnes et al. 2011; Fumagalli et al. 2011; Harris and Meyer 2006; Hawks et al. 2007; see Lachance and Tishkoff 2013 for review). That is, novel forms of niche construction with increasing population shifted selective pressures at the same time that they produced a growing pool of genetic variation.

Until the “sanitation revolution” of the nineteenth century, dwellers in European cities suffered from atrocious living conditions, so much so that the death rate exceeded the rate of live births (see Dye 2008). European cities were population sinks and could only maintain their size or grow through constant rural-to-urban migration (it is more difficult to judge the living conditions in non-European cities, although some were less prone to endemic infection). In developmental terms, urban residents in many regions evidenced patterns of stunted growth due to childhood disease and malnutrition (Wrigley 2004).

Today, health on average is better among urban populations than rural inhabitants of the same country, with greater access to medical care, increased immunization rates, higher average incomes, and improved infant survival. Rural-to-urban migration decreases the incidence of some communicable diseases, such as malaria, but it also increases the likelihood of others, such as HIV, tuberculosis, and—in some cases—Chagas’ disease and dengue (Dye 2008:768; Phillips 1993). Additionally, rural-to-urban migration correlates with a drop in fertility across cultures (Mace 2008). The overall profile is that increased urban growth is influencing human life trajectories, as Christopher Dye (2008) writes: “In sum, urbanization is a force in the global demographic transition from high to low birth rates and short to long life spans, and in the health and nutritional transitions that are shifting the burden of illness from acute childhood infections to chronic and mostly noncommunicable diseases of adults” (767).

The health gains of urbanization, however, are not uniform, as the lives of the *meninos de rua* demonstrate (United Nations Human Settlements 2003:72–74). Social inequality affects both health care and disease exposure. For example, poor city residents in developing countries are often exposed to high levels of industrial pollution (McMichael 2000; Phillips 1993). Urbanization correlates with deepening inequalities in medical care and health provision (Dye 2008:767). Unger (2013) points out significant intraurban differences in basic health indexes such as infant mortality, vaccination rates, malnutrition, infection exposure, and mortality from accidents, suggesting that on the whole residents of slums do not gain health benefits from urban residence. In developing countries, rural-to-urban migration for the poor may involve an “urban penalty” in health (Sverdluk 2011:140–141).

The overall mortality and fertility rates suggest, on first glance, a blunting of selective pressure on humans living in urban areas as the overall variance in mortality, fertility, and life expectancy decreases. But in some socioeconomic groups, threats to health and fertility increase with urban migration. In this sense, urbanization may be a niche construction dynamic that meets the neo-Darwinian criterion as a selective pressure because cities may skew the population gene pool. For example, endemic infectious disease, differential pollution exposure, and fertility suppression from obesity or exposure to endocrine-disrupting chemicals may, in the long run, change the population gene frequency. The intraurban inequities are so marked that one has to talk about multiple urban niches or “epidemiological polarization” (Phillips 1993: S98). The types of urban environments in which population growth is most rapid globally—slums and informal settlements in the developing world—may be those where niche selective effects are most intense.

However, many of the health challenges may be too transitory, or intergenerational residency in poverty too short in evolutionary time, to mark the underlying genetic diversity of our species. For example, the recent spike in chronic health problems linked to diet and stress, such as diabetes and hypertension, may give way in the face of better nutrition, lifestyle change, preventative medicine, or even urban planning that encourages greater physical activity. The rapidity of urbanization and the shifting profile of health and fertility challenges to residents, although severe, might lead cities as constructed niches to fall below the population-genetics threshold for selective potency. This does not, however, exhaust the usefulness of thinking about urbanization as a niche construction dynamic.

### Inequality, Niche Stratification, and *Meninos de Rua*

From the perspective of niche stratification, the urban landscape is not simply an ecologically distinct environment with endemic pathogens and built features; it is a heterogeneous social and behavioral milieu that makes varying demands on inhabitants. Just as complex social environments scaffold the acquisition of distinctly human abilities such as language, symbolic cognition, and communicative behaviors, the urban social niche also places diverse pressures on phenotypic adaptation through developmental time that not every individual will be equally capable of meeting.

For example, some children are forced to achieve independence earlier than others. D’Abreu and colleagues (D’Abreu, Mullis, and Cook 1999:748) found that although most street children had regular interaction with their families, a third in their small sample ( $N = 30$ ) had no contact; other researchers claim the proportion of wholly independent children is smaller still (e.g., Aptekar 1994:204). The disagreement in the evidence may result from the fact that street children such as the *meninos de rua* in Salvador are part of a continuum of

children living in poverty that may transition back and forth between home and “the street,” making both their independence and their total number difficult to determine (see Panter-Brick 2002). Scheper-Hughes and Hoffman (1994) argue that “street children” are just “poor children out of place”; the category means little in the favelas or slums, whether or not the children reside with their parents, as they spend more time outside their homes than typical for middle- and upper-class children. “Street children” are not just poor children, then, but poor children operating alongside people who often wish to exclude them, in contexts where the children do not get strong familial support and cooperation. For this reason, they are an especially interesting indicator of opportunities and developmental influences in the urban milieu precisely because of their exposure to and exploitation of shared public space and the unusual challenges they must face.

### *Nutrition and the Urban Poor*

The *meninos de rua* in Brazil are, when they are independent, urban “secondary foragers” like all city residents, acquiring food while seldom (or never) engaging in direct production. The contemporary city is dense with resources drawn from the extraurban catchment, but access is constrained in Brazil by market-based distribution networks. Smith (1998) argues that the dominance of the cash economy, not an absolute shortage of food, makes the urban poor especially vulnerable to malnutrition. Unlike rural areas, where the poor can avail themselves of free resources and engage in subsistence activities, urban food distribution systems increase the effects of poverty on diet (Satterthwaite 2003). The evidence from street children, however, suggests that these obstacles can be surmounted (or that urban market systems are not as closed as widely believed) and that the “nutrition transition” affects the availability and types of food in the urban niche (Popkin 1999, 2002).

Although they do purchase food, street children typically do so without regular income, and yet they are sufficiently successful that they sometimes return resources to their parents’ households or share with friends and siblings (Lee and Brewis 2009). In addition to buying food, they secure meals from the surplus of other people’s consumption, benefiting from overflows and leaks of the resource streams into urban space. Hecht (1998:48–49ff.), for example, describes a wide diversity of social arrangements, negotiations, and nonmonetary exchanges through which the street children he observed in Rio de Janeiro procured meals. During my fieldwork, one of the more common ways that children got food outside support programs was by approaching diners in restaurants, especially those preparing to take home leftover food.

The most thorough study of poor children’s foraging, by Sarah Lee and Alexandra Brewis (2009) and conducted in shantytowns near Xalapa, Mexico, found that food sharing among poor children was widespread and that most refused to resort to begging, stealing, or scavenging even though food

was available (and they scavenged for nonfood objects). Scavenging food violated social norms and attracted shame and parental disapproval. The one child in their study who did scavenge food—pizza at a bus station—was “highly socially rejected” (Lee and Brewis 2009:444). The majority of children, even those who showed signs of malnutrition, were not driven to break cultural taboos on food scavenging and stigmatized behavior. In Salvador, begging was fairly common, but it was targeted, focused especially in districts frequented by tourists. The children who begged were less constrained than Lee and Brewis’s subjects, but the activity was still limited, probably because of safety concerns, low return on effort, and social stigma.

Nutritional data on street children are difficult to find, but indirect evidence from health indicators provides some sense of long-term access to food (see Woan, Lin, and Auerswald 2013:316 for review). An early survey of health and nutrition among low socioeconomic status Brazilians by Ana Sawaya and colleagues (1995) found a 30% prevalence of malnutrition, with stunting the most common symptom. A smaller survey of street children by the team found stunting, malnutrition-related obesity, and wasting in the children, who were between 7 and 10 years of age, at higher rates than other poor children. In contrast, a later study in Brazil in the 1990s found that although the street children had lower body mass indexes (BMIs) than age-matched controls, they evidenced no significant difference in ability to get food than peers in school except not having access to dairy products, possibly due to refrigeration issues (D’Abreu, Mullis, and Cook 2001; Kac et al. 2012). Kac and Velásquez-Meléndez (2003) suggested that the evidence is contradictory because Brazil was passing through the “nutritional transition”; industrialized food production has meant that malnutrition rates have fallen while obesity rates have increased over the past 40 years in the developing world more generally (Conde and Monteiro 2014; Popkin 1999, 2002, 2006).<sup>8</sup>

Along similar lines, a multidisciplinary study led by anthropologist Catherine Panter-Brick in Nepal found, counterintuitively, that the street children who lived most independently demonstrated fewer physical signs of malnutrition (height, weight, and nutritional measures) than matched poor children from rural villages and semiurban squatter settlements (Panter-Brick, Todd, and Baker 1996). Boys in villages

were more than twice as likely as homeless urban boys to demonstrate severely stunted growth (Panter-Brick, Todd, and Baker 1996:445). Rural boys ate a monotonous diet, almost entirely high-cellulose cereals; in contrast, boys “of the street” ate a variety of foods, including rice, vegetables, and occasionally meat (Panter-Brick, Todd, and Baker 1996:448). Research on street children in Honduras, similarly, found fewer signs of malnutrition than in age-matched peers from poor urban families (Wright, Kaminsky, and Wittig 1993:182).

Investigation in a variety of countries has found mixed results comparing the nutritional status of street children to other poor children (see Panter-Brick 2001, 2002; Scanlon et al. 1998). This variance in the data highlights that cities are diverse, with different resource catchments, technologies for transfer, and social mechanisms for distribution, but that many offer adequate or close to adequate resources even to their most marginalized inhabitants. For the *meninos de rua*, being disconnected intermittently from resource-distributing networks in Salvador was not a severe developmental impediment and may have been less deleterious nutritionally than being trapped in an extremely disadvantaged rural household. Panter-Brick and colleagues (Panter-Brick, Todd, and Baker 1996:449) go so far as to suggest that homelessness and isolation from family may be a “rational and successful response” for children faced with extreme poverty.

#### *Learning to Forage in the Street*

Brazilian children demonstrate that contemporary urban self-provisioning outside cooperative structures such as the family is not as challenging as foraging in forest environments or perhaps even contemporary rural niches, especially for socially disadvantaged children. The fact that children, even malnourished ones, do not take advantage of all available resources highlights, however, the social costs of survival strategies that involve stigmatized behaviors.

Like the children of foraging peoples, *meninos de rua* develop techniques to find their own food. Street children have an advantage over poor rural children elsewhere because they are in a resource-rich landscape where time to independence is shortened. Gurven, Kaplan, and Gutierrez (2006), reviewing the evidence for food production in extant foraging groups, argue that the most complex foraging skills require 5–15 years to master after an individual achieves full size, effectively pushing the age of independence into adulthood (see also Hill and Kaplan 1999; Kaplan et al. 2000; Walker et al. 2002). Less physically demanding foraging skills can be mastered in shorter time periods and by even younger individuals, leading some researchers to suggest that Gurven and colleagues may overestimate foraging children’s dependence (Bird and Bliege Bird 2005; Bliege Bird and Bird 1995; Crittenden et al. 2013).

In cities, the skills needed to forage are simplified, and younger, smaller-statured children can undertake them successfully because many are social or net a broad range of resources. A number of studies have indicated a median age of

8. Omran (1971) first identified the “transition” of shifting demographics (from high fertility and mortality to lower fertility and longer life span) together with changing disease profile (from infectious to greater chronic and degenerative disorders). In fact, the relationship between childhood malnutrition and increased rates of adult obesity—what some public health researchers have called the “double burden” of the “nutrition transition”—is more complex, as childhood periods of malnutrition may prime the body for excessive adiposity later in life (Conde and Monteiro 2014; Dietz 1995; Doak et al. 2000; Santos 2013; Sichieri, Siqueira, and Moura 2000; Wells 2012).

13 years for children on the street in Brazil, with some *meninos de rua* as young as 5 years (Abdelgalil et al. 2004:819), much earlier than independence is possible in historical hunters and gatherers. Although children who scavenge food in cities may be the same ages as those in foraging groups, they learn to find sufficient calories more quickly because the urban skills needed to procure food are general purpose and do not vary with food type; a single act of social negotiation with a diner exiting a restaurant, for example, may net a selection of food types. In contrast, children in foraging societies must learn a variety of food gathering techniques and resource-specific knowledge (e.g., Bliege Bird and Bird 2002). At the same time, street foraging skills and modes of social negotiation for food are radically discontinuous with provisioning in the home. The degree of “independence” of street children should not be overestimated, as researchers in the area caution, but urban foraging clearly involves a shorter apprenticeship than in historical hunting and gathering groups because of greater food availability in contemporary urban landscapes.

Urbanization and industrialization in Brazil have changed the foodstuffs available in urban space: ultraprocessed food products manufactured by transnational corporations have increasingly displaced local food production networks, especially since the 1980s (Mendez and Popkin 2004; Monteiro and Cannon 2012; Wells 2012). As Popkin (1999) summarizes, research comparing urban and rural diets finds that urbanization leads to shifts to higher energy- and fat-density foods: “Urban diets show trends toward consumption of superior grains (e.g., rice or wheat, rather than corn or millet); more milled and polished grains (e.g., rice, wheat); food higher in fat; more animal products; more sugar; more food prepared away from the home; and more processed foods” (1908).

The difference is most pronounced, Popkin (1999) points out, in lower income countries, where urbanization leads to especially large increases in sweeteners in the diet. The fact that children outside the household have greater latitude to indulge their own food preferences may make them more likely to consume high-salt or high-sugar snacks and drinks. Lee and Brewis (2009:448) found that most of poor children’s discretionary purchases in a Mexican shantytown were food, the vast majority of which was high-calorie, low-nutrient snacks: sugared drinks, candy, or fried snacks.

The simplification of foraging techniques in urban environments may change the dynamic of cultural transmission, especially given that these skills are uniform across cities, even globally (Ali 2011:260). If so, especially with evidence of strong peer socialization and weaker intergenerational knowledge transfer (e.g., Lee and Brewis 2009:452), urban foraging techniques may be evoked culture. That is, the urban niche may “evoke” the foraging behavior rather than it being the type of transmitted, complex behavior demanded of historical foraging peoples. Traditional foraging may require significant intergenerational cumulative cultural knowledge (see

Sterelny 2012); urban foraging does not.<sup>9</sup> The simplicity of evoked, general-purpose foraging techniques suggests a relative “de-skilling,”<sup>10</sup> a pattern that resonates with an overall decrease in bodily activity in urban children.

#### *Bodily Activity, Locomotion, and Obesity*

Given the availability of energy-dense foods in the urban niche, changes in the average body mass, metabolism, and even skeleton of city dwellers are almost inevitable. These changes appear to be accelerating in recent decades because of decreased activity levels coupled with the industrialization of diet (Hill and Peters 1998). For example, US rates of obesity climbed 40%–50% in the past 2 decades alone (Leonard 2010:S293). The rise in obesity rates extends to developing countries, part of the global “nutrition transition” (Ezzati et al. 2005; Popkin and Gordon-Larsen 2004; Prentice 2006). In Brazil, childhood obesity is more common in urban than rural environments, and in the northeast region, where Salvador is, that rate exceeds 28% in spite of poverty (Niehues et al. 2014:1). The relative recentness and severity of the “obesity epidemic,” especially in the developing world, highlights that the metabolic change is not simply a Neolithic fact, that is, linked to agriculture like other widely discussed examples of human niche construction. Rather, it is a capitalist and especially an urban phenomenon (Popkin 1999; Wells 2012). Egger and Swinburn (1997) emphasize that an ecological approach is necessary to understand soaring obesity rates because underlying genetic propensities to weight gain cannot have shifted over the short time frame. They go so far as to argue that obesity is “normal physiology within a pathological environment”—the phenotypic consequence of an “obesogenic” developmental niche (Egger and Swinburn 1997:480).

The urban niche is obesogenic not just because of high-energy foods but also because daily life involves periods of abnormal sedentarism or substantially reduced activity relative to nonurban lifestyles (Dollmann, Norton, and Norton 2005; Townshend and Lake 2009). The World Health Organization (2009), for example, identified physical inactivity as “pandemic,” ranking it as the fourth leading risk factor for mortality worldwide (see Moffat 2010 for a critique). William

9. As Polly Wiessner (personal communication) has pointed out and research in Brazil on *meninos de rua* confirms, these social foraging techniques become more difficult as children age and the stigma of begging grows. In Brazil, street “children” must often transition into other social roles (such as joining urban gangs or constructing their own homes) or, as in other places around the world, they face increasing dangers from police violence or infectious disease as they age. The point is, urban foraging techniques are not just easy to learn (relative to foraging techniques in nonurban environments) but they also tend to be transitory skills, not developments of a lifelong basis for securing subsistence.

10. Maurice Bloch pointed out this pattern (personal communication).

Leonard's research comparing indigenous populations undergoing urbanization with groups that still lived by subsistence suggests that the move to urban living involves a reduction in overall activity levels, although not as pronounced as sometimes predicted (Leonard 2010:S293–S295). Similarly, Gurven and colleagues (2013) found that indigenous Tsimane in Bolivia were rarely sedentary during the course of a day, but adults were seldom engaged in overly vigorous activity.<sup>11</sup> In Brazil since the 1970s, Monteiro and colleagues (2002:110) have pointed to an increasing proportion of people employed in the service sector and declines in physically demanding sectors of the economy, including agriculture, as well as the greater prevalence of television in Brazilian homes, to suggest that decreased physical activity levels may contribute to increased obesity rates.

Health disparities within Brazil, however, show that not everyone is equally exposed to an obesogenic urban environment. Since the 1990s, health researchers have noted that education protects against obesity in Brazil even in disadvantaged socioeconomic groups (Monteiro, Conde, and Popkin 2001). The fact that education can mitigate the environmental effects demonstrates the agency of the individual in shaping behaviorally how the constructed niche affects him or her. More conventionally “cultural” factors, such as preferences in diet, local built environment, technology, commuting regimes, media consumption, customs in children's play, and daily activity patterns all influence phenotype (e.g., Ewing et al. 2003). Public health efforts to combat obesity and accompanying chronic disease rightly focus on both environmental and behavioral change strategies, including active commuting, altered eating habits, and strategic food pricing, because both construct the obesogenic niche (Lopez and Hynes 2006).

The nutrition transition in developing economies produces, paradoxically, a double burden of malnutrition and obesity, sometimes within the same household: childhood malnutrition can prime adult obesity (Doak et al. 2000; Popkin, Adair and Ng 2012; Santos 2013). This developmental pattern suggests that an anthropological account of increased obesity rates cannot simply focus on individual genetic or environmental determinants of phenotype but must take account of more complex environment-physiology-activity interactions over an individual's lifetime and across generations (Speakman 2013; Wells 2012). Ironically, the nutritional double burden underscores the degree to which a constructed niche may select against responsiveness if response is pathogenic; if some individuals react more severely to early malnutrition with a propensity to adult adiposity, the constructed niche

may bias against their ability to pass on their genes. That is, if obesity increases mortality or decreases fertility, obesogenic environments may skew the population gene pool to favor individuals with blunted response to early malnutrition: as Wells (2012:267) writes, “the obesogenic niche” may elicit “penalties for earlier plasticity.”

The spike in obesity in recent decades also compounds behavior-dependent changes in skeletal phenotype over the same time period. Erik Trinkaus (1997) outlined a decrease in the robusticity of the postcranial skeleton following the emergence of modern humans; he attributed this morphological change to decreased mechanical loading (see also Ruff et al. 1993; Ryan and Shaw 2014). A similar pattern of decreasing skeletal robusticity has occurred rapidly in recent decades, suggesting that reductions in physical exertion, especially during child development, occurred again during this most recent metabolic transition. Reitsch and colleagues (Reitsch, Godina, and Scheffler 2013) report that between 2000 and 2010, despite increasing average BMI (which should produce increased mechanical loading), children in Germany and Russia evidenced decreases in overall skeleton size and bone mass. Scheffler and Hermanussen (2014) add that decreased bone breadth and density is not generalized across the body but specific to those bones affected by walking and physical activities. Their assessment of changes to skeletal morphology in German children is blunt: “We interpret the recent reduction of bone breadths as a sign of neglect”; they summarize: “While approaching the ecological optimum within the potential phenotypic variability, we find values for bone breadth in the recent samples of healthy children and adolescents that appear to be in the very low range of their genetic potential” (Scheffler and Hermanussen 2014:596). These trends in skeletal change suggest excellent nutrition but low activity levels: the urban phenotype evidences more pronounced gracility than our *Homo sapiens* ancestors.

Although we do not have comparable skeletal data on *meninos de rua*, most of the review data suggest that street children do not have the same propensity for obesity as other children, whether as a result of higher activity levels or lower energy intake is not clear (D'Abreu, Mullis, and Cook 2001). My suspicion is that the children we worked with, on average, are more active than middle-class children in developed countries, at least at present; whether they will undergo a similar pattern of decreasing physical activity, as they have followed the nutritional transition, remains to be seen.

#### *Hypersociality as a Niche Demand*

Urban niches pose significant challenges to health, especially to children at risk and in poverty. A review by Woan, Lin, and Auerswald (2013) found in street children high rates of infectious disease, parasites, substance abuse, violence, and morbidity from accidents (Phillips 1993). In mental health, the *meninos de rua* exemplify a broader trend: urbanization correlates with increased risk of mental health problems

11. The fact that consistent activity levels in indigenous communities tended to fall within the high part of the range found in urbanized groups led Gurven's research team to conclude that “food intake may be a stronger candidate than diminished activity for the recent upsurge in obesity” (Gurven et al. 2013:11).

(Dohrenwend and Dohrenwend 1974). Meta-analyses have found that city dwellers have increased risk of anxiety and mood disorders; individuals born and raised in urban areas also suffer a more than twice-normal incidence of schizophrenia (Krabbendam and Van Os 2005; Peen et al. 2010; Sundquist, Frank, and Sundquist 2004; Vassos et al. 2012). Van Os (2004) goes so far as to suggest that 30% of all cases of schizophrenia can be attributed to the effects of urban environments. Potential reasons for the elevated risk of mental illness are many: urban social isolation, greater work and life stress, social hostility, poverty, violence, and the stress of migrating from rural areas (Kovess-Masféty et al. 2005:927).

In São Paulo, Andrade and colleagues (Andrade et al. 2012:8) found some of the highest rates for mental health problems ever recorded in large-scale epidemiological studies, especially for anxiety disorders, depression, substance abuse, and impulse control disorders. The authors suggest the high rates were likely linked in part to violence in Brazilian cities, with exposure comparable in São Paulo to results found in Lebanon (Andrade et al. 2012:8; see Caldeira 2000; Reichenheim et al. 2011). Research by Maciel and colleagues on 126 children who worked on the streets in São Paulo (Maciel et al. 2012) found even higher incidence of mental health problems as well as a pattern of exposure to violence, corporal punishment, physical abuse, and physical and emotional neglect. The team found a pattern of intergenerational transmission of violence; an NCT-based analysis emphasizes how this pattern could be compounded by niche development dynamics.

Urban residence forces humans to interact with many individuals over a lifetime. According to estimates by Kim Hill and colleagues (2014), based on observation of the Hadza of Tanzania and the Ache of Paraguay, humans in modern foraging groups likely encounter up to 1,000 individuals in a lifetime even though group sizes range from 20 to 50 individuals. In contrast, daily life in cities can lead to fleeting, superficial contact with many times more individuals each day. Ironically, social sensitivity that might have been an advantage to our ancestors could lead to chronic hyperarousal in current urban settings. Most city dwellers develop sensory, behavioral, and spatial strategies for limiting interaction; one of the dangers of homelessness is the inability to retreat from social contact (e.g., Desjarlais 1997). Flight from a violent home into the urban streets exposes children to much more frequent social interaction, potentially with hostile strangers. Because of the anonymous and superficial nature of these interactions—a kind of “hyposociality”—they may produce stress without the rewards of greater social engagement and support.<sup>12</sup>

Urban birth and upbringing correlate with heightened sensitivity in the mesolimbic dopamine system in healthy indi-

viduals, including increased amygdala activity linked to social stress processing (Lederbogen et al. 2011; Haddad et al. 2015; Selten et al. 2013). Olson (1999) has suggested that successful adaptation to urban life might involve a shedding of the inclination to experience anxiety under this stress. In contrast, Van Os and colleagues (Van Os et al. 2003) argue that individuals with a genetic predisposition for psychotic experience are more likely to develop schizophrenia in urban environments because their symptoms persist longer under the effect of constant low-level stress, demonstrating a gene-environment interaction. The team suggests that the “ontogenesis of psychosis may be conceived as the poor outcome of a developmentally common psychosis phenotype that, under the influence of environmental factors, may display abnormal persistence thus possibly increasing the risk for progression towards clinical psychotic disorder” (Spauwen et al. 2006:412). Myin-Germeys, Delespaul, and Van Os (2005:738) hypothesize that “behavioral sensitization” or “an enduring enhancement of the behavioural response to environmental stress” may be linked to hyperresponsiveness of the dopamine system, known to correlate with schizophrenia.

Selten and colleagues (Selten et al. 2013) point out that all five of the known predictors of higher risk of schizophrenia—urban upbringing, migration, childhood trauma, low intelligence, and drug abuse—all involve long-term exposure to “social defeat” or social exclusion (see also Selten and Cantor-Graae 2005). Experiences of being excluded or “defeated,” including frequent inability to engage meaningfully in social interaction, may accumulate and exacerbate any underlying psychological propensity for mental problems by repeatedly cuing corrosive emotional reactions. Given that schizophrenia correlates with significantly reduced fertility (Bassett et al. 1996; Laursen and Monk-Olsen 2010; Power et al. 2013), any genetic propensity to suffer the condition in the urban niche is likely to come under selective pressure. As with the obesogenic dynamic, selective dynamics may favor a genotype that blunts phenotypic response to developmental influences in the niche.

All of these effects suggest that the hypersociality demanded by urban environments, exaggerated by spending inordinate amounts of time in “hyposocial” public space, is not a trait innate to humans but a niche demand to which individuals must adapt, especially their affective systems. Not all individuals are equally capable of coping. Cities are only possible because of our social evolution, but the evidence from mental health issues in street children and urban dwellers is that “ultrasociality” is not simply a species-wide trait but a niche demand (cf. Gintis 2011; Gowdy and Krall 2014). That is, theorists such as Robin Dunbar (1998) and E. O. Wilson (2012) may be overestimating how easy it is for humans to be social. Individuals may adapt to the niche demands of hypersociality in cities with a variety of social strategies, including some that might be judged antisocial or even pathological, such as withdrawal, depression, or psychopathy. The variability of incidence rates of mental illness in cities also

12. Polly Wiessner (personal communication).



highlights that niche stratification means all inhabitants are not called on to adapt to the same degree, nor do they confront the same social milieu.

### Conclusion: Niche, Culture, and Embodiment

The case of street children and the developmental results of urban living demonstrate that cultural innovation, niche construction, and social sophistication do not end adaptation or repeal the laws of natural—or not so natural—selection. On the contrary, urban niche construction significantly influences our developmental trajectories and perhaps even our underlying genotype as a species. At the same time, careful examination reveals that niche stratification of the urban landscape results in diverse effects on their inhabitants. Cities are likely too young to know definitively whether recent stages of urbanization have had population-genetic consequences; the pace of urbanization is too explosive and variable. However, the scale of urban anthropogenic change and its broader ecological consequences make it hard to argue that feedback effects on our species are unlikely. Certainly, the evidence is substantial that cities have phenotypic effects on their inhabitants.

For anthropological analysis, understanding urban niche dynamics requires bridging between cultural, developmental, and biological approaches in our discipline. Just as NCT helps us to see that organisms and environments are not easily separated, cultural niche construction calls on us to recognize that enculturation and biological development are much harder to separate in analytical practice than in theoretical abstraction. The enculturability of the human organism is, in large part, undergirded by the developmental plasticity of our species, a biological capacity produced by natural selection, supported and manipulated by social institutions, and enabled by a peculiar delayed developmental trajectory (Li 2003; West-Eberhard 2003). Together with Daniel Lende, I have argued that from a neuroanthropological perspective, the human brain has been shaped over evolutionary time for a high degree of phenotypic flexibility and what we might call “niche susceptibility” (Downey and Lende 2012). Lende and I advocate recognizing that our evolved neurological endowment primed us to heightened receptivity to a developmental niche. This receptivity is variable, as discussions of genetic differences in propensity to psychiatric disorder demonstrate. Research on susceptibility suggests a broader pattern of biological predisposition for greater or lesser degrees of environmental responsiveness (e.g., Belsky and Pluess 2009; Ellis et al. 2011). Not in every circumstance is responsiveness to a niche an advantage; some children living in the street may be more or less malleable in the face of forces in the niche that might otherwise shape them.

We will only be able to achieve the integrative or “big tent” anthropological approach to human evolution that Agustín Fuentes (2015:303) recently called for if proponents of NCT move beyond reliance on case studies that meet the neo-

Darwinian litmus test of population-genetic consequences. NCT must be shown to apply more broadly, explaining how cultural niche construction creates both stable as well as fast-changing conduits for inheritance with sometimes unpredictable consequences for phenotypic development, behavior, and culture. Cities demonstrate that niches have both pervasive global influence and local variants, sometimes in the same geographical landscape, that can arise quickly and yet impress themselves deeply on human ontology. The recognition that humans have a distinctive urban phenotype—or a variety of urban phenotypes—helps to promote a much more robust, nonreductionist conversation between cultural and biological specialists. This synthesis is especially exciting to practitioners like me because it offers a method to integrate data and theoretical frameworks from cultural anthropology more extensively into the biocultural synthesis, a synthesis that has often been more “bio” than “cultural” (see Goodman 2013; McKinnon and Silverman 2005; Schultz 2009; Segal and Yanagisako 2005). The result will not be a reduced appreciation of human cultural diversity but rather a clearer sense of how deep enculturation goes into embodiment, including into the basic biological and cognitive traits of the individual.

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# A Landscape Architecture of Fire

## Cultural Emergence and Ecological Pyrodiversity in Australia's Western Desert

by Douglas W. Bird, Rebecca Bliege Bird, Brian F. Coddling,  
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Aboriginal foraging systems in Australia's Western Desert have been structured around landscape-burning practices for millennia. These systems are mediated at one end by factors that influence an immediate-return economy and at the other by the way that burning transforms vegetative succession and habitat heterogeneity (pyrodiversity). The distinctive pyrodiversity of anthropogenic landscapes are where Martu insist that they and their estates are conceived. These estates are transgenerational storehouses of relational wealth that operate in a delayed-return ritual economy. These storehouses were ransacked by colonialism in the mid-twentieth century, precipitating a collapse in the anthropogenic fire regime and a decline and extinction of many endemic species. Since returning to their homelands in the 1980s, Martu have reestablished a tight patchwork of vegetative succession and rescaled the landscape mosaic. Previous work has shown how the emergent ecological consequences of foraging and burning interact to create greater local diversity, increase landscape patchiness at massive spatial scales, and buffer against climate-driven ecosystem disturbance. In this paper we explore how the rescaling of patch diversity through anthropogenic fire operates as a form of dynamic cultural and ecological niche construction shaping systems of sociality among people and their interactions with other species.

A call to demolish the two-story edifice of dualism constructed to separate humans from nonhumans is nothing new. It should be demolished not only because our natural worlds are culturally constructed but because our cultural worlds are wholly natural. Cultural niches and social intuitions are constructed in the interactions of decisions, bodies, materials, values, and intentions of organic beings designed by natural selection. The barriers that we build between natural and artificial phenomena are constructs specific to very particular

contexts. In many other worlds, no such dichotomy exists, or it exists in radically different forms (see Elkin 1969 for an Australian example). An important goal, then, in developing a reintegrated anthropology—one that combines rigorous empirical analysis with an appreciation of diverse epistemologies and institutions fashioned in complex interactions between people, other species, and physical space—is to

render intelligible the way in which organisms of a particular kind find a place in the world, acquire a stable representation of it, and contribute to its transformation by forging with it and between one another links either constant or occasional and of remarkable but not infinite diversity. . . . For although it is commonly said, these days, that worlds are constructed, it is not known who are their architects and we still have very little idea about what materials are used in building them. (Descola 2013:xvii)

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Reintegrating anthropology as imagined by Wiessner (2016) and Fuentes (2016) will involve just that: figuring out (1) who the architects of niches are and (2) what construction materials they are using. We suggest this will require building a science that fully embraces an understanding of people in ecosystemic relationships. This will involve deliberate acts of both analytical reductionism and holism to identify scaled links between processes that shape decision making in resource use and vehicles through which they emerge as com-

plex systems.<sup>1</sup> We see the contributions to this special issue of *Current Anthropology* as an honest attempt to continue the job. All of the contributors to the Wenner-Gren conference from which this volume grew were intent on seeking explanations of diverse human worlds, including peoples' complex and divergent representational models and perceptions of life, by teasing apart processes and materials that shape the ways through which our habitats (or niches) are constructed, experienced, and made meaningful.

In what follows we set out to investigate some of the players, interactions, and materials used in constructing aspects of Martu worlds in a remote part of Australia's Western Desert (fig. 1). We are especially concerned with measuring factors that influence contemporary Martu hunting decisions, the expressions of which are mediated in social practices and the application of landscape fire, that feed back through ecological mechanisms to transform social-environmental relationships.<sup>2</sup>

We agree with recent theorists such as Descola (2013) and others (e.g., Cormier 2003; Hartigan 2014; Kohn 2013) in calling into question notions that we, because of culture, exist buffered from the natural environment. While this is old hat in anthropology, "a dichotomy between the material and the mental, between ecological interactions in nature and cultural constructions of nature" (Ingold 1996:144) continues to dominate the policy and science of global environmental change, where "human dimensions" are cast principally in terms of how people affect the "natural" system (Castree et al. 2014). In this paper we hope to further dissolve such dichotomies, but

1. Our use of "emergence" follows a common definition in evolutionary ecology, focusing on the synergistic processes shaping system organization that feed back on the fitness-related trade-offs of the organisms that compose complex systems. "In evolutionary processes, causation is iterative; effects are also causes. And this is equally true of the synergistic effects produced by emergent systems. In other words, emergence itself . . . has been the underlying cause of the evolution of emergent phenomena in biological evolution; it is the synergies produced by organized systems that are the key" (Corning 2002). This is not a call to a return of the old systems ecology of the 1960s and 1970s but instead to a new ecology that fully embraces agency and a science of individual decision making while recognizing the emergent properties of larger-scale social and ecological systems that interact with individual decisions.

2. Much has been written about how Western Desert Aboriginal selves and identities are conceived in relation to country and landesque capital: Aboriginal "country" is constituted within sets of social practices, dynamic rights, and contested values that link people to land (e.g., Dussart 2000; Myers 1988; Tonkinson 2007, 2011; Tonkinson and Tonkinson 2010). As Tonkinson (2011) and Myers (2002) so clearly explain for Western Desert Martu and Pintupi, respectively, their *ngurra*—their homelands—come into being not only through the lived experience of hunting and gathering (the concrete labor entangled in an environment of direct experience, sensu Ingold 1996, 2008) but also through processes of previous and lived experience shaped at all points by tiers of social interaction. "People do not simply 'experience' the world; they are taught—indeed, disciplined—to signify their experiences in distinctive ways" (Myers 2002:103).

we do so from a reductionist stance. In the heart of the analysis presented here, we intend to show how reducing complex phenomena to measurements of key interactions gives critical insight into the processes involved in making dynamic and complex social-ecological systems. This provides an ecological and quantitative perspective into how Aboriginal people often characterize themselves and their lands. Thus, we argue that distinctive Martu selves do not exist independently of the ecological relationships that make and signify family and homelands (Tonkinson 2011). Their notions of homeland and family are inherently relational, similar to notions captured in *oikos*, the Greek for home and the root for ecology.

It is important to note at the outset that the relationships many Martu have with their country, framed in *Jukurrpa* (the Dreaming, as discussed below), do not reflect a "conservation ethic," or what Sponsel (2012) refers to as "spiritual ecology." As Martu often explain it, the Dreaming is more than just a spiritual relationship between them and the natural world. Many traditionally oriented Martu believe that the proper taking and use of resources—not their conservation—is the key to a healthy country and healthy selves. To conserve resources is akin to hoarding and requires managing the labor and consumption of others through dictatorial action. Moreover, they do not perceive of themselves as having a spiritual connection that makes them "closer to the land" and thus natural conservationists; they insist that they *are* their country in the sense that humans are a critical component of ecological relationships. For many Martu, country and self are foraged in work (spiritual, ritual, mundane) that consumes and regenerates, especially in the application of fire to the landscape. There are sacred geographies, but they are diverse in scale and arbitrated in the intensity of living interactions and exchange between people, other species, and place. The key, as Tonkinson (2005) and Myers (1988) have suggested, is in how a lived world of material transfers between and among people and other species is interwoven with a world of religiously/spiritually constituted ownership (Bird and Bliege Bird 2010; Bliege Bird et al. 2012a). At the core of these relationships are practices associated with landscape burning and the way it is situated in the function of ecological systems.

Following a summary of contemporary Martu economies and ecological organization, we illustrate how many Martu express the architecture of their country and how they conceive of themselves and their land-based estates especially in relation to fire. We then provide a rough framework to situate humans in general as niche constructors, especially in the emergence of distinctively pyrodiverse habitats. We argue that such a framework requires investigating the effects of existential trade-offs people face in decisions about resource use. We thus describe the ways that Martu hunting decisions transform their lands into homelands in a series of analyses based on Martu accounts and quantitative records of over a decade of participant observation in Martu foraging, and we combine this with remote sensing and spatial analyses of anthropogenic and nonanthropogenic landscapes. We argue

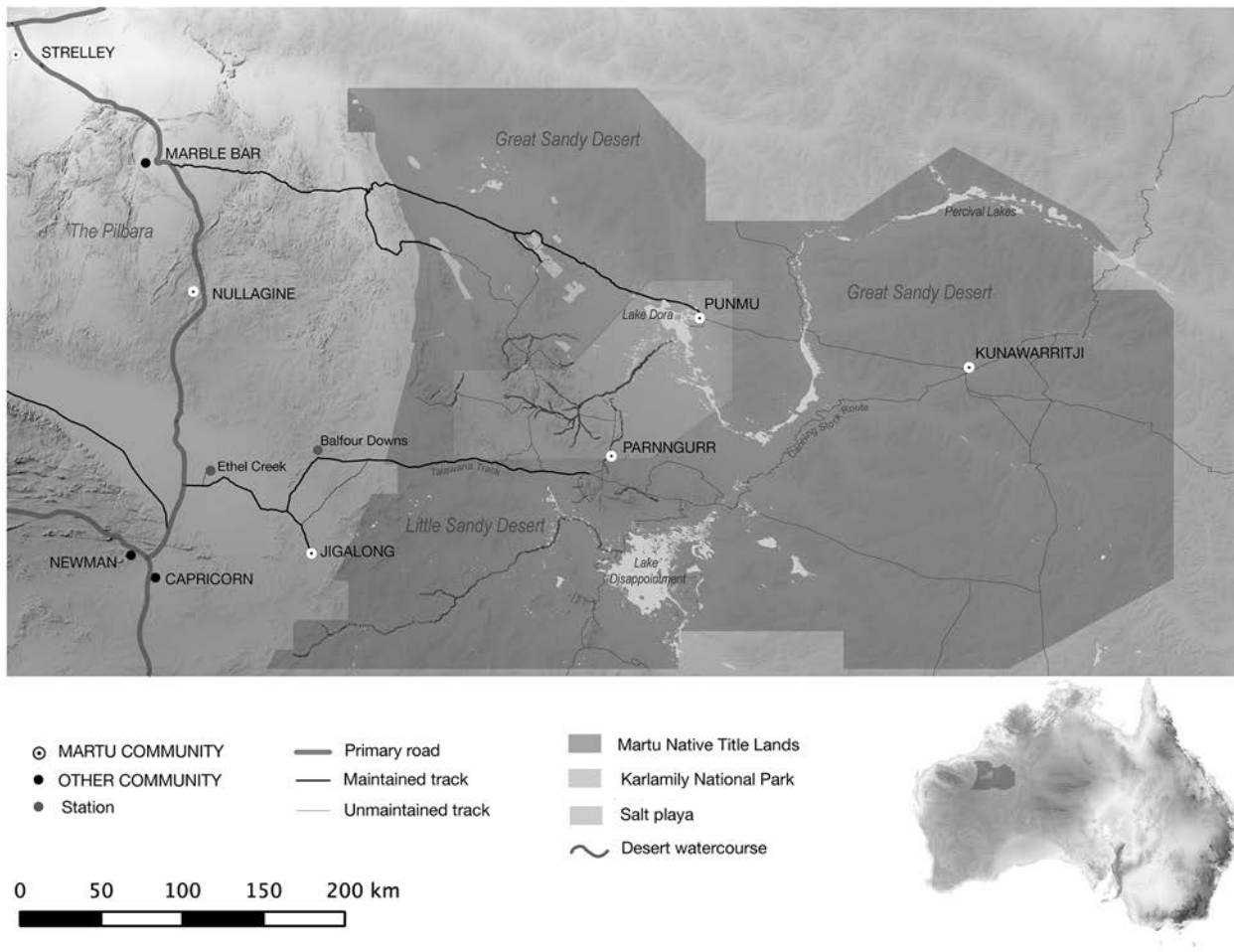


Figure 1. Map of the Martu homelands showing the Martu Native Title (darkest gray), Karlamilyi National Park (light gray within the Native Title), and the location of the three remote Martu communities within the Native Title (Parnngurr, Punmu, and Kunawarritji).

that these distinctively measurable landscapes emerge from the daily business of hunting and make up the owned ritual estates that form the basis of Martu-conceived heritage.

### Martu Economic and Ecological Organization

The contemporary economy in remote Martu communities is a hybrid of customary, state, and market sectors (sensu Altman, Biddle, and Buchanan 2012). In Parnngurr (fig. 1), the community where we are based, this includes hunting, gathering, some wage labor in mining and related industry, arts and crafts production through Martumili Artists (supported by the East Pilbara Shire), a new ranger program for Karlamilyi National Park and Martu Native Title Lands (facilitated by the Martu-based NGO Karnyirrinpa Jukurpa), as well as government benefit payments, some money from the Martu Lands trust, and work in the Community Development Employment Program. The links are dynamic, and labor within each sector is interwoven with commercial, subsistence, social, and religious values (Bird et al., forthcoming). Since the early 1990s Parnngurr has also had a community-

run primary school staffed by a Martu advisory council and mostly non-Aboriginal teachers. Based on a series of observational time-allocation surveys conducted in 2006 (Scelza, Bird, and Bliege Bird 2014) and 2009–2010 (Coddling 2012; Coddling et al. 2016), our research team recorded that adults and children five and over in Parnngurr spend an average of 23% of their days foraging, producing bush foods that make up 29%–49% of daily caloric intake for a person (man, woman, or child). Today this often involves the use of vehicles to access temporary foraging camps from which most hunting and gathering then proceeds on foot. Foraging—modified with the incorporation of new technologies, entanglements with markets and governments, and changing mobility and settlement patterns—remains fundamental to ecological and social organization.

### Contemporary Foraging

Between 2000 and 2010, members of our research team participated in 368 foraging trips with Martu. During foraging trips (averaging just over eight foragers per trip), we recorded

party composition, route, locale, and time that each participant devoted to active foraging. Resources acquired were counted and weighed before processing, usually at *mirrka ngurra* (see below), a locale where foragers gathered to prepare, share, and eat before returning to the settlement. Edible masses were converted into caloric measures using Brand-Miller, James, and Maggiore (1993). These records make up a data set of 1,831 individual adult foraging bouts consisting of all the time each forager spent in search, pursuit, capture, and processing of resources per day.

Men, women, and children are active hunters. Men tend to concentrate more of their effort on larger game (especially kangaroo and bustard hunting, which together make up 61% of men's foraging time), and women focus much of their foraging in pedestrian sandplain hunting, targeting sand monitor lizards (which makes up 72% of women's foraging time). However, there is a high degree of fluidity in gendered differences of labor, and there are times when men and women cooperate in hunting, especially during the summer in long-distance pursuits of large monitor lizards (Bird, Bliege Bird, and Codding 2009; Bliege Bird and Bird 2005, 2008; Codding, Bliege Bird, and Bird 2011).

Today, mutually exclusive foraging activities (made so by differences in habitat, technology, seasonality, and search strategy; see Bird et al. 2009, 2013 for details) are usually organized around the search for five staple animal prey: hill kangaroo (*kirti-kirti* [*Macropus robustus*], 24.7% of total production by whole weight), bustard (*kipara* [*Ardeotis australis*], 24.1%), sand monitor (*parnajarlpa* [*Varanus gouldii*], 19.1%), larger monitors (*maruntu* and *yalapara* [*Varanus giganteus* and *Varanus panoptes*], 2.7%), and feral house cats (1.5%). The remaining bush food comes mostly from solanum fruit, nectar, geophytes, and feral camel. When they choose to go out, a forager typically acquires about 3,000 kcal per day.

While kangaroo and bustard hunting produce occasional bonanzas, much of daily bush food comes from pedestrian hunting in spinifex (*Triodia* spp.)-dominated grasslands. The activity targets sand monitor but also includes the on-encounter pursuit of skinks, snakes, fruit, feral cats, and larger monitors. As shorthand we will refer to this as "sandplain hunting." Martu refer to the activity as *parnajarlpa wartilpa*, or sand monitor hunting, because sand monitors are the principal resource acquired. Overall, Martu in Parnngurr allocate more time to sandplain hunting than any other type of foraging activity. While this type of hunting is an important economic activity for all, it is especially so for older women and when money is short (Bird et al., forthcoming; Bliege Bird and Bird 2008; Scelza et al. 2014).

### Contemporary Burning

Because monitor lizards are denned in the cool-dry season, sandplain hunting is constrained by den visibility, so foragers either target patches characterized by early-successional vegetation or set a broadcast fire to clear off a large patch of older

growth vegetation to expose a searchable area. Hunters work alone or in small cooperative groups, searching for dens and tracks and probing the area around an encountered den with a long, narrow digging stick to locate the resting chamber, which lies 10–20 cm belowground.

In the winter, if foragers do not burn a patch of late-successional-age vegetation, they gain only  $25 \pm 407$  (SE) kcal per hour of search and pursuit. Older-growth vegetation inhibits search, and at that rate (given energy expended while foraging), on average hunters would work at energetic deficit. However, if they burn those patches, their returns increase dramatically to  $1,552 \pm 326$  kcal per hour (Bliege Bird et al. 2013). Then, over the course of an average foraging bout (just under 3 hours), a single forager can very reliably supply daily food requirements for two to three people. There is a clear linear relationship between time invested and harvest size, so unlike less reliable activities such as kangaroo and bustard hunting, foragers can predictably adjust harvest sizes with more search if there are more consumers at camp (Codding, Bird, and Bliege Bird 2010). Both men and women conduct broadcast burns while sandplain hunting, but women do so more often (Bird, Bliege Bird, and Parker 2005; Bliege Bird et al. 2008).

In the summer, when fire behavior is often unpredictable and monitors are active on the surface and pursued by tracking, burning is uncommon. Access to ground that was burned earlier in the year is then critical in the warmer months. Summer returns per hour hunting in late-successional patches are significantly lower ( $76 \pm 771$ ) than those in early-successional patches ( $1,838 \pm 446$ ). With ready access to patches burned earlier in the year, there is little need to burn extensively in order to pursue lizards in the summertime (Bliege Bird et al. 2013).

The main fuel burned in hunting fires is the highly flammable spinifex hummock grass, mainly *Triodia schinzii* and *Triodia basedowii*, which dominates much of the arid interior of Australia. Patches regenerating after fire are associated with different community composition, referred to as seral stages (Latz and Green 1995; Pianka and Goodyear 2012). Martu use a five-tiered seral classification of spinifex grasslands to characterize their landscapes. *Nyurnma* is the stage immediately following a burn, when there is no surface vegetation except surviving shrubs and trees. *Waru-waru* characterizes a community of new green shoots from the seed bank of diverse forbs and grasses, usually following a *nyurnma* within a few months, depending on precipitation. *Nyukura* is a community where fruiting plants have matured, and there is an abundance of resources for people and other herbivores. Herbs such as *Solanum diversiflorum* and other bush tomatoes, along with seed grasses such as woollybutt (*Eragrostis eriopoda*), are most abundant in *nyukura*, usually 1–4 years postfire. *Manguu* characterizes patches where spinifex has started to crowd out other grasses and forbs, a process that usually takes 5–10 years following a burn. *Manguu* has spinifex hummocks close enough to carry a fire. *Kunarka* is the final stage of spinifex growth, in



which large hummocks of grass completely dominate the patch, and the hummocks are so old that they begin to die in the middle and form circular rings several meters across, a process that can take up to 20 years.

Animals, too, show differential fire responses. Bustards (*Ardeotis australis*) come into *nyurnma* to feed and also to enjoy the desert raisin (*Solanum centrale*) so abundant in *nyukura*. Hill kangaroo prefer *waru-waru*, where newly emerging green shoots offer more nutritious browse, and *nyukura*, where solanum fruit is more abundant (Coddling et al. 2014). Sand monitors are omnivorous edge lovers: they often den in “islands” of older growth *manguu* or even *kunarka* adjacent to younger *nyukura* patches for foraging. As such their populations increase with edge density in the finer-grained anthropogenic mosaics Martu create (Bliege Bird et al. 2012b, 2013).<sup>3</sup> Having many different patches at different regrowth stages (a tight mosaic of seral stages) is a good indicator of both animal and plant species diversity at the landscape scale (Bliege Bird et al. 2008).

#### Contact History and Ecological Changes

Many remote Western Desert people who walked west at European contact are referred to as Martu,<sup>4</sup> while those who went east are called Pintupi. Some bands from a number of dialect-named groups, mostly Manyiljarra and Warnman, remained fully autonomous in the Karlamilyi and Percival Lakes regions until the mid-1960s, when they went west, mostly to Jigalong (Davenport, Johnson, and Yuwali 2005; Tonkinson 1991). In the 1980s many of these people began a process of reoccupying their homelands, establishing three remote communities at Parnngurr, Punmu, and Kunawarritji in the Little and Great Sandy Deserts (fig. 1). Unlike other parts of Australia, the Sandy deserts have been spared the ecological degradation of pastoralism, agriculture, and development: in the absence of Martu, the desert had been silent, the only visitors being mining exploration teams intent on gold and uranium. Even so, when Martu returned to their homelands, they confronted an ecosystem far different from the one they had left. Paradoxically, their hiatus coincided with the local extinction of numerous species of endemic mammals and the decline of many more.

3. Termite specialists such as *Ctenophorus nuchalis*, the netted dragon, a 50–100-g slow-moving lizard, are more prevalent in the recent burns of *nyurnma*, while *Ctenophorus isolepis*, which requires long-unburned spinifex for refuge and thermoregulation, is more abundant in long-unburned areas (Letnic et al. 2004; Masters 1996; Pianka and Goodyear 2012).

4. “Martu,” meaning “people” (indigenous people), is commonly used as a term of self-reference for members of different linguistic dialect groups that migrated to Jigalong in the 1950s and 1960s. It is not a culturally, linguistically, or relationally self-contained ethnic unit, and thus some of the beliefs and practices we describe for our mainly Manyiljarra and Warnman interlocutors in Parnngurr and Punmu will differ from those described by Tonkinson, who worked mainly with Kartujarra speakers in Jigalong.

Gone were several small marsupials that had been common prey: the rufous hare wallaby (*mala* [*Lagorchestes hirsutus*]), the brush-tail possum (*wayuta* [*Trichosurus caninus*]), the burrowing bettong (*jamparn* [*Bettongia lesuer*]), and the golden bandicoot (*minkajurru* [*Isodon auratus*]), and in their place were feral house cats, camels, and foxes. These new landscapes were dominated by extensive lightning fires that burned 10 to 100 times larger than the fires Martu were used to (Bliege Bird, Coddling, and Bird 2016). Nyalangka Tayor recounted that in 2004,

when the first lot of folks came to Parnngurr after being gone for 20 years, they burned the area first before they made their *ngurra*. When they went out hunting, they burned in every direction to keep lightning fires from coming close to camp. Martu like to make sure that they burn areas in all directions from camp and keep the *waru* [fire] small, controlled, so that it doesn't burn places that it shouldn't.

Between 1986 and 1990, ethnobotanist Fiona Walsh made several visits to Parnngurr to document customary foraging and land use and found that fires were becoming smaller and the country more diverse. Yet people were still concerned that not enough habitat had been burned, and there was a perception of food scarcity—not just the decline of marsupials but the disappearance of fruiting trees (e.g., *Santalum lanceolatum*) and the limited distribution of fruiting forbs, including staples such as solanum fruit. Martu in 1986 “attributed the scarcity of bush food species to factors other than hunting. In their view, the converse was true, traditionally oriented people believed hunting, gathering, and the manipulation of country and resources to be critical to their perpetuation” (Walsh 2008:170). That hunting, gathering, and burning is not the cause of resource scarcity but the critical support for resource persistence seems paradoxical, and to many, evidence of a logic that has little to do with ecological reality. Many Martu insist rather that the continued performance of these activities is critical to the integrity of both the ecological and socioritual landscapes.

Fire, Food, Family, Home: “We Are [Kin]. . . We Are Painters. . . We Hunt. . . We Burn.”

The painting shown in figure 2 is titled *Yarrkalpa* (hunting ground). Its accompanying caption, composed in Martu Wangka by the artists, begins with a rehearsal of the seral stages of vegetative succession that follow the application of fire to the landscape (*nyurnma*, *waru-waru*, *nyukura*, *manguu*, *kunarka*) and then transitions to a verse translated here by Nyalangka Tayor, who is also one of the artists.

We are sisters, mothers, daughters, granddaughters, aunts, nieces.

We are painters, we are Martu women, caring for our country.

We hunt in this country to look after it.

We burn it, then gather bush fruit.

We burn it, and the animals eat the *waru-waru*,



Figure 2. Kumpaya Girgirba walking in front of a section of the large canvas *Yarrkalpa* painted by women whose estates make up contiguous country across the Martu homelands. *Yarrkalpa* (hunting ground), 2013, 300 cm × 500 cm, by Kumpaya Girgirba, Yikartu Bumba, Karnu Taylor, Ngamaru Bidu, Yuwali Nixon, Reena Rogers, Thelma Judson, Nyalangka Taylor. Photo used with permission from Martumili Artists. A color version of this figure is available online.

Then they get fat, and we hunt and eat the animals:  
Goanna, hill-kangaroo, bustard, cat.  
We are telling lots of little stories about hunting in the  
Parnngurr area  
All of the women putting their stories together on a big  
canvas.  
It is special to teach others—Martu and non-Martu—how  
we live now  
And always have  
In this country.  
This country is us.  
We need to share it, and talk about it, and protect it . . . keep  
it strong.

Each of the eight artists (and their apprentices) has painted her own estate. An estate is a co-owned body of “little stories”: sets of owned and heritable responsibilities for maintaining the ceremony and totemic geography depicted in the painting as patches and paths forming mosaics from a bird’s-eye view of the landscape. Each estate contains a core group of custodians who are most closely tied to one of the regions associated with the principal Martu dialect-named groups (mostly Putjarra, Kartujarra, Kiyajarra, Warnman, and Manyjilyjarra; Tonkinson 1991). While owned corporately, the estates are not necessarily clearly bounded units in space or held to the exclusion of all others by a discrete group of people—each estate contains individuals who claim the most responsibility

to a core set of sacred sites and ceremonies, but each of those individuals will also have ties to other estates through negotiations about initiation, decent, spirit travel, totemic conception place, and residence (Tonkinson 2011). Both men and women can be estate holders (such that siblings are often co-owners), but within an estate there are gender-specific segments of knowledge and ceremonial performance (see Dussart 2000). However, even the most sacred “men’s business” usually requires participation of senior co-owning women (Tonkinson 1991). Below we suggest that Martu estates are constituted by social ties of relational wealth (Borgerhoff Mulder et al. 2009) facilitated in part through trust bound in foraging, burning, and food sharing.

Taken together, the whole of the patches, points, and tracks in figure 2 represent the ancestral estates that make up much of the Martu homelands (“All of the women putting their stories together on a big canvas”). Note that the artists begin by drawing attention to the ties that define their social relationships and the means—both on country and on canvas—used to represent how those relationships are expressed. The forms used show vegetative mosaics, dunes, watercourses, rock holes, clay pans, playas, Dreaming tracks, and roads. The shapes and colors represent both the terraforming activities of ancestral beings and different patches of seral stage regrowth.

Martu often use the patchwork of seral stages (both on the ground and in painting) as an index of devotion to one’s estate: the efforts of those that hunt to share enough to support

large networks of people are signified in landscapes that Martu refer to as *ngurra juri*, or sweet country, that have a tight mosaic of seral stages. In order to share, one must burn the land (*waruku ngurra*) to produce food (*waruku mirrka*). Burning both destroys and creates, but it is necessary for sharing. And sharing for Martu is simultaneously virtuous and political (Bird and Bliege Bird 2010; Bliege Bird et al. 2012a; Bliege Bird and Power 2015).

The act of painting *ngurra juri*, or maintaining it through burning, is as much an asserted claim to an estate as it is an ecological, commercial, and spiritual representation of home. Only those artists whose claims are recognized as legitimate by an audience of fully initiated owners would dare to assert representation of an estate through painting (Carty 2010), and only those who know the sacred geography would dare to burn within an estate. The legitimacy is forged in part through a reputation built by hunting and sharing. In turn, the cumulative existential processes of foraging and burning on country are a rehearsal of the terraforming acts of ancestral beings that brought homelands into existence in the Jukurr, the Dreaming.

*Jukurrpa*, described by Martu and others variously as “Law” or “Business” and by anthropologists as “The Everywhen” (Stanner 1979 [1953]), is cosmology, religion, philosophy, politics, and natural history. *Jukurrpa* encompasses the creative epoch of Dreamtime ancestors and the contemporary practice/knowledge required to sustain a homeland. It is the totemic geography, epistemology, and body of knowledge and ceremony concerning the terraforming performance of ancestral beings that left their life force across the landscape, the sacred and mundane activities that maintain the world, and prescriptions concerning the nature of the relationships between humans and other species and how those relationships are sustained (Tonkinson 2011). It “provides an explanation of nature, establishes a social code, creates a basis for prestige and political status within the community, acts as a religious philosophy and forms a psychological basis for life” (Cane 2002). Critical to the perpetuation of life is the proper adherence to the Law contained in *Jukurrpa*, which for many Martu frames the importance of hunting and sharing within the notion that “country must be used and appropriately burned” if life is to continue. As one elder put it, to stop using up resources, to stop hunting and burning, would mean “the end of the world.”

Jones (1969) and others (e.g., Gould 1971) have noted a clear link between Aboriginal fire ecology, harvestable food resources, water sources, and religious practice in *Jukurrpa*. Gammage (2011) has recently expanded the argument, suggesting that at the time of European invasion, the “landesque capital” of Aboriginal Australia existed as a set of contiguous estates held together by systems of land management facilitated by anthropogenic fire. Whether or not these systems were designed as long-term land management strategies (which for Martu, we argue, they are not), most acknowledge a profound role for landscape-burning practices in the function

of many Australian societies and ecosystems (Bowman et al. 2011).

For Martu, following the Law set out in *Jukurrpa* requires that one burn in particular ways: holding (*kanyini*) the country, not managing in top-down fashion, but holding it as part of a larger set of caretaking responsibilities over people. To burn outside of the context of permission from estate owners, or at times or in areas where a fire will threaten sacred sites, will bring consternation at the least and likely severe punishment. However, any designed “management” of land is an epiphenomenon of *kanyininpa*, the treatment of people and resources that Martu insist is based on encouraging individual autonomy (sensu Folds 2001). *Kanyini* means literally to carry something, but it is often used in the context of nursing: to nurse a child, or to nurse a fire stick and keep it from going out. When one *kanyininpa ngurrara*, carries the country, one is looking after country like one would look after a child, nurturing, feeding, giving it room to grow according to its own inevitable processes, fostering its autonomy and self-direction, and not controlling and managing it.

Traditional Martu beliefs emphasize that holding the country involves reenacting the creative forces first established by the Dreaming ancestors who brought the landforms into existence. Burning is a requisite reenactment of this creation given expression by the mundane business of everyday work. This, they say, ensures the fruitful reproduction of Martu, of species that sustain Martu, and the animals and plants that sustain those species. Thus, they claim that the estates represented in figure 2 exist only as a result of the terraforming activities of the Dreamtime ancestors sustained in *kanyininpa* by emulating their landscaping through burning.

Nurturing sentiments in *kanyininpa* are most often expressed through food sharing, especially unconditional sharing (*yankupayi*) with family (*walytja-marri*, defined as those of us who share, whether it be a home, country, birthplace, food). *Kanyininpa* creates both *walytja* and *ngurra*, a camp. *Ngurra* is a profoundly complex term incorporating notions of place, belonging, home, country, habitat, and generosity (Tonkinson 2005). Elsewhere in Australia there may be more clearly defined differences between the spatial notions of *ngurra* and the social notions of *walytja*, but many remote-living Manyjilyijarra- and Warnman-speaking Martu insist the distinction is blurry and that *ngurra* exists only within *walytja*. There is no home without family, and *walytja* share *ngurra* by definition. *Ngurra* is not bound in space or time; it can be formed and transformed at any spatial or temporal scale, with any group of people that come together as family, especially to share food.<sup>5</sup>

5. Within a *ngurra*, kinship always affects how individuals interact, but kinship does not, in a direct sense, determine the outcome of food sharing. For example, outside of a highly constrained and specific religious context, two *yumuri* (a mother-in-law and son-in-law of orthogonal alternate merged generational groups; Tonkinson 1991) would never address each other, sit near each other, or make eye contact, let alone hunt together or directly transfer food between each other. But

Out from the settlement foragers often establish a central locale to which they return in the evening to prepare, cook, share, and consume the day's take. Martu call this a *mirrka ngurra*, a dinner camp, and the location of that camp, as well as the individuals in the foraging party, will usually shift from day to day. Regardless of how ephemeral, at a *mirrka ngurra*, Martu assert they have an obligation to share evenly with everyone at the camp—if the day's take was meager, everyone will be equally hungry (Bliege Bird and Bird 2008).<sup>6</sup> Our data confirm that this is largely the case in practice, but any biases that emerge materially disfavor the more consistent large producers (Bird and Bliege Bird 2010; Bliege Bird et al. 2012a; Bliege Bird and Power 2015). For a producer to bias the consumption away from others based on kinship would be offensive.<sup>7</sup> How shares are nominally identified, as well as who hands what shares to whom and how one can address someone regarding a share, are of course matters of kinship (think of the closest grandparental relationships, which are same or parallel sections, vs. the most restrained in-law relationships, which are orthogonal sections; Tonkinson 1991). But this does not structure the composition of people present at *ngurra*—where food is delivered, prepared, distributed, and consumed—nor does it bias the amount and quality of who consumes what (Bird and Bliege Bird 2010; Bird et al. 2013). Martu claim that tiers of distribution ensure that all adults present ultimately get an equal share, and it is the obligation of the producer to act modestly—and the distributor compassionately—toward those with less (Bliege Bird and Power 2015).

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there are often *yumuri* sharing a camp and sharing food that they or others produce—they simply separate themselves in space. For example, if out on a temporary camp, *yumuri* will often separate themselves by at least a few tens of meters, backs to each other and a brush divider or vehicle between them. Yet *yumuri* are fundamentally family and fundamental to family in part, say Martu, because they share food at camp.

6. While for Martu, social interactions—including food sharing—never exist independent of concerns about kinship relationships (in fact, parcels of game are often referred to in terms of a kinship relationship between a hunter and an idealized recipient of the share, e.g., a kangaroo rump is often called the in-law share), kinship relationships do not diametrically regulate the everyday flows and amounts of food distributed from producers to consumers. Martu that we live with insist that all of the adults present when food is distributed at a *ngurra* should receive equal shares of food (or defer shares as they wish) regardless of the kinship relationship between the producer and the consumer.

7. This is so even under broad obligations young men have to hunt for their in-laws or other older men, especially a mother's brother. Younger Martu men often declare that affinal obligations influence their decisions to go hunting and that they have responsibilities to work for old men and affinal kin, but a young hunter almost never takes the lead in cooking, butchering, or distributing large game. Distributions are conducted by the most senior person present, and they do not bias portions such that larger shares go toward affinal kin or mother's brother of the hunter (Bird and Bliege Bird 2010). This does not mean, however, that younger men do not have special responsibilities to their in-laws or older men.

The obligations to ensure consumption equality emerge through the way social status is maintained, which is mediated through the maintenance of social networks of sharing and cooperation. We have argued elsewhere that individuals are motivated to return as much food as possible to the *ngurra* because they gain respect and some measure of prestige from distributing a greater percentage of their harvest, as in kangaroo hunting (Bird and Bliege Bird 2010; Bliege Bird 2012a) or, as in sand monitor hunting, that they gain social capital from the costly support of extensive social networks and an honest display of pecuniary disinterest, of not benefitting from one's own overproduction (Bliege Bird and Power 2015). The benefits of costly sharing thus condition the return of all foraged foods to the dinner camp.

Martu are thus strict central place provisioners with respect to the formation of the *ngurra*. Hunters very rarely eat while searching for and pursuing prey and do not cook prey except at the hearth in the *ngurra*. Even children return all prey back to the *ngurra* for cooking before consumption. The only exception is the consumption of small amounts of fruit or nectar while collecting or occasionally a snack if gutting larger game at a kill site. This is not conditioned by the constraints of tools, cooking pots, or other items left back at the central place: nearly all foraged food Martu acquire is either eaten raw or roasted whole over coals or in roasting pits. Ironically, the formation of the *ngurra* trumps residential patterns in the community at large. Martu are not strict central place provisioners with respect to the settlement; only what is not consumed at the *ngurra* is brought back to the settlement. Most of the small prey is thus consumed by the *ngurra*, while only leftover portions of larger prey are brought back to the community and redistributed. The formation of a *ngurra* is determined simply by coresidence around a cooking hearth. Those who share a cooking fire are “at table” together regardless of their kinship relationships or residency in other contexts (Bliege Bird et al. 2012a). They are made family.<sup>8</sup>

Martu family making includes the sharing of a multiplicity of ties created through consubstantiality and rituals of unconditional economic exchange (Tonkinson 2011). “Consub-

8. This does not mean that all family are equal or that everyone who is considered family gets an equal share. It is simply that those present when food is prepared, distributed, and eaten are made family and get an equal share (or have the right to refuse an equal share). Those not present get nothing, or only what is not consumed immediately. In the context of most foraging today, someone not present in a foraging party (the group that makes a *mirrka ngurra*) cannot expect to get much of anything that was acquired that day. They may be upset about that and may address their concerns according to kinship (“I am your auntie, you went foraging; why did you not bring me anything?”), but neither the producers nor distributors control distribution in a way that would ensure shares at a foraging camp are biased in order to return portions to specific individuals in the settlement. One could defer consumption of a share received at distribution and then deliver it to someone in the settlement, but that is likely to raise questions from others in the settlement about perceived bias (see Bird et al. 2013).

stantiality” refers to the possession of a common substance as the basis of a social tie between two individuals. In some societies, this is primarily the substance of genetic descent, but in others, it also includes the shared intake of many different substances. For Martu, family (*walytja*) is generated through the sharing of one mother’s milk, the consumption of the same hunted animal, or sharing souls or spirits that have emerged from the same *yinta*, a spring with life-giving water. Families are said to be established through sharing the love of the same mother(s) who raised them as her own children, sharing the same or parallel section (merged alternate generational groups: *Karimarra and Panaka* or *Milangka and Purungu*; Tonkinson 1991) or sharing material without the expectation of return (*yankupayi*). It is not that consanguinity is unimportant; it is that one can buffer questions about descent by creating social bonds through shared experience and “substance,” and these bonds can be given just as much weight as those characterized by clearly defined ancestry (Tonkinson and Tonkinson 2004). Being *walytjamarri* (those of us from the same spring, *yinta*) is about sharing, and it can be as much about sharing the same country, meat, fire, water, or mother’s milk as it is about sharing an ancestor.

For Martu, decisions about foraging are thus shaped by decisions about sharing. Martu often say they hunt to share: hunting is always embedded in a context of social exchange. When hunters leave *ngurra* thinking about *yunkupayi* (sharing without expectation of return), they are said to bring back more meat, and in bringing back more, the goal is not to eat more but to share more to other members of the *ngurra*. Sharing unconditionally is partly a manifestation of one of the central emotions of Martu existence: sympathy, or sorrow (*nyarru*). One shares with those less successful because one feels sorry for them. Yet there is also a motivation to share to receive the rewards of being *mirtilya*, a good hunter. *Mirtilya* are skilled hunters who broker their excess production into social capital. A hunter who produces more than anyone else should eat as little as possible from his or her own production and share the surplus widely and unconditionally, especially to those with whom she has little obligation to share—those who are not genealogical kin. A *mirtilya* has that status because she builds kinship ties with those to whom she is not necessarily closely related. A productive hunter’s reward is not the meat but the *pukurrpa* (happiness) that comes from binding people together in a family through the meat they have provided. This binding of family is *kanyininpa*, holding, and it is simultaneously economic, parental, and ritual.

Among Martu, holding country requires that you feed and nurture others without restricting their autonomy in any way: shares are thus distributed in ways that defuse the “power of the gift” (Mauss 1954). The power of the gift is muted in several ways typical of “immediate return economies” that disassociate the hunter with ownership of the food he or she has acquired, create egalitarian distributions of economic goods, promote tolerance of free riding, encourage cooperation, and

discourage contingency in the sharing of food. Those who acquire more do not benefit in consumption from their overproduction: better hunters share a larger proportion of their harvest and do so routinely without contingent reciprocity in food (Bliege Bird and Power 2015). However, the better hunter who eats little, shares most, and cooperates extensively with poor hunters does benefit, and although we cannot measure *pukurrpa*, we can measure the social networks of interaction that are created through sharing. The benefits of sharing lie in the construction of social relationships of trust and cooperation that build family ties. Those who are more generous on average have higher centrality scores in the cooperative hunting network, meaning they cooperate more with others who are also cooperative (Bliege Bird and Power 2015). More generous sharers are thus able to create a social network of strong ties between connected individuals. Where “generosity is the main measure of a man’s goodness” (Hiatt 1982:14), building and maintaining a reputation for virtue generates trust in many different dimensions of Martu social life. Foragers share a greater percentage of their harvest the larger it is, feeding and holding those who cannot or will not forage for themselves. For this is how Martu gain a measure of social prestige and become respected as those strong in the law: through disengaging with material property (Tonkinson 1988) and fostering egalitarian material relationships in the holding of *ngurra* and *walytja* (Bird and Bliege Bird 2010).

#### Emergent Pyrodiversity: “We Hunt in This Country to Look After It. The Animals Get Fat, and We Hunt and Eat Them.”

As expressed in the poem above, the notion that people are critical for the perpetuation of life in the desert has parallels with nonequilibrium theory in ecology, which recognizes the importance of disturbance and the positive effects it can generate. When organisms disturb ecological communities, some species experience population reductions, but others may do better. If in influencing local population declines among a few species an organism provides positive effects such as enhancing food or shelter for other species, they are referred to as “ecosystem engineers” (Jones, Lawton, and Shachak 1996) or “niche constructors” (Odling-Smee, Laland, and Feldman 2003). The classic example is that of beavers constructing dams. Dams flood creeks, which causes localized mortality to some plants but increases wetland habitat and produces greater environmental heterogeneity, in turn supporting larger populations of a wider range of species at a landscape scale (Wright, Jones, and Flecker 2002). Ecosystem engineers can have positive effects through a variety of different mechanisms. They can affect landscape heterogeneity, which may stabilize species interactions and provide a variety of habitats for shelter and feeding (Holt 1984; Roff 1974; Roxburgh, Shea, and Wilson 2004); they may also increase food web stability simply by being a predatory generalist who hunts prey at different trophic levels (Gross et al. 2009). Organisms that play a key role in holding

communities together are often referred to as “keystone species” or “foundational facilitators.” Remove that species and you may precipitate a wave of extinctions that ripples through an entire food web (Terborgh et al. 2001).

Like species, physical processes can act as keystone facilitators. Fire shapes global ecosystem patterns and is often a keystone process, a form of disturbance that causes mortality at local scales but may have positive effects at the scale of the community or landscape (Bowman et al. 2009). At the scale of a burned patch, fire immediately removes vegetation and reduces local animal populations, but it may increase in-patch species diversity (alpha diversity) by interrupting the process of plant succession that results in domination by a few competitive species. Communities associated with different time since last fire may have a very different set of plants and animals associated with them, and species diversity may actually be highest not at the endpoint of recovery from fire but at some point in the middle. Across a landscape, fire may increase diversity by increasing the heterogeneity of community types across the landscape (beta diversity).

Across a vast landscape of nearly 500,000 hectares, Martu set approximately 360 fires per year, averaging around 100 hectares in area. These hunting fires are very different from lightning fires: they are ten times smaller on average and 10 times closer to each other (Bliege Bird et al. 2012). Fires are smaller for a number of reasons. Martu light fires mostly under conditions when fire size can be more easily controlled. Under conditions unfavorable to control of fire, hunting fires tend to be larger. Lightning fires are large regardless of conditions because they tend to be lit mainly when temperatures are high and winds are unpredictable. The size of lightning fires is limited mainly by the contiguity and amount of fuels, which is measured by antecedent cumulative rainfall (Bliege Bird et al. 2012). When the grass is thick, Martu simply light more small fires, because thick grass reduces sandplain hunting search efficiency. The small, patchy fires scattered throughout the landscape by Martu hunters have the incidental effect of creating firebreaks that prevent the spread of lightning fire during seasons when large fires threaten.

To explore the interactive effects of over 4,500 observed foraging hours on the structure of the landscape and its interaction with resources, we stratified the entire study area by different levels of human use, ranging from more than two forager days per square kilometer to practically zero, and then overlaid land-use intensity on a composite seral stage (vegetation age since fire) classification map (fig. 3). The patchy landscapes created through several years of wintertime hunting shown in figure 3 have significant effects on the distribution of both plant and animal species. Sand monitor density is increased in regions where there is greater environmental heterogeneity: the higher the density of habitat edges—contrasts between new burns, regrowing vegetation, and old growth—the higher the density of monitor lizards. In fact, lizards are more abundant in landscapes where they are more intensively hunted (Bliege Bird et al. 2013).

This increase in game, in turn, doubles Martu hunting efficiency and increases success rates six times over in more heavily hunted regions compared with regions that are rarely visited (Bliege Bird et al. 2013). As a result, foraging return rates across all different hunting and gathering activities are highest in areas under intermediate human use, where the negative effects of human predation are dominated by the positive effects of anthropogenic fire (fig. 4). Even in high-use regions, foragers do significantly better than they do in more remote regions less affected by anthropogenic fire.

Martu hunting fires also shape population distributions of other desert species that benefit from access to a more diverse successional mosaic, such as hill kangaroo, which are more abundant in regions associated with higher patch diversity (Codding et al. 2014). Characteristics of many of the animal species that disappeared or are in decline also suggest that they, too, may have been advantaged by Martu fire mosaics. Hare wallabies are browsers that rely on plants in many different successional stages as well as mature spinifex hummocks for nesting and predator predation. Before the 1960s, they were abundant and widespread throughout the spinifex sandplains and were hunted frequently. The continued persistence of the population has been argued to be dependent on continued patch mosaic burning to maintain access to early-successional habitat adjacent to mature spinifex (Lundie-Jenkins 1993; Lundie-Jenkins, Corbett, and Phillips 1993; Lundie-Jenkins, Phillips, and Jarman 1993; see Kerle et al. 1992 for similar effects in other endemic mammals).

Landscapes where hunting is most intense also have more patches of midsuccessional grassland, which has a significantly greater density of high-ranked seed grasses such as *Eragrostis* and fruits such as *Solanum*. Anthropogenic landscapes reduce the cost of accessing such patches by rescaling habitat structure. Foragers in an anthropogenic landscape have a 96% chance of being able to find a patch within 3 km; in regions far from Martu influence, the chances of finding such patches nearby drop to 82% (Zeanah et al. 2015). Essentially, an anthropogenic landscape rescales resource patch density to reduce the cost of accessing a wider range of resources.

### Ecological Emergence of Homelands: “This Country Is Us.”

In a very real sense, Martu foragers and their resources (especially sand monitor lizards) are locked in coevolutionary dependence with deep temporal roots, one that is akin to farming but on a spatial scale that requires more expansive mobility than most systems of horticulture. This is so in spite of (and in part because of) the fact that contemporary foraging and mobility are entangled in and modified by extrinsic markets and settler colonial constraints and opportunities. The customary sector of a Martu economy thrives because of the social value that Martu place in sharing: sandplain hunting is fundamental to sustaining relationships whose value is defined by pecuniary disinterest (Bliege Bird and Power

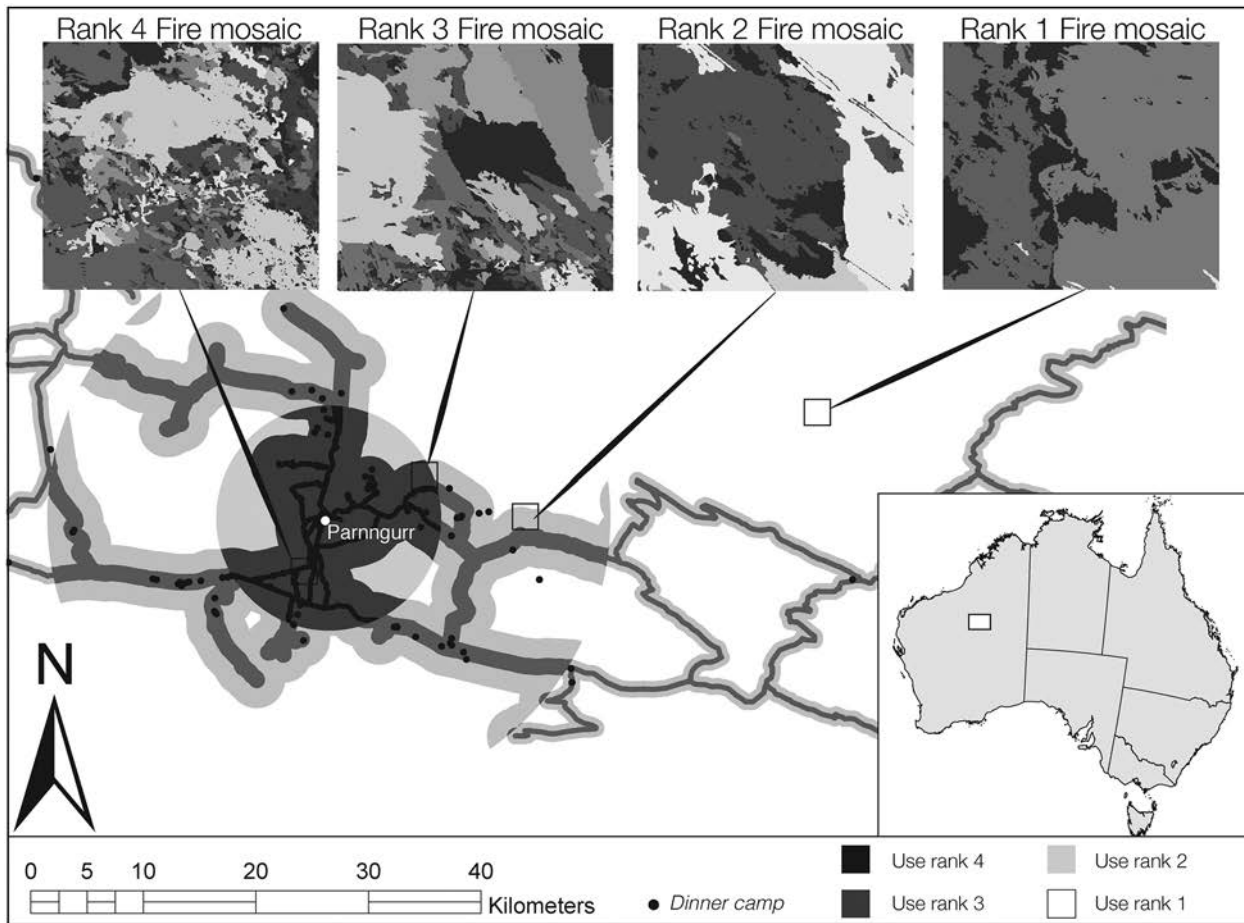


Figure 3. Study region within the Martu homelands stratified by different levels of land-use intensity from more than 4,621 observed forager hours between 2000 and 2010. As illustrated in the lower graphic, the highest-use areas (category 4, black) include those regions within a 25-km radius of Parnngurr with  $>2$  forager days recorded per square kilometer. Moderately high-use areas (category 3, dark gray) include those regions within a 50-km radius with between 0.26 and 2 forager days recorded per square kilometer. Moderately low-use areas (category 2, light gray) include all regions with between 0.06 and 0.25 forager days per square kilometer. Low-use areas (white) include those regions with  $<0.05$  forager days recorded per square kilometer. The mosaics (shown to scale in location in the lower graphic) are composite satellite images creating a cumulative 10-year fire-history map (Bliege Bird et al. 2012b) to illustrate patchiness of seral stage (earlier succession is shown in lighter shades) according to use rank.

2015). For Martu this is fundamentally tied to pedestrian hunting in the sandplains and the burning that supports it.

High predictability and density of lizards is a necessary precondition to produce desert livelihoods characterized by reductions in residential mobility, the mid-Holocene hallmark of broad spectrum foraging economies in arid Australia (Smith 2013). Even today, with vehicles and metal digging sticks, hunters cannot be efficient enough to support themselves or others without burning (see “Fire, Food, Family, Home”; Bliege Bird, Coddling, and Bird 2016; Zeanah et al. 2015). Such livelihoods can only be sustained through the creation of a fine-grained mosaic of diverse vegetative succession produced by the cumulative effects of anthropogenic burning (Bliege Bird et al. 2008, 2012b). These anthropogenic landscapes, however, are emergent phenomena: they are maintained through attempts to increase the immediate effi-

ciency of searching for small prey. The immediate benefits of burning to hunt offset the costs of collective action required for intentionally designed systems of management (policing, in effect) that characterize more intensified farming: Martu “farm” lizards with “fire sticks” (Jones 1969), but on a requisite spatial scale (supported by expansive logistical mobility out from a residential base) that would make maintaining long-term exclusive rites of producer control over a “cultivated” plot inordinately expensive. Ownership of land-based estates is maintained in a delayed-return ritual economy (Sutton 2003) in which the exclusivity of an estate is defined by the accumulation, performance, and inheritance of esoteric knowledge, not directly through the maintenance of long-term rites to exclude access to a spatially bound set of resources cultivated through burning. The route to sustaining a claim to an estate is indirectly linked to the maintenance of a

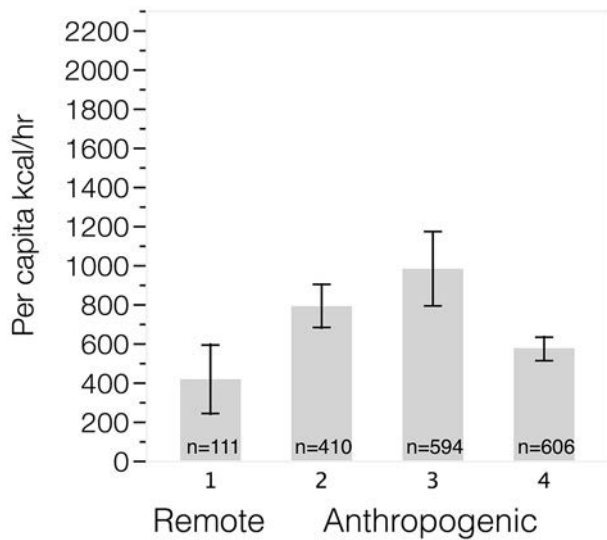


Figure 4. Relationship between foraging efficiency (kcal per forager hour,  $N = 1,831$  foraging bouts) and intensity of land use (see fig. 3). Landscape heterogeneity increases as a result of higher levels of anthropogenic burning in more intensively used area (Bliege Bird et al. 2008, 2012b). This feeds back to increase subsistence returns for pedestrian foraging in intermediate-use regions. Even in the most intensively used areas (category 4), the positive effects of an established mosaic of anthropogenic burning outweigh the costs of localized resource depression from more intensive extraction. Return rates from foraging bouts in categories 2, 3, and 4 are all significantly higher than return rates in category 1 ( $P < .05$ ).

distinctive anthropogenic landscape through the way that skill and generosity in hunting forge the rights of ritual performance and ownership (Bird and Bliege Bird 2010). These systems of social exchange thus emerge from the distribution of resources across the landscape, which is fundamentally shaped by anthropogenic fire.<sup>9</sup>

Implicit within the *Jukurpa* is the notion that the desert supports a network of interactions between all species, what ecologists refer to as a food web, in which humans are an

9. The status of being *mirtilya* (a skilled and generous hunter) is dependent on a lifetime of holding others and building relational wealth (sensu Mulder et al. 2009). This holding of others (*kanyininpa*), which are bonds of trust, requires honest displays of asceticism, of devotion to dispossession (Bird and Bliege Bird 2010; Bliege Bird and Power 2015; Bliege Bird et al. 2012a). Paradoxically, it is through this dispossession that a claim to possess an estate is maintained. The means of estate inheritance are complex and vary geographically across desert societies (Cane 2002; Dussart 2000; Myers 1986). For remote-living Martu, rights to stake and maintain a claim to an estate and negotiate its performance in ritual and artistic expression are in part based on respect generated by how well you can bind together networks of co-owners (sensu Myers 1988). Hunting to share requires immediate returns that can only be realized in landscape burning, the long-term (“emergent”) effects of which are the distinctly anthropogenic landscapes that Martu call home. That becomes the landesque capital of a delayed-return economy of ritual inheritance.

important keystone species and fire is a keystone process. The ritual significance of burning is that Martu fulfill their role within the food web by burning to acquire food and distributing it to the younger generation, holding them and in so doing, holding the country for inheritance.<sup>10</sup> Holding country emerges naturally out of the holding of *walytja*, a group who at the most local scale share ownership of “a little story” (see “Emergent Pyrodiversity”), often a single *yinta*, or waterhole. The patterning of fires on the landscape is not designed toward some optimal management goal, it is simply meant to be. If the mundane and ritual practices of life were not integrated, the land would not reproduce, and it would be the end of the world.

## Conclusions

Many Martu emphasize that the social, ecological, and metaphysical landscape exist simultaneously, inextricably intertwined in a complex web of interaction. Hunting in the sandplain grasslands is integral to the maintenance of this web and ultimately sustains important networks of cooperation (Bliege Bird and Power 2015; Bliege Bird et al. 2012a). Such hunting is possible only within an environment where small animals flourish, which requires the intervention of human fire sticks (Bliege Bird et al. 2013). Fire makes possible high foraging production, increasing both predictability and return rates in hunting small animals. The foraging benefits supplied by fire-maintained habitats are invested into social relationships via food sharing. Fire sustains the generosity of the *mirtilya* (hunters with a lifetime of reputations based on skill and generosity) and supports a moral economy that emerges from generosity, which fosters stronger social ties between individuals by generating trust and facilitating cooperation.

Anthropogenic fire sustains a web of interaction that links the realms of the economic, the social, and the ecological. Fire is the shaping of country, the reenactment of creation, and the holding of *Jukurpa* (the Dreaming), and it sustains the ties that bind people together. In binding networks together through sharing, Martu also serve as ecosystem engineers, creating small-scale habitats that prevent the spread of very large fires and buffer small, ground-dwelling mammals from both the effects of climate-driven fire and from the heavy predation that ensues when animals are exposed in burned areas.

The logic behind the Dreaming places humans within the web of ecological relationships critical to the coexistence of a wide range of desert species, predicted the trophic collapse that occurred during the Martu hiatus, and explains why Martu understood species extinctions to be linked to the loss, not the intensity, of human hunting. Once Martu began the

10. Similar themes are expressed in the burning of a vehicle to forge trust in co-ownership: if there is a dispute over a vehicle, Martu will burn the vehicle (e.g., Myers 1988). It is a display of commitments to hold together networks of people and country made honest in your ability to bear the burden of subjecting an object to destruction.



mid-twentieth-century process of migration onto missions, pastoral stations, and European settlements and stopped hunting and burning on the landscape, fire mosaics began to break down, large fires swept through, both invasive and endemic predators spread and increased in population, and many species of both plants and animals went extinct (Bliege Bird, Codding, and Bird 2016; Bliege Bird et al. 2012b). The world, as Martu knew it, did come to an end, as the Dreaming had predicted it would. The homelands came back to life as Martu returned in the 1980s to hunt and burn. Dreaming logic is thus revealed as a deep understanding of the social-ecological relationships between human foragers and their environments.

Rather than viewing Martu conceptions of “looking after country” as management, we show here that what many Martu mean when they talk about caring is that the long-term benefits of anthropogenic habitat modification are an emergent property of a coevolved social-ecological system maintained by the short-term benefits to small game hunting returns. Positive environmental effects emerge not from designed or institutionalized management schemes but from the cumulative patterning of individual decision making across a landscape of social, residential, ritual, and economically driven land-use patterns. People, and other species, then capitalize on the ecological properties that emerge.

Our hope is that the analysis illustrates one way by which anthropological disciplines can be reintegrated through questioning the mutual exclusivity of reductionist versus holistic and emic versus etic perspectives. Our approach attempts to isolate and break down some of the processes shaping emergent properties of complex social-ecological systems while at the same time contextualizing the transcendent worlds that people construct from their relationships with each other, other species, and materials. Many Martu insist that they are their country through their “holding” of people and land. One way to interpret this is in how their practices construct networks of relationships from which an ecological niche emerges. Things in the niche are thus constituted not in delineated forms but in the weave of interactions (Hodder 2012). “The environment, then, comprises not the surroundings of the organism but a zone of entanglement” (Ingold 2008:1796). We argue that measuring the interactions and the way they are recorded in habitat heterogeneity, including patterns of decision making about food acquisition and the application of fire to the landscape, gives critical insight into the processes that hold together people and their entanglements with country.

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# Imagination from the Outside and from the Inside

by Maurice Bloch

In this paper, I consider the problems and advantages of combining the traditional subdisciplines of anthropology, especially the problem of combining studies that attempt to interpret and represent the “from the inside” point of view of a particular group of people, a practice typical of ethnography, with the more scientific approach that ultimately attempts to study our species and its evolution, inevitably “from the outside” of the particular point of view of any culture or society. I focus on imagination. Imagination “from the outside” seems a feature of human cognition, but a particular use of this capacity means that human beings can create apparently stable institutional structures. “From the inside,” the idea that the social system, which in the case considered by and large equals the kinship system, is imaginary would seem false. Yet if we look at the representations we find in rituals such as initiation or ideas about incest, we find locals’ ideas not at all incommensurate with those of the scientists. Again, if we look at the scientists’ understanding of what motivates people in specific places, we find that they need to imagine a “from the inside” environment.

## A Reflection on the Reintegration of Anthropology

In this paper I show how the topic of human imagination can serve as a link for a number of disciplines concerned with human beings that will enable them to illuminate each other and move forward. The proof of the pudding will be in the eating. The disciplines concerned include the traditional four fields of anthropology, but they also include other disciplines dealing with our species, most notably psychology, philosophy, history, and sociology.

I particularly value the combination of disciplines traditionally thought of as coming from the humanities with some usually thought of as more traditional “sciences.” The fruitfulness of such a combination has hardly begun to be explored. However, the odd history of the institutional academic subject that is anthropology has, perhaps by accident, brought about this possibility. I therefore value the combination of approaches using the more rigorous and verifiable conclusions of the experimental methods of natural science, which we find in biological anthropology as well as in much archaeology, with intuition-led interpretation such as has characterized much social and cultural anthropology as well as history. I shall call the former approach “external,” or “from the outside,” because the standpoint of the scientist appears to be independent of what is stud-

ied. I shall call the latter “internal,” or “from the inside,” because the standpoint is as though through the eyes of those written about.

It is important to keep the two perspectives quite separate before we put them together and not to link them surreptitiously. I fear that Scott Atran’s “sacred” might suffer from existing in a no man’s land between “the inside” and “the outside” (Atran 2016). The combination of these two points of view will be what I will discuss in this paper, and in many ways trying to do this was a major theme in the “Integrating Anthropology” meeting. There is no doubt that the introduction of niche construction theory into anthropology is a major step, and I am grateful to the organizers of the meeting having made me realize its potential fruitfulness. However, as Greg Downey stresses, when it is applied to humans, a deeper understanding of the way the social and the cultural is experienced is necessary (Downey 2016). Thus, Douglas Bird puts together a “from the outside” ecological perspective with a “from the inside” understanding of sharing and dreaming without while avoiding too direct a causative link between the one and the other (Bird et al. 2016).

One of the virtues of the old four-fields approach in anthropology is precisely that it has created the potential for such an unusual but ultimately fruitful combination of approaches. I hope that this paper will point to the way this alliance can be envisaged again and how it might move forward our thinking. In what follows, in order to argue for this difficult combination, I will, at different points, bring together methods, theories, and concerns that have been characteristic of the four fields of traditional anthropology and that have usually been located only within one or the other.

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I am not, however, committed to recreating exactly the old alliance of the four fields as they might have existed in a golden age of anthropology. This is so for two reasons. First, as I have already suggested above, I do not see an intrinsic privileged relationship among these four fields. Even if in some of my work I have made use of insights from linguistics, archaeology, and biological anthropology, I do not want to confine myself, or even privilege, my considerations to the old four “subdisciplines.” Other disciplines might be just as useful if not more.

Second, it is very important not to mix up the value of intellectual and theoretical cross-fertilization with what are in fact institutional arrangements. As just noted I, as a social anthropologist, have made more use of linguistic theory, prehistory, and biological anthropology than have most of my social anthropology colleagues, and I have worked with people from these disciplines, but I am far from convinced that it is a good idea for these disciplines to be together in a single university department. For example, in my experience, departments that combine within one administrative structure cultural anthropologists and biological anthropologists are much more likely to create pointless internal fights over space and budgets than if they were quite separate in terms of finances and if they were in quite separate buildings. Institutional fights can so easily transform themselves into pseudoscientific fights and how the process that Bateson (1958 [1936]) called “schismogenesis” can lead to the ridiculous situations, typical of the 1990s, that occurred in some American universities and that the conference brought together by the Wenner-Gren Foundation in 2014 sees itself as reacting against.

Another general point can be made in this introduction. Combining approaches from, let us say, a discipline such as experimental psychology and interpretative social anthropology may sound desirable, but it is very difficult to do it in practice. Making both sides, however well-intentioned they might be, cooperate and above all appreciate each other requires an enormous effort of intellectual imagination and humility on the part of the participants that years of training in particular ways of thinking hinder very much. A publication such as this, following a stimulating Wenner-Gren conference intended to integrate the different branches of anthropology, leads us too easily to believe that we have understood each other. We probably left the cross-disciplinary conference with a spring in our step, with the feeling that we have benefited from different approaches or even that we are on the point of fruitful cooperation, but then, only to find ourselves, in the cold light of morning, as far apart theoretically and personally as if the meeting had never taken place.

Another reason for the difficulty of working together is more banal. All of us find it very difficult to keep up with the work going on in our own disciplines. If we want to know what is going on in other disciplines, the requirement may seem impossible. To that problem there is only one solution. When we look over the fence to other disciplines, we can only inform ourselves very generally, we can only pick here and there

or use general work as though it were the received wisdom of another discipline when, in fact, the patrician tone of what we are reading is simply hiding very tendentious minority views. As we move out of our comfort zone, we will inevitably become more and more uncomfortable. And so we should. We will be making awful mistakes. However, with luck, by reading more, and, above all, by talking to people of other disciplines, we will often be able to correct our naive preliminary mistakes.

Thus, this business of talking across boundaries is much less straightforward than it might seem in an idealized world. We will court humiliation as our ignorance is shown up by experts. Above all, we will need to make an effort of sympathetic imagination to appreciate what it is to interact with people who talk in completely different ways, who have quite different criteria of validity, and who write in very different styles. What follows is my attempt to do what the conference called for and to show how work developed in at least three of the four fields can come together fruitfully. But we should not stop there, and we should occasionally borrow from farther away.

## Imagination

I have chosen the topic of imagination here to show both the fruitfulness and the difficulty of combining approaches characteristic of interpretative ethnography and biological anthropology. This is because imagination is a key topic for all those who call themselves anthropologists of whatever kind. My immediate motivation was the uncomfortable reception of a paper I wrote in 2008 that showed up in an interesting way the problem of looking at imagination in ways that I shall call here “from the outside” and “from the inside” (Bloch 2008).

That paper argued against various cognitive theories of religion current in the social and cognitive sciences. It did this not so much by criticizing what the authors on the topic had to say about religion but by pointing out that the characteristics that, for example, Pascal Boyer, and here I would include Purzycki (2016), had emphasized as distinctive of religion were in fact omnipresent in all aspects of human life (Boyer 1994).

Soon after publication, the paper was picked up by the more popular British journal *New Scientist*, and the account that was given of it in its pages was pretty accurate. Unfortunately, the title of the piece was “Religion a Figment of Human Imagination,” and this turned out to be misleading and contentious (Coghlan 2008). The provocation was fired up even further by the fact that the article was accompanied by a picture of the crucifixion. Soon a flood of indignant denunciations were posted on the web. As far as I know or surmise, none of the authors of these responses had read the original paper or even the account of it given in *New Scientist*, but the title had been enough to rouse their fury. It could be easy to dismiss their reaction, but I think the misunderstanding of what I had been up to was actually quite interesting. These religiously involved people were implying that for me to say that religion was a

matter of imagination, whatever they understood by the term, simply did not correspond, even remotely, to what they felt was the place of religion in their lives. Discussions such as mine were missing the point. The world of a scientist of religion just did not connect with their religion. Many of my colleagues in the cognitive science of religion probably just would not care about such a knee-jerk reaction, but I, as a social anthropologist, because of the odd combination of subdisciplines that the history of the encompassing discipline has brought together, felt that it was just as much my job to justify that part of my argument that *New Scientist* reproduced as it was to understand what the web responders to the title were saying. Doing both jobs and putting them together is the challenge that the four-field approach to anthropology presents to us.

### Imagination from the Outside

I start with what might be called the scientific approach to the imagination.

Imagination is linked to the ability to create images in the brain separate from perceived stimulus. As such it seems necessary for all conceptual thinking. It would seem to be such a basic element of the process between perception and cognition that it would be very surprising if it were not present, in some form or other, in the capacities of the brain of other primates.

What seems a much more difficult issue is whether such images can be separated from the here and now and be projected onto the past and the future; whether, in other words, primates other than ourselves can use imagination in order to go in for what has been called “time travel.” The person who began the discussion about time travel is the psychologist Endel Tulving (2002), and he coined for it the word “chronostesia.” Tulving is famous for his work on human memory, and so he concentrated on very advanced forms of human imagination about the past. Because of this he may well have exaggerated the limitations of chimpanzee capacities for chronostesia, and he argued therefore that this ability was totally absent in non-human species. This point has been repeated since (Quoidbach, Hansenne, and Mottet 2008). One thing seems clear, however; the symbolic ability of chimpanzees is very limited compared with that of humans (Rakoczy, Warneken, and Tomasello 2008). By “symbolism,” most psychologists mean the ability to see one thing stand for another, in other words, to have a dual type of access to certain concepts. Without this it seems full chronostesia is impossible. In other words, only humans can imagine a separation between a state of affairs and its full existence in the past or future. Furthermore, the brain areas that seem to be involved in time travel in humans are much less developed in chimpanzees (Schacter and Addis 2007; Suddendorf et al. 2007).

My interest in the topic concerns a somewhat different form of time travel than the kind of things Tulving was thinking about. If we have the ability to construct images of the past and the future, this would seem to mean more generally that

we also have the ability to create images that are not inexorably tied to the present. If that is so, I would argue that we must also have the tools for the ability to think of representations that exist independently of the passage of time and that, therefore, have escaped the continual mutability that time involvement in the fluid world out there necessitates. The ability to create time-process-independent types of representations is thus one of the uses of our capacity for imagination. This ability is one that is certainly found in humans.

One of these time-process-independent uses of imagination that is particularly relevant for understanding the social is the human ability to think of conventional roles and groups. This is because what have been called roles and groups—for example, in a tradition such as British social anthropology of the mid-twentieth century—are representations that exist independently of how people are perceived in the day-to-day process of interaction. For example, the role of being a student is independent of the empirical person and what they are up to at any particular instant. Similarly the members of a clan need not be marked by any empirical feature yet are “seen,” in certain contexts, in this way. People remain members of the same clan even if they never interact or meet. They remain members of the clan in the same way as they grow old, become senile, and even die. This capacity of separating the role from the living person enables such extraordinary phenomena as the fact that a person can be made a husband simply because a priest has said, “I hereby declare you man and wife,” and that henceforth the person will remain a “husband” until death or divorce (Searle 1995). It also makes possible the equally extraordinary fact that people can say such things as “this clan came to this area 300 years ago” even though it is obvious that none of the present clan members were living 300 years ago. Such examination of what roles and groups are makes the questions considered by Gettler (2016) and Strassmann and Kurapati (2016) and about fathers and patrilineages to a certain extent secondary to a necessary preliminary questioning of the far from obvious character of the concept that is indicated of things that can be meant by the English word “father.” Such questioning would even benefit an examination of what someone like Barnard (2016) means by “kinship.”

The implications of this capacity for imagining a form of the time-resistant social in this way are enormous. It means that human societies can be infinitely larger in size than would be possible simply if these were based on interactions between individuals. It also means, as the example of the clan mentioned above shows, that social groups and societies can be imagined as having a “life” that extends in time way beyond the lives of human beings. It is clear that the apparent reality through time of such groups in imagination is made possible by ritual, as Coe argues (Palmer, Coe, and Steadman 2016); going more deeply into this question is beyond my scope here, though I have done this elsewhere (Bloch 1992).

Because of these two facts, at least, we can assert that the development of the capacity for the sort of imagination that

makes this transactional-free social possible, and because of its absence in our nearest primates, means that the acquisition of minds that can perform this feat is a dramatic step in human evolution. Furthermore, it probably explains, partly or fully, what has been called “the upper Paleolithic revolution.” One of the reasons for such an adventurous suggestion is that at the time when this took place, a change in our brain must have occurred or been already present that made modern human beings capable of such feats of imagination as are involved in representing roles and groups (Renfrew 2008).

One reason for believing that this use of imagination is fundamental to what it is that makes us the kind of beings we are is that there is evidence from the field of cognitive development that suggests that we have an innate predisposition to make use of this ability. Like Downey (2016) and Moya and Boyd (2016), I believe that by anthropologists focusing on the cognitive development of infants and children, the kind of integration that the meeting was seeking is greatly advanced.

This is because the early understanding of conventional social roles and groups is suggested by recent research on the topic of pretend play. Pretend play is something that normal infants spontaneously go in for. It begins at least as young as 2 years old if not before (Harris 2000; Piaget 1962; Rakoczy et al. 2008). Most significantly, pretend play is absent in other species and in chimpanzees (Wyman and Rakoczy 2011). Pretend play involves understanding that an adult can pretend that one thing is another—for example, that a stone is a delicious apple—and furthermore the child sees this pretense as a form of game. A normal child not only understands pretend play when an adult is playing with her but can herself initiate it and participate in the game and thereby create a shared make-believe scenario. For example, she may herself pick up a banana and use it as if it were a telephone. As she does this, her laughter shows that she knows it is “pretense,” and she will expect those with her to laugh also. Such activity is clearly, in the words of psychologist Paul Harris (2000), a part of the “work of the imagination.” It involves the child giving two separate but linked cognized phenomenological existences to both the signifier and the signified. Furthermore, it is significant that such pretend play already exploits the time-negating potential of basic human cognition because, in order to pretend that a stone is an apple that one can eat, both the concept of stone and of apple need to be separated from the here and now.

However, most important for my argument is the social extension of pretend play. Already, before the child is involved in pretend play, at around the age of 6 months, children seem to have some notion of roles. Renée Baillargeon and her colleagues have shown that a child familiarized with a person who acts in certain typical yet conventional ways becomes bewildered when the same person reappears acting in a different way than in the “role” she had previously assumed. This understanding already relies on the separation in the mind of the child of the representation of the person as an entity to which one relates to from moment to moment and on the idea

of the “kind” of conventional person she is (Baillargeon et al. 2014).

Much clearer for the development for the notion of social role discussed above is full pretend play and its link to imagination. Already in 1990 Walton talked of “prescribed imaginings” (Walton 1990). In 2007 Rakoczy and Tomasello linked pretend play to general issues in social theory, especially those raised by the philosopher Searle concerning the imaginary aspect of the social (Rakoczy and Tomasello 2008; Searle 1995). At around the same time, in the paper mentioned above, I discussed the same link between imagination, pretend play, and the constitution of the social and, furthermore, what all this meant for “religion” as an analytical category (Bloch 2008). For example, social pretend play may involve the child pretending that she is “teacher” to, for example, her teddy bears. Rakoczy and Tomasello called this “a developmental cradle for children’s understanding of social conventions and institutions.” One can go further. In order for the child to pretend she is “teacher,” she must already have bifurcated her experience of the Mrs. Brown who is the teacher into Mrs. Brown, the phenomenon, and her role as “teacher.” This is necessary in order for the child to be able to take onto herself the role “teacher” knowing perfectly well she is not Mrs. Brown in her multitude of manifestations. The child in a game such as playing “teacher” to her “pupil” teddy bears is showing she understands that roles relate to each other in a systemic way. The child therefore knows that she is entering a special world, different from the world of ordinary interaction, an imaginary play world where the rules are different.

This “as if” world is pushed further when children recruit other actual children into their social pretend play. Thus, a child may convince other children to join in a game where she is “teacher” or “doctor” while the others are “pupils” or “nurses” or “patients.” In a way, one can say that what the child is doing is creating a make-believe social world where roles interact and constrain each other. Rakoczy notes just how important rule following in such pretend play becomes and how upset children become when one or another participant breaks the rule.

At this point in the argument, we may well ask whether these facts about human children do not demonstrate that we are hardwired for social roles and conventions, thereby suggesting that every child creates instinctively the social for herself by using the resources her imaginative capacity offers her. To reach such a conclusion makes us run before we can walk, but this is so for two reasons.

First, we need to look more carefully at the word “imagination.” In ordinary usage “imagination” often evokes individual creativity; it evokes ideas such as that of the artist coming up with something new. Not only is this idea of individual creativity dangerously closely linked to recent developments in Western individualist ideology but also much psychological work shows how what might, at first, appear as the product of individual creativity turns out to be much more conventional than we are tempted to imagine (Ward 1995).

The cautionary tale of Ward's experiments is particularly important for the anthropologist, and this brings us to the second qualification to be added to the idea of a predisposition for the imaginary social. What is most important for the anthropologist is shared imaginations, though the fact that they are shared does not in any way diminish the significance of the fact that human children are individually predisposed to certain types of imagination. In terms of the individual child born in a particular place and time, this means that we should understand her as using her predispositions as a tool for taking on already shared imaginations. To return to the topic of pretend play as a "cradle" for the social of roles and groups, we need to understand this as a capacity that enables meshing together innate dispositions manifested in the fact of practicing pretend play and the shared pretend play that is already going long before the child's birth but that her predispositions enable her to learn easily. In the example of the child playing teacher, it is clear that she has predispositions for such pretend play but that this does not imply the ridiculous idea that the concepts of teachers and schools are her individual invention. The child is joining an already constituted system of conventions and institutions.

### Imagination from the Inside

In the previous section I discussed how the human capacity for a special kind of imagination and a predisposition for it enabled human beings to construct in shared representations a type of social system that has the potential to be infinitely larger in actual size and phenomenological duration than would be found among any other primate species. One thus can crudely summarize what I have been saying as that an important form of the human social exists in a special use of imagination. Such a formulation immediately raises a difficulty.

I shall take a simplified example to illustrate this problem. It concerns the relatively isolated Malagasy village that I have been studying on and off for more than 40 years. The framework of social organization of this village would traditionally be described by a competent ethnographer, and indeed by the people who live in the village, as that of a place where kinship can be equated with the social and where everybody characterizes their relation to others in kinship terms. This evoked idea of kinship and relation is, of course, in terms of the specific way this culture understands relations of kinship and affinity, but this corresponds fairly well with general concepts in traditional anthropology about what kinship is. This "kinship" system will be further explained as the system of rules and duties that should govern behavior between people. "We are all one family," the villagers endlessly repeat. Nonetheless, the villagers would have no problem in agreeing that the kinship system is not the whole story to account for what is going on in the village; far from it. They would normally explain the divergence between what rules specify and what actually happens as simply due to the sad fact that people do not always, nor are always able to, obey their moral duties.

This divergence does not mean, however, that villagers would think of the kinship system in ways remotely like those I suggested in the previous section of this paper. If one was to say to them that the kinship system was a matter of imagination, they would react with horror, rather like the religious Internet surfers who hit on the title of the *New Scientist* account of my article. They were horrified at the suggested misrepresentation of what religion meant for them. Similarly, the Malagasy villagers would be horrified by the idea that kinship was somehow not "real." This horror would not be dissimilar to that of conservative folk in Europe on being told (as Searle, Rakoczy, or I would do) that marriage is a "fiction." The externalist anthropologist of the previous section might well say that this lack of recognition does not matter, that the scientist knows best. Matters are not so simple. The villagers consider the kinship system to be an obvious reality, something that follows from the facts of birth, sex, and parenthood. It goes without saying. Everything that is done in the village appears to them to be framed by this fact, and to a certain extent it is. It seems to be in terms of its unchallenged true fact, of the "reality" of the kinship system, that they act. It would be misleading to say that in some sense or other this was not so. This is the point made by those recent anthropologists who, following many unacknowledged predecessors, have called themselves "of the ontological turn." They repeatedly and not unreasonably criticize others who, they say, sneakily introduce the suggestion that people do not really mean the framework that they declare they live by.

A suggestion such as the one made in the section titled "Imagination" that some aspects of the social are a matter of imagination just does not seem to mesh with the villagers' understanding when put in this way, and, because it is the villagers understanding that guides their actions and that explains what they do, we cannot ignore it. It might be all right to say that we can forget about individual representations if we want to understand the form of a shoal of fish. This is not the case for people. That being so, it begins to be highly problematic to see how we can put the "from the inside" and "from the outside" points of view together. They seem incommensurate, and it is even difficult to think of the two at the same time.

### Inside Out

Are we then to despair in any attempt to relate the inside and the outside? Or, putting it another way, is the work of the social/cultural anthropologist irreconcilable/incommensurate with that of the more scientifically orientated subdisciplines of anthropology that informed the earlier section of this paper concerned with the outside perspective? I argue in what follows that we need not be so pessimistic, though we should not underestimate the very real difficulty of the enterprise.

In order to move toward reconciliation, we should first of all reconsider the proposition that people, such as the Malagasy villagers, really live within a hermetically coherent kin-



ship world while the scientists see things in an equally hermetically coherent external way that is independent of the point of view of normal human beings. To put the question another way, we could ask whether the kinds of arguments made in the section titled “Imagination” could not, with a degree of effort and good will on both sides, be made comprehensible and relevant to the Malagasy villagers, and that in spite of their total lack of experience of scientific practices, universities, and anthropology departments.

It is true that the Malagasy villagers cannot envisage the imaginary character of certain aspects of kinship in the way that it was presented in the section titled “Imagination,” but is there not a possibility of some common ground that would begin to make such a leap of communication possible? In order to search for such a possibility, we need to think in quite different terms from those used in academic discourse and to imagine the matter in the context of a quite different way of life. This seems to me to be only possible through the much decried practice of long-term participant observation that has been typical of much traditional social and cultural anthropology.

I stress long-term participant observation because only through the insights it brings can we glimpse the flaw in the “ontological” perspective and the closure to other worlds it implies. A long-term participant observer, such as myself, as she involves herself more deeply with people such as Malagasy villagers, will realize that their understandings are not as simple, as univocal, as they seem from far away or from the oversystematization that comes from remembering distant fieldwork done long before the time of study. Fully documenting this fact would be very important, but it would also need more time than is available here. That being so, I shall limit myself to two aspects of the ethnography that are well known and that furnish a glimpse of an “external” point of view that is not totally absent from what would be considered at first as the totally “from the inside” world of the Malagasy villagers.

One example of this “outside from the inside” point of view available to Malagasy villagers is revealed when we look at what happens in many rituals. I take the example of the elaborate sequence involved in the ritual of circumcision that occurs, in one form or another, throughout Madagascar but that is fundamentally similar to what we know from many other parts of the world (Bloch 1986).

As the drama of the ritual intensifies, two types of world are evoked in succession only for the second to triumph over the first. The first evocation is of a disorganized social world where only links through women and more particularly mothers are recognized. This world is illustrated in a multitude of ways in the symbolism of the ritual but particularly clearly by parthenogenic plants such as bananas and couch grass. The ritual evocation of these plants illustrates a world where neither “fathers” nor alliance has any social role in reproduction.

This evoked world in the first part of the ritual is then violently replaced by a totally different world that seems to

legitimate the connection of the male child to his father and his father’s ancestors more generally. This is what the operation on the child’s penis puts right. This second, ultimately triumphant evocation, is the kinship system as it should be. That this ordered world should be what the ritual seeks to bring about is not surprising. What is more surprising is that it seems necessary to evoke the chaotic world of the first part to give dramatic life to the second. It is as though the second, ordered world could only be in negation of something else, a kind of denial of the obvious facts such as that children come out of women’s bodies. The implication is that the world of the social, of the second act in the drama, is a counterfactual world although a valued one.

Of course this opposition of the world of the first part of the ritual and that of the second uses a totally different language to that I used when I opposed the time-bound world of daily life with the time-defying world that a type of imagination makes possible. Yet it shares much in common with it. Does it not offer a bridge between the outside and the inside point of view?

Another ethnographic observation can be used to make a similar point. It is about the way Malagasy consider incest, especially incest between full siblings. This has elements that we find all over the world. Here I am particularly struck by the apparent contrast between the idea that incest has catastrophic consequences for all aspects of life—agriculture, fertility, morality, health—and the incoherent variety of explanations that are given for this apparently fundamental rule. In a recent paper, Astuti and I (Astuti and Bloch 2015) have interpreted these facts in light of our knowledge of different Malagasy groups in the following way. As we understand the comments that villagers make to us on the subject of incest, we hear behind the explicit the terrifying contemplation of the possibility that there might indeed be a society where incest between siblings is sanctioned. This produces a phantasmagorical image of a world without any rules, roles, and groups. The fact that such an image of such a world can exist, however much it is rejected, suggests the recognition of the ultimate fragility of the imaginary timelessness of the kinship system that in other contexts people seem to assume is completely evident. What if there were no incest rule? Then affinity, and therefore filiation, as understood by the Malagasy would crumble. In many ways the explicit social would be replaced by anarchy. Lurking behind the apparent inevitability of kinship, which is normally treated as self-evident, the horrifying image of a perhaps less arbitrary but totally negative world is cognized. Kinship is thus revealed in Malagasy thought not to be a straightforward self-contained system but one that has to be continually built and evoked in order to overcome a very real terrifying possibility that social life is continually hinting at. In this way, far from being the normal framework of the life of human beings, kinship becomes a creation that requires a continual effort to maintain, something that might so easily disappear. Behind it, in the shadows, so to speak, is a chaotic, desire-driven, and dominantly matrilineal

world that will, at any moment, threaten to engulf. It is what we see evoked in the first part of the circumcision ritual.

Again, we can almost say that for the Malagasy, too, kinship is a form of enforced imagination; a necessary transformation of another image of what society might be like without rules, which inevitably are thereby revealed as arbitrary. The “from the outside” image turns out to be suggested, wedged within the “from the inside” point of view. Of course once again this wedged-in image is not explicit and not identical to that of the “from the outside” point of view that is the subject of explicit or ritual moralizing discourse, but I believe the two can be related.

One can represent the Malagasy system as totally exotic if we see it as a self-contained system of ordered roles and groups, as would many anthropologists, but as soon as we introduce the counterimage of a world where incest is tolerated and where there are no rules regulating sex, this negative image will sound familiar to people almost anywhere even if they are quite unfamiliar with Madagascar. The reason is that the ideas that it is Amazon women who bear children alone and that there could be a totally promiscuous world are not difficult scenarios to envisage anywhere, as much mythology and pseudohistory demonstrates.

This presence of the image of a nontranscendental world in myth and ritual raises an interesting question. It could be argued that this is as much a matter of imagination as that of the ordered transcendental world. After all, myth and ritual are commonly thought of as the locus classicus of fantasy. The easily cross-culturally understood content of this counterimage suggests another possibility: that what is superficially the most fanciful is in fact much closer to reality, that is, a reality imagined without rules, roles, or groups.

## Outside In

But what about the external perspective? A representation of this more “scientific” approach could be that it is a method that is free of the point of view of anybody, in other words, as a truly “objective approach.” The scientific approach would then be one that explains the world independently of any cognized interpretation. This, however, would be to forget that the whole discussion in the section titled “Imagination” was about what it was to be a human being, what it is to live in the imaginary systems that characterize our ways of being social in specific places in specific times. Such characterization can only be done through the assumption, often totally inexplicit, of a certain degree of shared imaginary representation with the people who are being talked about. This is probably necessarily present in all science, but it is obviously central for sciences that deal with the behavior of human beings. Disciplines such as evolutionary biology, linguistics, and archaeology no doubt discover empirical facts that guide them. However, they guide them to weave these facts into narratives that make it seem reasonable that human beings behave, or have behaved, in the ways proposed. These narratives therefore rely on the presumption of

shared motivations and understandings of the world such as we find in those we study and in ourselves. For the matters that have concerned me here, this argument means that the scientific imagination involves imagining the imagination of those we write about. We can only do this by basing ourselves on “what feels right.” Thus, our “from the outside” analysis of their “from the inside” view turns out not to escape totally our own “from the inside.” Again, as in the previous section, where we might have thought that there was absolute incommensurability we find more bridges than we could have suspected.

## Conclusion

In this paper I have started with an approach typical of such subjects as biological anthropology, psychology, and even neurology, and I have discussed certain aspects of human evolution. Then I have gone on to a consideration of what many would consider the epistemologically incompatible approach of interpretation “from the inside” of a particular culture and society. This is the approach typical of ethnography or social and cultural anthropology. But in the last two sections (“Inside Out” and “Outside In”), I have moved to conclusions where the incommensurable chasm has diminished, though not disappeared. If doing this is possible, then there is perhaps some hope of making the different branches of traditional anthropology live more productively together than has been the case in the recent past.

Such a conclusion is also relevant for a more general argument of this paper that I have purposefully kept in the background. The Malagasy, living in small villages deep in the forest, and we share a similar biology and evolutionary history; in spite of differences of environment and history, we nevertheless live in a fundamentally similar world governed by basic causal laws of physics and chemistry. We and they make out of that world all sorts of different systems in part by imagining levels on levels and metaphors on metaphors, but in the end, we cannot escape the parameters of existence. As human beings we are continually faced with the fact that things are not as straightforward as we would wish, but we make continuous attempts to make them straightforward. Our constructions are fragile, dragged down from underneath, never complete, and because of this, the external and internal perspectives, however we might imagine them at first to be, are, in the end, not so foreign to each other.

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# The Evolution of Gods' Minds in the Tyva Republic

by Benjamin Grant Purzycki

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As appeals to what gods know and care about often motivate and rationalize human behavior, understanding shared models of gods' minds is crucial for understanding religion's contributions to human sociality. If religious systems function to minimize the effects of social and ecological problems, then models of gods' concerns should coevolve with these problems. The present work assesses this prediction using data collected in the Tyva Republic. After briefly introducing the social and ecological history of ritual cairn piety in Inner Asia, I examine explicit representational models of morality, virtue, and gods' concerns in Tyva. I show that (a) there is very little conceptual overlap between Tyvans' models of morality and virtue and the things about which spirits care, (b) Tyvan spirit masters are primarily concerned with ritual and breaches of resource maintenance, and (c) among the emerging, salient factors that anger spirit masters are alcohol abuse and littering, very recent social problems in the region. This report provides support for the hypothesis that representational models of gods' minds will evolve in accordance with ever-shifting local problems and offers the first formal treatment of empirically determining what constitutes a "moralistic" deity among living people.

All human communities face problems of cooperation and coordination (Cronk and Leech 2013). With respect to how religion contributes to the resolution or reduction of these threats to sociality, some emphasize the role of supernatural monitors and punishers that curb antisocial behavior and/or boost prosocial behavior toward in-group members (Bering and Johnson 2005; Johnson 2005; Johnson and Bering 2006; Norenzayan 2013; Schloss and Murray 2011). Others find that ritualized costly signals and other behavioral forms of commitment can keep potential defectors out of groups as well as convey trustworthiness and "cooperative intentions" to others (Bulbulia 2004; Irons 2001; Purzycki and Arakchaa 2013; Ruffle and Sosis 2006, 2007; Soler 2012; Sosis, Kress, and Boster 2007; Sosis and Ruffle 2003; Tan and Vogel 2008; Xygalatas et al. 2013).

While religion often appears to address such problems, and there are a few exemplary ethnographic studies of religion's measurable effects on fitness gains (Bliege Bird 2013; Lansing 1987, 1991; Lansing and Kremer 1993; Rappaport 2000; Strassman 1992; Strassman et al. 2012), little is known about how the content and form of religious traditions change through time to meet emerging challenges. Contemporary systems views of religion seek answers to this question by examining (a) the

constituent parts of religion, (b) how these parts link together, (c) how these parts and links function, and (d) how alterations in the constituent parts alter other components (see Alcorta and Sosis 2005; Bulbulia 2008; Johnson et al. 2015; Malley 1995; Purzycki and Sosis 2009; Sørensen 2004; Sosis 2007; Sosis and Kiper 2014). Systems approaches motivated by evolutionary theory attend to the ultimate reasons for these links by testing the hypotheses that religion can minimize the costs incurred by social and ecological problems and that key components of religious traditions will evolve in response to shifting pressures (Purzycki, Haque, and Sosis 2014; Purzycki and Sosis 2010, 2011, 2013; Shariff, Purzycki, and Sosis 2014).<sup>1</sup> In this report I address these concerns by examining one religious system in the Tyva Republic (Tyva) with a particular emphasis on representational models of gods' minds.

1. Though significantly distinct from traditional forms of functionalism (see Shariff, Purzycki, and Sosis 2014; Smith and Winterhalder 1992), this view sympathizes with some of its premises (Durkheim 2001 [1915]; Harris 1979; Malinowski 1939, 1964; Rappaport 1979, 1999; Wilson 2002) insofar as it views components of religion as not only corresponding to but also often minimizing the deleterious effects of the risks inherent in being a member of a social species. This view also predicts, therefore, that if the specific risks shift, features of the religious system will also shift in accordance with different problems. However, contemporary empirical approaches are necessarily piecemeal and attempt to test for the presence of patterns and their effects rather than rely exclusively on intuition and interpretation.

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In the present work, I first discuss the significant relationship between conceptions of gods' minds and human sociality. I then provide a brief portrait of the social and ecological history of the ritual cairn system in Inner Asia and argue that local deities' associations with cairn piety likely emerged as a response to the pressures inherent in the pastoralist economy. Drawing from this association, I then detail Tyvans' explicit models of what gods care about and assess the degree to which these models overlap with local models of morality and virtue. Finally, I calculate the degree to which current social problems contribute to the content of gods' concerns and the source of these changes.

### Gods' Minds and the Religious System

Appeals to and perceptions of gods' minds play a critical role in religious cognition and communication (Purzycki and McNamara 2016; Purzycki and Sosis 2011). Central to religious cognition is our ability to mentally represent and reason about other minds (i.e., our "theory of mind" or "mentalizing" abilities; Baron-Cohen 1995; Premack and Woodruff 1978). As humans promiscuously attribute mental states to objects in our world in order to make sense of them, religion stems from this ancestral trait insofar as we seek to explain the mysterious or potentially dangerous in terms of an agent (or agents) who often possesses powers beyond our own (Barrett 2004; Barrett and Keil 1996; Dennett 1971, 1987; Guthrie 1980, 1995). Indeed, variation in individuals' readiness to attribute agency to other entities (e.g., people, objects, events, etc.) predicts variation in religiosity (Norenzayan, Gervais, and Trzesniewski 2012; cf. Reddish, Tok, and Kundt 2016).

With respect to agency detection's effects on human sociality, experiments show that exposure to "natural" (e.g., a photo of two eyes; Ernest-Jones, Nettle, and Bateson 2011; Haley and Fessler 2005; Nettle et al. 2013; Powell, Roberts, and Nettle 2012) or "supernatural" (Bering, McLeod, and Shackelford 2005; Piazza, Bering, and Ingram 2011; Randolph-Seng and Nielsen 2007; Shariff and Norenzayan 2007) cues can increase prosociality or reduce antisocial behavior. So, while detecting gods' minds might be possible by virtue of the same underlying cognitive faculties used for making sense of humans' minds, there is also evidence that detecting supernatural minds also engages the regulatory systems we use in everyday social interactions (Purzycki 2013a; Purzycki et al. 2012).

While this research may account for the machinery that makes representing gods' minds possible and how detection of these minds affect our sociality, people regularly make explicit appeals to the mental states of the gods through prayer, pleading, claims of their desires and motivations, and rituals devoted to them. Under some conditions, variation in explicit beliefs about gods' desires to punish predicts fair play in experimental economic games (McNamara, Norenzayan, and Henrich 2016; Purzycki et al. 2016; Shariff and Norenzayan 2011). Cross-culturally, people claim that their gods care about fairly discrete sets of things that appear to correspond to specific conditions.

By implication, models of gods' minds may evolve to harness the aforementioned effects of supernatural agency and social cognition under new conditions (Purzycki 2011; Purzycki and McNamara 2016; Purzycki and Sosis 2011). There are a few lines of evidence suggesting that this is the case.

For example, commitment to moralistic, punitive "high gods" curbs temptation to defect in prosocial norms in contexts with heightened anonymity and unaccountability or in cases where valuable resources are scarce (Botero et al. 2014; Johnson 2005; Lahti 2009; Norenzayan 2013; Peoples and Marlowe 2012; Rappaport 1999; Sanderson 2008; Stark 2001; Swanson 1960; Wallace 1966; cf. Watts et al. 2015a). Despite the importance of these works, they suffer from a few limitations. First, they exclusively rely on cross-cultural or cross-national databases that were not explicitly designed to answer such questions. Second, target variables are biased to specifically ask questions about "moralistic" deities (i.e., those that care about "morality") rather than whatever "nonmoralistic" deities might care about (cf. Boehm 2008; Purzycki 2011). Third, what exactly constitutes a "moralistic" deity largely escapes scrutiny.<sup>2</sup>

Other work attempts to identify what makes god concepts particularly salient and memorable, arguing that it is gods' knowledge of "socially strategic information" that makes them especially important factors in cultural transmission (Atran 2002; Barrett 2008b; Boyer 2001, 2002; Purzycki et al. 2012). Socially strategic knowledge is "the subset of all the information . . . that activates the mental systems that regulate social interaction" (Boyer 2001:152). Note, however, that "everything" and "anything" can be construed as socially strategic, "moral," or "virtuous" depending on the context. This suggests that gods' concerns ought to be quite general. Yet we know that what constitutes "moral" domains varies across space and time emically (see Shweder, Mahapatra, and Miller 1987; Shweder et al. 1997) and etically (see Haidt 2008; Rossano 2008; Smetana 2006:121; Turiel 1983:3). While the luxury of post hoc etic views of gods' concerns allows us to characterize anything we want as "socially strategic" or "moral," doing so fails to explain these concerns; it ignores cross-cultural variation as well as the distinction between emic with etic conceptions of

2. For example, studies utilizing the Standard Cross-Cultural Sample (Murdock and White 2006) to examine the evolution of "moralistic High Gods" rely on a single question (no. 238). This question defines a "High God" as "a spiritual being who is believed to have created all reality and/or to be its ultimate governor, even though his/her sole act was to create other spirits who, in turn, created or control the natural world." Of the five options in this question, one characterizes such gods as those who are "present, active, and specifically supportive of human morality." Is "supportive of morality" adequately represented by a dichotomous variable? What do we mean by "morality"? Whose morality? What is the form of "support"? How ethnographers and the coders of their works determined the answers to such questions is unknown (see Boehm 2008; Johnson 2015). In essence, such studies report evidence of the presence or absence of ethnographers' mention of something that approximates to gods being "specifically supportive of human morality."

these domains (see n. 2). Additionally, this maneuver also ignores the fact that gods do not care about all kinds of “socially strategic” information equally (Purzycki 2011; Purzycki and McNamara 2016; Purzycki and Sosis 2011).

Here I seek to overcome these limitations by assessing representational models directly from people by assessing the hypotheses that (1) gods care about “socially strategic information” generally, (2) explicit representational models of gods’ concerns will point to salient, locally specific problems and ways to minimize their effects, and (3) changes in locally specific problems should predict changes in the content of belief sets. Using naturalistically collected freelist data in the Tyva Republic of southern Siberia, I offer the first formal assessment of the degree to which gods care about “morality.” In order to properly contextualize the present case study, I now turn to the major factors that contributed to the evolution of religion in Inner Asia.

### The Social and Ecological History of Ritual Cairns in Inner Asia

Throughout Inner Asia, local deities are linked to ritual practices at designated locations. Some of the locations are marked by cairns made of stones or branches, often found on territorial or political borders (see CA+ online supplement A5 for image; CA+ supplements A1–A5 are available online in a PDF), while some are located at specific resources or features of the natural environment. This ritual system appears to have emerged in response to the hunting and pastoralist economies of the region. Pastoralism in particular requires access to grazing land to sustain and increase the size of herds. Eventually, this requirement introduces the problem of competition over land and livestock with neighbors. One way to address this problem is to territorialize.

Under certain conditions, territorializing is an optimal strategy for resource regulation as it can minimize the costs associated with territorial conflict (Cashdan 1983; Dyson-Hudson and Smith 1978; Johnson and Toft 2014). As Christian (1998) suggests, “the inherent instability of pastoralist lifeways leads to a constant jostling for pasturelands and inhibits the emergence of a strong sense of individual or even collective property in land. Jostling for land, and uncertainty about ownership lead to frequent raiding and sometimes large-scale warfare” (87; see also Irons 1974). This competition over access to land for herds can coevolve with concepts and claims of stewardship or ownership; regions and resources considered to be held by a specific family are only thought of as “owned” in a context where others may exploit these regions and resources. Raiding establishes the need for increased group cohesion and military discipline, particularly among males (see Beckwith 2009). Once specific sections of land become associated with specific people, respecting that association requires monitoring and maintenance, something fairly difficult in contexts where your neighbors are not immediately accessible and external institutions (e.g., a border patrol) are absent.

Indeed, historians and ethnographers of nomadic Inner Asia have long examined the complicated relationship between pastoralism, territoriality, and status (Lattimore 1947:39). In the case of Tyva, Vainshtein (1980) notes that “it was normal for each *aal* [household/campsite; Mongolian *ail*] to have its own more or less traditional migration routes which were followed year after year. Knowing this, Tuvian herdsman . . . avoided grazing their cattle along the routes of other *aals*” (84). The fact that groups develop predictable migration patterns and avoidance strategies suggests conflict can indeed arise if others can threaten access to grazing land and livestock. As mentioned above, one significant ecological problem that pastoral populations face is maintaining territory when populations are diffuse; as *aal* seasonally move on land recognized as “theirs,” there should be some mechanism to ensure relatively stable relations across *aal* in terms of access to pasture and the reduction of livestock theft. Moreover, territoriality presupposes a fairly predictable pattern of resource exploitation (cf. Irons 1974). It is under these conditions that the ritual cairn complex in Inner Asia likely developed.<sup>3</sup>

If features of religious systems do indeed mediate problems of cooperation and coordination, evidence should point to religious beliefs and behaviors corresponding to these issues of territoriality and resource maintenance. Given the aforementioned studies, “strategically” placing supernatural indices and concomitant rituals on territorial borders may minimize breaches of territorial recognition while collective rituals held on such places may reaffirm that territory by ritualistically strengthening bonds (Purzycki 2010, 2012). There are at least three compelling lines of evidence suggesting this might be the case in Inner Asia.

First, there is abundant evidence that ritual cairns (*obo*, *oboo*, *ovoo*, *ovaa* are regional variants of the term; see below) are indeed located on territorial borders throughout Inner Asia and beyond, among other pastoralist traditions (see Purzycki 2012:341–360; Sierksma 1963). Humphrey and Onon (1996) note that each Daur village in Mongolia “had its own oboo cairn for worship, and they were also separated from the next by another kind of smaller oboo which marked the boundary” (22). Vreeland (1953:11) observed that after a boundary dispute

3. While the archaeology of ritual cairns in Inner Asia is fairly scant, some of the earliest dated cairns are from the “deer stone-*khirigsuur* complex” in Mongolia (Fitzhugh 2009a, 2009b), “which generally consist of a central stone mound, a square or circular ‘fence’ of surface stones, as well as small stone mounds and circles” (Allard and Erdenebaatar 2005:548). Researchers regularly attribute these monuments to the third through the first millennia BCE nomads of the Early Iron Age. The oldest *khirigsuur* contained antler fragments that were carbon dated to 2350 ± 40 (2470–2330 cal BCE; Wright 2006:207–210), and in the bulk of excavations, the central cists showed no human remains and no evidence of looting. This suggests that the primary function of these monuments was indeed devotional rather than funerary (Wright 2006, 2007). Note that such archaeological evidence suggests that these cairns followed the advent and stabilization of pastoralism in the region (ca. 6000–4000 BCE; Anthony 2007; Christian 1998; Khazanov 1994; Kuz'mina 2008; Outram et al. 2009).

in Mongolia, the “official boundary lines” of some small communities were then marked with stone cairns. Clearly, then, there is a close relationship between land, family, community, and ritual cairns in such cases.

Second, the etymology of the local term for sacred cairns appears to be linked to terms for pastoral social units throughout the Turkic-speaking world. Sneath (2007:146) documents how in Mongolia the Qing imposed on its subjects “administrative and tax units used by both Russian and Iranian states” as well as the Turkmen. These units were called *oba* (*ova*, *obog*, *obiúg*, *ovog*). Among the Iranian Yomut,

The smallest residence group was a group known in Turkmen as an *oba*. This consisted of a group of households which together shared a joint estate with reference to a defined stretch of territory known as the territory of the *oba*. All members of the *oba* had a right to camp and pasture their livestock anywhere on the *oba*'s territory. Outsiders could do these things only after obtaining permission from the residents. Any joint action by the group had to be based on a consensus reached through discussion among the men of the community. Each *oba* had a headman selected by the group, but his role was merely that of spokesman for the group to outsiders. He had no authority to act other than on the basis of the consensus of the group. (Irons 1974:640)

Third, ritual participation has a significant effect on interpersonal relationships. Researchers have observed that participation in collective cairn rituals builds and conveys solidarity (Humphrey 1995; Sneath 1992). Indeed, Tyvans are also more likely to trust people who regularly make offerings at ritual cairns (Purzycki and Arakchaa 2013). Moreover, many neighboring hunting and fishing groups mark territory using supernatural indicators. The Khanty, for instance, mark hunting territories and settlements with crafted spirits' houses embedded in trees. Outsiders are supposed to give the spirits proper respect upon entering others' territory (Jordan 2001, 2003). In this sense, then, ritual cairns and other forms of border sacralization may function as psycho-behavioral primes that trigger the social responses found in the aforementioned experimental literature.

In summary, if territorializing evolved as a response to ensure access to certain areas and to minimize the costs of conflict, territorialization suffers from the problem of maintenance, and if the coupling of gods and rituals can function to curb antisocial behavior, then one solution might be to spatially distribute cairns devoted to local gods along borders to maintain respect for territory (Purzycki 2010, 2012). As discussed below, spirits associated with exploitable natural resources may also function to curb problems of overexploitation or sully those resources. Shared models of gods' concerns ought to point to rituals at these places. Additionally, indices of newer problems that stem from contemporary conditions should be evident in these models. As I examine these hypotheses in the Tyva Republic, I now turn to a brief characterization of the religious landscape there.

## Religion in the Tyva Republic

The Tyva Republic (Tyva, or popularly known as “Tuva”) lies just north of western Mongolia, surrounded by the republics of Altai, Khakassia, and Buryatia. The landscapes and economies of Tyva are notably diverse. The northeastern region (Tozhu) is host to small villages and reindeer herders. The central steppe and western taiga regions host herders of sheep, goats, and cattle. Tyvans represent an ethnic majority in the republic (~80%, with the remainder predominantly ethnic Russians), and an overwhelming majority (99.6%) of Tyvans claim Tyvan as their native language (Chevalier 2010). Roughly half of the republic's total population (~310,000) lives in rural villages and/or yurt and lodge encampments, while the other half live in the capital city of Kyzyl and the asbestos-mining town of Ak Dovurak.

Despite Soviet repression and influence and the subsequent cultural and economic reconfigurations brought about by market integration (see Donahoe 2002, 2003), Tyvans have successfully maintained and reinvigorated their cultural heritage, with strong ties to what some might consider the “traditional” religion, economies of nomadic pastoralism, hunting, and fishing and resurgence in forms of the visual, musical, and literary arts. Notably, however, inexpensive and readily accessible alcohol has taken its toll. In 2009, Tyvan females ranked among the 10 highest among Russian populations for alcohol-related mortality (82.5 per 100,000), and males ranked the highest for fatal accidental alcohol poisoning (74.6 per 100,000; Semyonova et al. 2014). Moreover, between 1991 and 2005, Tyva had the highest regional homicide rate per capita in Russia (118.25 per 100,000, while the second highest, Irkutsk, was 66.14; Treyger 2011:18).

The two officially recognized religions in the Tyva Republic are shamanism and Buddhism, and the two are often syncretically intertwined throughout Buddhist Inner Asia (Evans and Humphrey 2003; Heissig 1980:103–110). Of central importance to religion in rural Tyva are local spirit masters (pl. *cher eeleri*, literally “master” or “owner” of the place) of specific regions and resources. As is the case in much of Inner Asia, various types of sacred sites and places pepper the landscape of Tyva. Mineral springs (*arzhaan*), lakes (*khöl*), and other natural areas are often marked by places to leave a ritualized offering to spring and lake spirit masters as well. Spirits associated with natural resources are more likely to be zoomorphic, whereas anthropomorphic spirits typically govern territories and vaguely defined areas such as mountain ranges and forests (Purzycki 2013b). As in the case of other regions in Siberia (Halemba 2006:78–82), collective cairn rituals typically occur seasonally, while many stop at *ovaa* in transit. The former are region-wide, typically male-only affairs that entail considerable costs (e.g., hiring a shaman or lama, killing livestock for food, travel, ritual accoutrements, etc.), whereas the latter are relatively low in cost (see below).

In qualitative interviews (Purzycki 2010), Tyvans explain *ovaa* piety as honoring local spirits and being thankful or

hopeful for a safe journey. Most of the explanations are bound in notions of territoriality, and as already discussed, families controlled traditional migration routes and regions. For instance, one man noted that “each *aimak* [tribe or extended family] has its place: the Mongushes, Kuulars, Khomushkus, Oorzhaks . . . have different places, trees to pray to [for example]. Torgalyg’s people have a pine-tree. [Some have] even three or four places. And the Kuulars have their place too” (27).<sup>4</sup> Kristensen (2004) claims that the “Duha Tuvianians [*sic*; of Mongolia] perceive human fate . . . as intimately connected with the deeds of their ancestors, who influence them through specific natural entities located in the local landscape. Each patrilineal clan has its own sacrificial mountain oboos . . . which they describe as ‘my mountain.’” Moreover, “commonly known oboos and sacrificial trees are distributed along the migration routes of past generations.”

At the base of many *ovaa* there are collection bowls for the spirit masters (*cher eezi*) of the place; in the case of remote *ovaa*, people place offerings on or in the *ovaa* itself and/or add a stone or branch. In many cases, springs and lakes will not have cairns but will have nearby trees or bushes by which to make offerings in the form of prayer ties (*chalama* or *kadak*). When one approaches a sacred place, one makes a prayer to the *cher eezi* by offering food, tobacco, and/or various amounts of money. At cairns, one quietly walks around the perimeter of the *ovaa* three times in prayer, thinking only good thoughts so as not to excite the spirits. In one episode from my experience, my hosts’ river water was sullied by a recent rain. We drove to our neighbors’ *aal* to fill up large milk jugs with the water from a spring near the neighbors’ yurts. Before extracting water, we tied prayer ties around the tree and threw coins near the spring’s source to honor its spirit master. As we performed this ritual, the neighbors watched us from their yurts and waited until we were filling the jugs to come down to the spring to socialize.

As spirit masters are associated with rituals at territorial borders and various resources, Tyvan beliefs about their concerns should reflect this. If ritual behavior is thought of as a salient feature of what it means to be moral—good or bad—then Tyvans should readily report this. If spirits are thought of as concerned with general “morality,” then the targets of spirits’ concerns should consist of moral behavior. To determine this requires examining Tyvan models of morality and spirits’ concerns and measuring the degree to which the content

of these domains overlap. Moreover, if cultural models of gods’ concerns point to social and ecological problems, newly emerging problems should also be salient features of those models. If so, then Tyvan spirit masters’ concerns should indicate a shift toward the problems that affect contemporary Tyvan social life.

## Study

### Methods

Interviews consisted of a battery of instruments including (1) standard demographic and religiosity questions, (2) freelist tasks, and (3) a survey about spirit masters’ concerns and knowledge (Purzycki 2011, 2013; see Purzycki 2012:406–414 and CA+ supplement A4 for interview materials). An assistant translated the interview protocol into Tyvan, then another back-translated it into English, and we subsequently edited it for consistency and clarity.

Demographic variables included age, number of children, years of formal education, years of living in a city, whether people were born in a rural or urban environment, and self-assessments of fluency in the Tyvan language on a five-point scale (knowledge of Tyvan was rated as 0 = none; 1 = not good; 2 = good; 3 = very good; 4 = fluent).

I used freelist tasks to elicit data about Tyvans’ belief sets. Freelists (see Borgatti 1998; Quinlan 2005; Smith 1993; Smith et al. 1995) provide a naturalistic way of examining representational content domains and are far more informative than surveys regarding emic models of gods’ concerns. Elsewhere, I (Purzycki 2011, 2013a) found that while cultural consensus models resoundingly demonstrated that there was no such consensus, Tyvans will nevertheless claim spirit masters know and care about moral behavior in a post hoc fashion when answering survey questions. Perhaps due to a latent moralization bias of supernatural agents (see above), participants are more inclined to respond affirmatively to direct questions about whether or not the gods care about moral behaviors even though these are not necessarily salient associations for people. As this study seeks a better grasp on the degree to which explicit models of morality/virtue overlap with models of gods’ concerns, a naturalistic method such as a freelist task is more appropriate.

Participants completed four freelist tasks (of 10–15 items each), classed into two domains that included two subdomains each. One domain—morality/virtue—required that participants list the things that constitute (1) a good Tyvan person and (2) a bad Tyvan person. In the spirit masters’ concerns domain, we asked for (3) things that please or make *cher eezi* happy and (4) the things that anger or displease them. Assistants and I recorded all freelist data in the order in which they were listed in order to calculate cognitive salience (see CA+ supplement A1 for calculations). After translating all data into English, we then cleaned it, coded it, checked it for errors,

4. Organizational units in Inner Asia have been subject to misrepresentation and distortion over the years on the part of anthropologists and imperialists alike (Sneath 2007). To take one example, Sneath notes that “The Mongol term *aimag* [similar to Tyvan *aimak*] was conventionally translated into Chinese as *buluo*. In the Qing period, the *aimag* was the large administrative division into which the local principalities called *khoshuu* [kozhuun in Tyvan] . . . were grouped. . . . But in historical documents, the word is commonly translated as *tribe* . . . and in official Mongolian histories the term *aimag* became the standard term to describe ‘tribal’ pre-Chinggisid political formation” (66–71).



and subsequently made minor corrections. No individuals repeated items within lists; thus, there were no concerns of salience inflation.

To measure religiosity, I adapted an eight-item religiosity scale (Nicholas 2004; Nicholas and Durrheim 1995; Rohrbaugh and Jessor 1975; see CA+ supplement A4) anchored at zero. Three individuals answered with more than one answer on the prayer frequency question, and these values were converted to means. This religiosity index had good reliability ( $\alpha = .76$ ) and was converted to sums for each individual. Additionally, we asked for self-reports of the frequency of *ovaa* piety and shaman visitation frequency using five-point Likert scales anchored at zero. As including both of these questions in the religiosity scale slightly lowered the alpha, and as these are culturally specific questions, they were treated as separate items from the religiosity index.

In order to assess whether or not models of spirit masters' minds were influenced by external sources, two questions had to do with the degree to which participants interacted with people from other religious traditions. One question (five-point scale anchored at zero) asked, "How much do you participate in religious activities with people who have a different religion from yours?" The other (six-point scale) asked, "How often do you discuss religion with people who have a different religion from you?"

Drawn from previous interviews (Purzycki 2010), one question sought to capture the variation in Tyvans' sense of what *cher eezi* are. The options were (a) creations of nature, (b) ancestors, (c) creators of nature, and (d) "other," with space to provide a response. We also asked participants about the breadth of knowledge they attribute to spirit masters (a four-point "omniscience scale") with the following options: (1) He/She/It only knows what happens to her; (2) He/She/It only knows everything that happens in her area; (3) He/She/It only knows everything that happens in Tyva; and (4) He/She/It knows everything that happens in the world.

### Participants

Local assistants and I conducted interviews in the capital city of Kyzyl between the months of March and August of 2010. We approached ethnic Tyvans in various places around the city (schools, clinics, shops, etc.), asked them whether they could speak Tyvan well and whether they were interested in participating in an interview that would take about 30 minutes. This sample ( $N = 87$ ; 49 women; 9 did not report sex) consisted of adults from various regions throughout Tyva who were of various religious self-identifications (52 Buddhist, 2 shamanist, 21 Buddhist-shamanist, 1 Buddhist-Christian, 1 answered "other" with no additional information listed, and 10 did not answer). The "other" was treated as a missing value (NA). These responses were subsequently condensed to a dichotomous variable to denote explicit self-identification with shamanism; those who self-identified as any form of

shamanist were given a score of 1, and all others were given a score of 0.

The urban index is the proportion of years spent living in cities to participants' ages (two did not know). On average, participants lived in urban environments for about half of their lives ( $M = 0.54$ ,  $SD = .31$ ). Regarding participants' birthplace, while 11 individuals did not provide an answer, out of those who did, 57 (75%) were born in rural areas, and 22 were born in a city or larger town. Overall, Tyvans reported their competence in the Tyvan language as "very good" ( $M = 3.32$ ,  $SD = 1.01$ ) and had an average of 14.16 years of formal education ( $SD = 4.56$ ). One individual reported "three to eight" years, which was converted to the mean of 5.5. One individual did not know, and this response was treated as a missing value.

Table 1 details the sample's basic demographic and religiosity statistics, and table 2 is a correlation matrix of these variables. Note that religious participation and religious discussion with religious out-group members had a strong correlation (Pearson's  $r = 0.62$ ,  $P \leq .001$ ). To avoid issues of multicollinearity, I focus here on discussion of religion with religious out-group members.

## Results

### *Spirit Masters*

Tyvans conceive of spirit masters primarily as creations of nature ( $N = 32$ ; 43.24%). Twenty-one (28.38%) responded that spirit masters are ancestors, whereas fourteen (18.92%) suggested that they are creators of nature. Among those who answered "other" ( $N = 7$ ; 8.05%), one answered "both ancestors and creations of nature," whereas the rest provided no response ( $N = 13$ ; 14.94%).

### *Accounting for Cairn Piety*

Though there was notable variation in previous qualitative interviews (Purzycki 2010), some casual accounts suggest that stopping at every *ovaa* one passes is obligatory (Carruthers 1994 [1913]:245; Harrison 2007:123). Table 3 details the self-reported proportion of *ovaa* at which Tyvans stop. While 65.52% of the participants claim they stop at half or more of the *ovaa* they pass, 48.28% of the participants claim they stop at most or all of the *ovaa* they pass. Even though 22.99% seldom or never stop, there is a clear overall emphasis on stopping (or at least claiming to) at the majority of *ovaa*.

In order to account for *ovaa* piety, I regressed *ovaa* visitation frequency with the other target variables (table 4). Age, years of formal education, and fluency in Tyvan were centered at these respective variables' means. Models were backward-selected from the full model (model 1), which includes all focal variables and an interaction term of reporting being a shamanist and the shaman visitation frequency (see CA+ supplement A3 for analytical notes). Model 2 removes this

Table 1. Basic demographics and religiosity variables

Demographic	N	Scale	M	SD	SE	NA
Age	76	...	38.95	13.56	1.56	11
Children	73	...	1.93	1.37	.16	14
Years of formal education	74	...	14.16	4.56	.53	13
Urban index	70	0–1	.54	.31	.04	17
Tyvan language fluency	78	1–4	3.32	1.01	.11	9
Religiosity index <sup>a</sup>	78	0–33	20.33	5.06	.57	9
Shaman visitation frequency <sup>a</sup>	75	0–4	.69	.70	.08	12
<i>Ovaa</i> visitation frequency <sup>a</sup>	77	0–4	2.39	1.07	.12	10
Religious participation with out-group <sup>a</sup>	77	0–4	.68	1.19	.14	10
Religious discussion with out-group <sup>a</sup>	78	0–5	1.76	1.36	.15	9
Omniscience scale	70	1–4	2.36	.97	.11	14

Note. *N* = number of participants who answered each question; *M* = mean; *SD* = standard deviation; *SE* = standard error; *NA* = number without response.

<sup>a</sup> See CA+ supplement A4 for questions.

interaction term. Model 3 retains the variables of theoretical and statistical significance from model 1, including the interaction term, while model 4 is the same but removes the interaction.

Using corrected Akaike Information Criterion (AICc; Burnham, Anderson, and Huyvaert 2011) statistics,  $\Delta\text{AICc}$  is the difference between the target model's AICc score and the smallest AICc score. The evidence ratio  $\exp([\text{AICc}_x - \text{AICc}_{\min}]/2)$  for the  $\Delta\text{AICc}$  between model 1 and 2 is 7.61; model 1 is 7.61 times stronger at minimizing information loss than model 2. The evidence ratio between model 1 and 3 is 112.17, and models 1 and 4 have an evidence ratio of 4359.01. Given this extremely high ratio, the first two models better account for *ovaa* piety, though model 3 accounted for the greatest amount of variance (adjusted  $R^2 = 0.35$ ).

Participant age and sex were consistently associated with self-reported frequency of cairn piety (with no crossed effects); the older participants are from the mean age, the more they report stopping at *ovaa*, and males claim to stop more often than females. The effect of age could be due to at least two possibly related factors. First, it may be indicative of a generational shift in traditional religious commitments. Second, this effect is consistent with other findings that religious commitments can vary with age by virtue of life-history factors; older people differentially allocate resources for religious purposes because of varying returns (Argue, Johnson, and White 1999; Shaver and Sosis 2014). Greater male frequency in cairn rituals is consistent with the aforementioned fact that collective rites are often male-only affairs. Note, too, that affiliation with shamanism predicts cairn piety frequency in models 1 and 3 while holding the interaction of shamanist affiliation and frequency of visits to shamans constant. Also, the more participants claimed that these spirits knew, the less they claimed to stop at *ovaa*. I return to this point below. In summary, what best predicts greater self-reported *ovaa* piety are commitment to shamanism, age, and being male, while increased attributed breadth of knowledge corresponds to a decreased self-reported frequency of stopping at cairns.

### Representational Models of Gods' Minds

Turning now to Tyvans' models of morality and gods' concerns, figure 1 and table 5 detail the eight most salient items in the freelists for all four subdomains (see also CA+ supplements A1, A2). In figure 1, the magnitude of conceptual salience is indicated by the connection thickness between the domain (the center circle) and each listed item (the peripheral circles). The numerical values are Smith's *S* (salience) scores for each item, with dotted connections indicating  $S < 0.10$ . Values by the dotted brackets indicate the proportion of listed items that co-occur in the other domain, with values in parentheses indicating the mean salience of those items.

In order of descending salience, the eight most salient items in Tyvans' models of what it means to be a good person consisted of being (1) hardworking, (2) helpful, (3) kind, (4) modest, (5) respectful, (6) honest, (7) intelligent, and (8) having love for or strong ties to family members (84 respondents;  $N_{\text{listed}} = 499$ ;  $M_{\text{listed}} = 5.94$ ;  $SD_{\text{listed}} = 2.43$ ). In terms of what constitutes a "bad Tyvan person," the most salient items listed were being (1) untrustworthy, (2) drunks or those who drink alcohol, (3) lazy, (4) envious, (5) greedy, (6) disrespectful, (7) cruel, and (8) ignorant (83 respondents;  $N_{\text{listed}} = 483$ ;  $M_{\text{listed}} = 5.82$ ;  $SD_{\text{listed}} = 2.76$ ). In light of the relatively high homicide rate in Tyva, it is noteworthy that "murder" only occurred three times.

The most salient items listed for things that please spirit masters were (1) sanctification rituals, (2) offerings, (3) prayer, (4) not littering or polluting their areas, (5) believing in them, (6) sprinkling food, milk, or tea, (7) cleaning up their areas, and (8) reading invocations of various sorts (77 respondents;  $N_{\text{listed}} = 259$ ;  $M_{\text{listed}} = 3.36$ ;  $SD_{\text{listed}} = 1.60$ ).<sup>5</sup> What angers the spirits are (1) littering/polluting/sullyng the place, (2) not performing rituals, (3) drinking alcohol, (4) being greedy with resources, (5) not putting out fires, (6) defacing nature, (7) having bad thoughts or engaging in bad behavior, and (8) having no respect for family, the spirits, or ancestors (73 respondents;

5. These data include those reported in Purzycki (2011b).

Table 2. Pearson's correlation matrix of variables

	Urban index	Age	Number of children	Years formal education	Tyvan language fluency	Shaman visit frequency	Religiosity index	Ovaa visit frequency	Participation in others' religion	Discussion with others about religion	Omniscience scale	Moral items listed (angry)
Age	-.13*											
Number of children	-.05‡	.41*										
Years of formal education	.23†	-.03	-.14‡									
Tyvan language fluency	-.36**	.23†	.20‡	-.09								
Shaman visitation frequency	-.16‡	-.05	.30‡	-.27*	.17							
Religiosity index	.05	.15	.03	.03	.14	.11						
Ovaa visitation frequency	.08	.37‡	.13	.02	.26	-.00	.20					
Religious participation with out-group	-.02	.29‡	.26‡	.11	.03	.07	.34†	.19				
Religious discussion with out-group	.01	.17	.15	.12	.00	.11	.28	.18	.62***			
Omniscience scale	-.07	-.13‡	-.32*	.00	-.18‡	-.03	-.16‡	-.37*	-.18‡	-.18		
Frequency of moral items in the "anger" freelist	.26†	-.17†	-.23*	.27‡	-.45**	-.15‡	-.13	.27	-.07	.23	.30	
Frequency of moral items in the "please" freelist	.71***	-.47**	-.18†	.33†	-.42**	.00	-.14	.08	-.29†	-.09	-.03	.33*

‡  $P \leq .15$ .

†  $P \leq .10$ .

\*  $P \leq .05$ .

\*\*\*  $P \leq .001$ .

Table 3. How often do you stop at *ovaa*?

Response	N	Total (%)
I stop at every one	10	11.49
I stop at most of them, but not every one I pass	32	36.78
I stop half the time	15	17.24
I seldom stop at them	18	20.69
I don't stop at <i>ovaa</i>	2	2.30
No response	10	11.49
Total	87	100.00

Note. N = number who responded.

$N_{\text{listed}} = 257$ ;  $M_{\text{listed}} = 3.52$ ;  $SD_{\text{listed}} = 2.16$ ). As predicted, what pleases spirit masters largely consists of ritual behaviors, while what angers them is overexploitation and destruction of the natural resources in their domain. To what degree do these domains overlap?

As it turns out, there is notably little “religious” content in Tyvans’ models of morality and virtue. In terms of what constitutes a “good person,” only seven participants listed explicitly religious items in the “good Tyvan” domain: two listed “protective of nature,” and five listed things like “Buddhist,” “faithful in the threefold path of the Buddha, Dharma, and Sangha,” and “religious” as good. Additionally, three listed “protective of nature” as good qualities as well. In terms of what constitutes a “bad person,” two listed “not religious” as indicators of “bad Tyvans.” One said “not teaching Tyvan ways,” which might be construed as including religious traditions. Two indicated that a lack of a connection to nature is indicative of bad people. Only

one individual listed a religious item in both the good and bad lists (and this individual did *not* list moral items among the spirit masters’ concerns).

Overall, Tyvans listed 15 items (5.84%) among the things that please spirit masters that also co-occurred in the moral/virtue domain. These included bravery ( $N = 2$ ), not using soap to clean yourself ( $N = 1$ ), various qualities of “being good” or “not being bad” to others ( $N = 3$ ), honesty ( $N = 3$ ), honoring one’s homeland ( $N = 1$ ), not fighting ( $N = 1$ ), and passing down traditions ( $N = 2$ ); and two mentioned not drinking alcohol. Among the things that anger or displease *cher eezi*, there were a total of 58 immoral items listed (22.47%). Twenty of these items (34%) consisted of alcohol use or abuse.

Figure 1 illustrates the contribution of overlap from each subdomain (see CA+ supplements A1, A2 for calculations). Recall that in table 2, the Pearson’s correlation of frequency

Table 4. Linear regression models accounting for reported frequency of *ovaa* piety

Predictor	Model 1	Model 2	Model 3	Model 4
Shamanist (1 = Shamanist)	.44 [.13, 1.75]*	.12 [−.37, .88]	.47 [.29, 1.71]**	.10 [−.32, .77]
Shaman visitation frequency	.28 [−.15, .93]	−.04 [−.48, .38]	.24 [−.04, .76]†	−.03 [−.37, .29]
Religiosity index	.02 [−.06, .06]	.02 [−.06, .07]	...	...
Religious discussion with out-group	.12 [−.10, .28]	.10 [−.13, .28]	...	...
Omniscience scale	−.26 [−.58, .01]†	−.16 [−.47, .13]	−.37 [−.67, −.17]**	−.26 [−.55, −.05]*
Age <sup>a</sup>	.44 [.01, .06]**	.42 [.01, .06]*	.40 [.01, .05]***	.36 [.01, .04]**
Sex (0 = female)	.37 [.17, 1.38]*	.31 [.01, 1.28]*	.28 [.12, 1.06]*	.21 [−.04, .94]†
Children	.04 [−.24, .30]	−.06 [−.33, .23]	...	...
Years of formal education <sup>a</sup>	.01 [−.06, .06]	−.09 [−.09, .04]	...	...
Birthplace (0 = rural; 1 = urban)	.01 [−.66, .72]	.13 [−.41, .99]	...	...
Urban index	.09 [−.70, 1.34]	.12 [−.68, 1.48]	...	...
Tyvan language fluency <sup>a</sup>	−.01 [−.32, .31]	.07 [−.25, .40]	...	...
Shamanist × shaman visit	−.66 [−1.92, −.21]*	...	−.61 [−1.75, −.38]**	...
Constant	−[.19, 3.73]*	−[.13, 3.89]*	−[2.15, 3.60]***	−[2.10, 3.64]***
Adjusted R <sup>2</sup>	.27	.18	.35	.26
AICc	166.44	170.50	175.88	183.20
ΔAICc	...	4.06	9.44	16.76
N	54	54	65	65

Note. All models in the form  $\beta$  [lower, upper]; 95% confidence intervals in brackets. All models’ mean variance inflation factors were  $\leq 2.01$ .

<sup>a</sup> Variables centered at mean.

‡  $P \leq .15$ .

†  $P \leq .10$ .

\*  $P \leq .05$ .

\*\*\*  $P \leq .001$ .

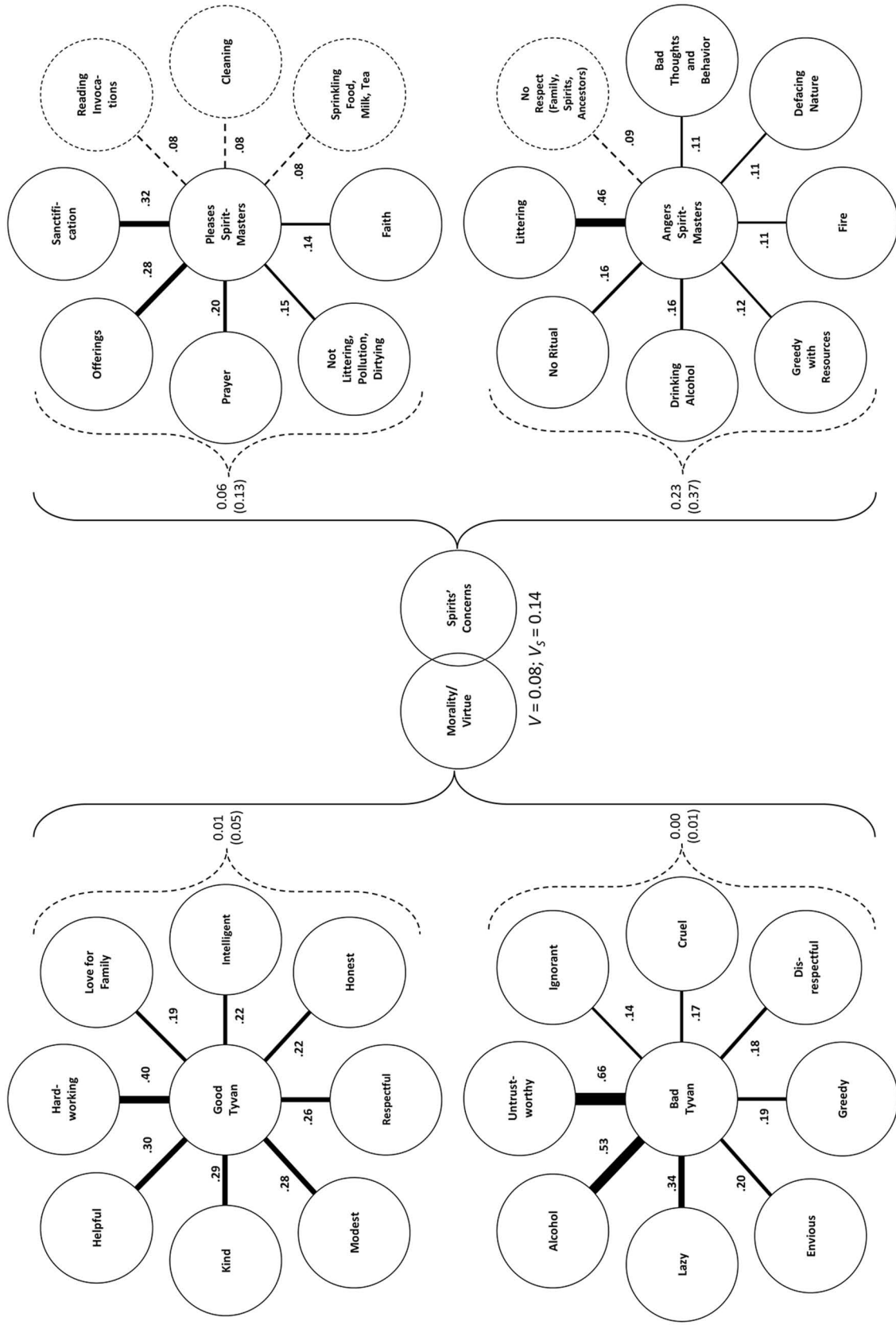


Figure 1. Eight most salient items in representational models of (counterclockwise from top left): (a) good Tyvans, (b) bad Tyvans, (c) what pleases spirit masters, and (d) what angers spirit masters. Connection weights are Smith's S scores for items, and dotted lines represent those with salience scores of  $\leq 0.10$ ; bracket values indicate proportion of cross-domain items listed in each subdomain with standard deviation in parentheses;  $V$  = overlap;  $V_S$  = salience of overlap.

Table 5. Descriptive statistics of eight most salient items per domain

Model and domain	Code	MS	SS	S	N	Frequency (%)	Total (%)
Models of morality/virtue:							
Good Tyvans	Hardworking	.60	33.75	.40	56	.19	.11
	Helpful	.64	25.12	.30	39	.13	.08
	Kind	.75	24.73	.29	33	.11	.07
	Modest	.66	23.59	.28	36	.12	.07
	Respectful	.57	22.08	.26	39	.13	.08
	Intelligent	.58	18.65	.22	32	.11	.06
	Honest	.67	18.16	.22	27	.09	.05
	Family	.49	16.18	.19	33	.11	.07
Bad Tyvans	Untrustworthy	.65	54.85	.66	84	.27	.17
	Drinking—alcohol	.83	43.80	.53	53	.17	.11
	Lazy	.59	27.85	.34	47	.15	.10
	Envious	.59	16.97	.20	29	.09	.06
	Greedy	.60	15.73	.19	26	.08	.05
	Disrespectful	.50	15.00	.18	30	.10	.06
	Cruel	.62	14.27	.17	23	.07	.05
	Ignorant	.58	11.56	.14	20	.06	.04
Models of spirits' concerns:							
Please spirit masters	Sanctification of place	.63	23.78	.32	38	.24	.15
	Offerings	.52	21.28	.28	41	.25	.16
	Prayer	.67	14.81	.20	22	.14	.09
	No littering, polluting, dirtying	.72	11.46	.15	16	.10	.06
	Faith	.75	10.55	.14	14	.09	.05
	Sprinkle—food, milk, tea	.45	6.30	.08	14	.09	.05
	Cleaning	.77	6.18	.08	8	.05	.03
Anger spirit masters	Reading—invocations ( <i>Iöreeel</i> ), mantras	.73	5.80	.08	8	.05	.03
	Littering/polluting (water, <i>ovaa</i> , area)	.53	33.69	.46	64	.42	.25
	No ritual	.78	11.63	.16	15	.10	.06
	Drinking—alcohol	.58	11.58	.16	20	.13	.08
	Greedy with resources (berries, hunting)	.69	8.98	.12	13	.08	.05
	Fire	.72	7.94	.11	11	.07	.04
	Breaking/carving/cutting (branches/stones)	.71	7.79	.11	11	.07	.04
Bad (thoughts, behavior)	Bad (thoughts, behavior)	.77	7.71	.11	10	.06	.04
	No respect (family, spirits, ancestors)	.65	6.52	.09	10	.06	.04

Note. MS = mean individual salience; SS = sum of salience; S = Smith's S; N = frequency; Frequency (%) = proportion of items listed by subdomain sample size; Total (%) = proportion of items listed by total items listed in subdomain.

moral/virtue items listed in the “pleases spirit masters” and “angers spirit masters” domains is 0.33 ( $P \leq .05$ ). In other words, individual Tyvans are moderately consistent across subdomains in attributing moral concerns to these spirits.

Participants were more likely to list moral items ( $M = 0.95$ ,  $SD = 1.12$ ) among the things that spirit masters care about than list religious things ( $M = 0.11$ ,  $SD = 0.35$ ) among the things that constitute good and bad Tyvans (mean difference =  $-0.84$ , 95% CI =  $[-1.11, -0.57]$ ). Out of the 15 total moral items listed among the things that please spirit masters, the earliest listed items ( $N = 12$ ) had a mean salience of 0.83 and a Smith's  $S$  of 0.13. Out of the 58 total moral items listed in the anger subdomain ( $M_{\text{listed}} = 0.79$ ,  $SD_{\text{listed}} = 0.94$ ), the earliest listed items ( $N = 39$ ) had a mean salience of 0.69 ( $SD = 0.24$ ). Smith's  $S$  for these items is 0.37. According to the more inclusive calculation (CA+ supplement A2), overlap ( $V$ ) between these two domains is 0.08, and the  $S$  of these items ( $V_s$ ) is 0.14. In summary, there is very little conceptual overlap be-

tween Tyvan models of morality and spirits' concerns; their attributed moral concern is negligible.

#### Explaining Spirit Masters' Moral Concerns

To account for the frequency of moral items listed in the spirits' concerns domain, I regressed the total moral items listed across both subdomains for each participant with the target variables. Table 6 reports models that account for variance in how many moral items Tyvans listed in the spirits' concerns freelist task (see CA+ supplement A3 for further analyses).

Model 2 (model 1 with the removed interaction term) has the lowest AICc score. According to the evidence ratio, it is 7.21 times stronger than model 1. Models 2–4 were backward-selected to retain those variables with the greatest effect. Model 2 is 2.11 times stronger than model 3 and 8.58 times stronger than model 4. Model 4 explains the greatest amount of variance (adjusted  $R^2 = 0.19$ ).

Table 6. Linear regression models accounting for frequency of moral items attributed to spirit masters' concerns

Predictor	Model 1	Model 2	Model 3	Model 4
Shamanist (1 = shamanist)	.08 [-.80, 1.13]	-.01[-.66, .60]	...	...
Shaman visitation frequency	.43 [.09, 1.31]†	.33 [.00, .94]*	.26 [.03, .71]*	.25 [.03, .70]*
Religiosity index	-.01 [-.07, .06]	-.01 [-.07, .06]	...	...
<i>Ovaa</i> visitation frequency	.34 [-.04, .68]†	.38 [.01, .69]*	.30 [.02, .51]*	.24 [-.01, .45]†
Religious discussion with out-group	.24 [-.05, .38]‡	.23 [-.05, .37]‡	.25 [-.00, .34]†	.25 [.00, .33]*
Omniscience scale	.29 [-.06, .66]†	.34 [.04, .66]*	.06 [.04, .58]*	.33 [.09, .59]**
Age <sup>a</sup>	-.27 [-.05, .01]	-.29 [-.05, .01]‡	-.16 [-.03, .01]	...
Sex (0 = female)	-.07 [-.87, .59]	-.10 [-.88, .51]	...	...
Children	-.04 [-.32, .27]	-.06 [-.33, .24]	...	...
Years of formal education <sup>a</sup>	.22 [-.02, .12]	.20 [-.02, .11]	...	...
Birthplace (0 = rural; 1 = urban)	.03 [-.73, .88]	.07 [-.58, .90]	...	...
Urban index	.05 [-.97, 1.34]	.06 [-.92, 1.35]	...	...
Tuvan language fluency <sup>a</sup>	.13 [-.23, .50]	.16 [-.18, .50]	...	...
Shamanist × shaman visit	-.20 [-1.40, .81]	...	...	...
Constant	-[-3.40, .65]	-[-3.44, .53]‡	-[-2.40, -.22]*	-[-2.28, -.21]*
Adjusted R <sup>2</sup>	.11	.13	.17	.19
AICc	165.64	161.69	163.18	165.99
ΔAICc	3.95	-	1.49	4.30
N	50	50	60	62

Note. All models in the form  $\beta$  [lower, upper]; 95% confidence intervals in brackets. All models' mean variance inflation factors were  $\leq 2.01$ .

<sup>a</sup> Variables centered at mean.

‡  $P \leq .15$ .

†  $P \leq .10$ .

\*  $P \leq .05$ .

\*\*\*  $P \leq .001$ .

Across all models, the strongest predictors of attributing moral concerns to spirits were (a) reported frequency of visits to shamans and *ovaa*, (b) regularity of religious discussions with religious out-group members, and (c) the breadth of spirits' attributed knowledge. The first two findings provide readily interpretable sources of transmission: discussions with shamans and—in all probability—Russian Christians reliably correlate with moralizing spirit masters' concerns. While this effect was not present in these models, as reported in table 2, there is a negative correlation between self-ratings of fluency in the Tyvan language and frequency of listing moral items for things that anger ( $r = -0.45, P \leq .01$ ) and please ( $r = -0.42, P \leq .01$ ) the spirits. If those who feel they speak Tyvan less well feel more comfortable speaking Russian, this negative correlation might be interpreted as an effect of Russianization. And again, the more Tyvans claim that spirits know is a predictor of how moralistic they think the spirits are. However, there was a slight negative, nonsignificant correlation with the omniscience scale and participation ( $r = -0.18, P \leq .15$ ) or discussion ( $r = -0.18, P > .15$ ) of religion with religious out-groups.

Note that the omniscience scale showed no strong interaction effect with any other variable. This lack of an interaction indicates that breadth of knowledge and explicitly claiming a god cares about morality is grounded in human cognition rather than cultural transmission (see Purzycki 2013 for the same effect using a different instrument). Recall that age predicted cairn piety. However, cairn piety and age show no interaction effects of claiming the spirits care about morality

or virtue. There were also no interaction effects between other variables and discussion of religion with out-group members that would indicate out-group influence (see CA+ supplement A3 for further analyses).

## Discussion

In this report I sought to account for representational models of gods' minds in the Tyva Republic. By situating contemporary beliefs and practices in the social and ecological history of traditional Inner Asian religion, I first argued that the ritual cairn–spirit master system likely developed in response to maintaining territory, an acute problem for mobile populations. As supernatural agent cognition and ritual practices can function to minimize threats from others and contribute to prosocial behavior, placing rituals on borders may sanctify those territories. Indeed, according to the belief sets examined here, these spirits are primarily concerned with ritual and maintaining the vitality of the resources over which they lord.

Additionally, self-identifying as shamanist, being older, and being male predict greater cairn piety. Claiming spirits know more, however, predicts lower frequency of paying respects at *ovaa*. As also predicted, indices of new problems appear to filter into models of gods' concerns: some Tyvans claim that spirits care about human morality and virtue, particularly alcohol use and abuse. Factors involved in claiming the spirits care about morality included how often people visited shamans and ritual

cairns, the frequency of discussing religion with a religious out-group member, and how much participants claimed spirit masters know. While these factors may partly account for the source of participants' claims that the spirits care about morality, the content of that moral concern appears to conform to new conditions of urbanity and alcohol consumption.

*Cher eezi* are primarily concerned with ritual and with maintaining the vitality of their resource of mastery. The long-held association of spirit masters with ritual detailed above provides a partial explanation for this association. This, coupled with the fact that Tyvans trust people more if they engage regularly in cairn rituals located on territories (Purzycki and Arakchaa 2013), suggests that beliefs about gods' concerns are reliable indices of this particular religious system's operations: strategically located rituals on borders may indeed outsource the costs of maintaining respect for territory, just as associating a spirit with, for example, a natural spring may very well maintain the spring.

It is important to note, however, that even though Tyvans claim these gods care about rituals or overexploiting resources, this study is obviously no test of whether or not representational models actually motivate people or whether or not such a religious system solves the problems with which it is associated. There is evidence, however, that ritual functions to strengthen bonds and promote trust and that supernatural agency detection can decrease antisocial behavior. While Tyvans keep sacred places clean and engage in rituals to honor the spirits, the relationship between resource exploitation and beliefs about spirits' concerns requires further investigation (see Donahoe 2003). It is plausible however, that such appeals do curb excessive consumption and hunting, as there is evidence elsewhere that associating resources with spirits can alter the way in which people manage resources (see Atran et al. 2002; Berkes 2012; Bliege Bird et al. 2013; cf. Hames 1991, 2007; Smith and Wishnie 2000). As far as I am aware, a direct test of whether or not belief sets covary with preservation behaviors has yet to be conducted.

There are two primary lines of evidence that suggest that models of gods' concerns will coevolve with new problems. First, it is notable that almost a quarter of the sample listed alcohol use and abuse as things that anger spirit masters. While the seasonal distribution and consumption of fermented milk (*araga*) is often formalized, the introduction and availability of liquor and beer has undoubtedly contributed to widespread alcohol abuse and its related social ills. As religiosity can contribute to abstinence (Chitwood, Weiss, and Leukefeld 2008; Medicine 2007), appealing to the gods to curb abuse may be an effective starting point toward recovery, but formalized group support is likely also crucial. The fact that spirit masters point to this pervasive issue nevertheless lends support to the hypothesis that religion coevolves with social and ecological problems.

Second, concerns of littering and polluting also suggest that gods' concerns change in accordance with new problems. While one interviewee in a previous work emphatically denied

that spirit masters care about litter (Purzycki 2010:32), the present sample clearly emphasized that maintaining the vitality of the land and resources is central among the spirits' concerns. Presumably, before the introduction of litter, sacred places were to be kept free of pollution and resources maintained (recall that "defacing nature" had a Smith's *S* of 0.11). It is undoubtedly pragmatic to keep, for example, natural springs clean in order to maintain their utility. However, with the introduction of a market economy, consumables packaged in disposable materials, and a struggling infrastructure, waste management is an increased concern in Tyva, particularly in Kyzyl, the capital city. Indeed, during a recent trip, I saw televised public service announcements discouraging people from littering. As such, the meaning of keeping sacred spaces clean and vital also appears to be changing.

Curiously, while holding other variables constant, the more Tyvans said the spirits know, the more moral items they listed among spirits' concerns. To date, we have virtually nothing in the way of reliable cross-cultural data to assess what accounts for variation in gods' breadth of knowledge (see, however, Barrett, Richert, and Driesenga 2001; Lane, Wellman, and Evans 2012, 2014; Purzycki 2013a; Purzycki et al. 2012; Wigger, Paxson, and Ryan 2013). Perhaps gods' knowledge increases as a function of population density and social complexity; the more people interact with but cannot account for, the more gods know (Atkinson and Bourrat 2011; Norenzayan 2013), but we currently have no direct data to test this assertion. Table 2 indicated that the more participants' lives were spent in cities, the more they listed moral items in each of the subdomains of the spirits' concerns. This is consistent with the often found relationship between moralistic gods and social complexity and suggests that gods that care about interpersonal social behavior are useful devices to ensure proper conduct when there are far more anonymous and unaccountable people interacting. Yet, the urban index shows no correlation with the omniscience scale.

This report also offers a way to determine the degree to which people claim a deity cares about "morality." As previously discussed, a relatively long history of cross-cultural studies have focused on explaining "moralistic" deities. Yet to the best of my knowledge, this report is the first to critically examine what exactly this means by using data directly collected from people (cf. Purzycki 2011). If we take the "good" and the "bad" to be emic models of morality, then Tyvan models of morality barely overlap with what spirit masters care about. Again, targeted questions about whether or not these spirits know Tyvans' moral behavior is more likely to yield positive responses (Purzycki 2013), but this is clearly inconsistent with naturalistic, open-ended tasks. While Tyvan spirits may nevertheless contribute to upholding the moral order, they are not readily thought of as caring about it.

Exactly why models of gods' concerns consist of and change in accordance with specific pressing problems remains to be thoroughly understood. In part, gods concerned with indices of these problems might be easier to remember by virtue of



their interaction with evolved cognitive architecture and learning biases (see Atran 2002; Atran and Norenzayan, 2004; Barrett 2004, 2008a; Boyd and Richerson 1985:132–171; Boyer and Ramble 2001; Henrich and Gil-White 2001; Henrich and McElreath 2003; Purzycki and Willard, forthcoming; Richerson and Boyd 2005:58–98; Sperber 1996). However, these approaches are primarily interested in explaining transmission rather than explaining the content of that information with respect to social and ecological pressures, how individuals extract information related to these problems from the environment, and the constraints on domain inclusion.

Of particular relevance to cognitive approaches to religion may be a fitness-relevance memory bias (see Broesch, Barrett, and Henrich 2014; Nairne et al. 2009; Sandry et al. 2013; see also Henrich and Henrich 2010), but again, why some fitness-relevant things (e.g., alcohol abuse) over others (e.g., murder) become associated with gods' concerns remains an open question. In the present case, Tyvans might view alcohol as the source to most other social ills such as homicide, and this may be a more effective candidate to associate with gods. It is also possible that alcohol use and abuse are simply far more visible and therefore salient than homicide. In turn, this feeds into models of spirits' concerns.

The genesis of gods' concerns deserves serious consideration. In one example from Papua New Guinea, people competed to supernaturally explain a flood. Explanations ranged from retaliatory human sorcerers from an antagonistic neighboring group, members of the neighboring group claiming that planting crops on disputed land elicited sorcery, and some claimed that God was punishing them for not attending church as often as they should (Barker 2008: 122). What this suggests is that because others regularly show deference to spirits and supernatural forces, people claim the gods are concerned with otherwise new things for personal or collective ends. Sudden, synchronic episodes such as this may provide the impetus to use powerful deities to influence others in novel ways. Sustained, diachronic forces are likely what stabilize and aide the dissemination of conceptual associations with gods and socioecological problems (Purzycki and McNamara 2015).

While the work presented here found a correlation between thinking the gods care about morality and virtue and discussion of religion with undefined religious out-group members, it remains difficult to definitively speak to any directionality of influence. If we assume these out-group members are Christian Russians (or Christian Tyvans), it remains a question as to why such specific concerns would be “transferred” from *other* spirits from a different tradition. Nevertheless, what was a consistently better predictor was shaman visitation frequency, suggesting a top-down modification of spirits' concerns. If indeed such concerns are getting transmitted from shamans, why shamans appear to be attributing moral concerns to local spirits requires further investigation.

Recent works have employed novel analytical techniques with historical or ethnographic databases to track the source and emergence of moralistic deities (e.g., Botero et al. 2014;

Watts et al. 2015b). While this research has been and will continue to be invaluable, coming to better terms with the belief sets of living people will allow us to get a better sense of the otherwise unexplored variation that exists and to test directly whether or not religion evolves in accordance with the problems it appears to address. More importantly, it will also allow us to test whether or not it actually solves those problems.

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# Age Grouping and Social Complexity

by Pierre Lienard

In order to be sustainable, larger-scale social systems require containing nepotistic tendencies, which are potentially disruptive in multiple domains of social activities. Many formal institutions of our modern democratic states seem to facilitate such offsetting. The ethnographic records provide many examples of large tribes not relying on either formal institutional frameworks or strict hierarchies to articulate the diverging requirements of kin-group allegiance and broader social affiliations. How does greater social complexity emerge in such decentralized societies? Among the different informal solutions presented in the literature, we find an interesting one: age-set systems, which involve the grouping of coevals in cross-kin associations. An essential aspect of such systems is their ability to enable the swift neutralizing of the basic pull of nepotism without intensive investments in a formal institutional apparatus, as is observed in more complex and modern social systems. When great benefits can be obtained through social exchange in large cooperative networks, an age-based organization helps counter familistic preferences by creating new incentive structures.

## Introduction

In state societies, individual agents enjoy easy and efficient coordination and cooperation thanks to elaborate institutional frameworks.<sup>1</sup> Far from having long been the case in the history of humanity, such extensive investment in coordinating and controlling institutions is a novel phenomenon. It is the outcome of a gradual process of growing differentiation and specialization of social worlds and a concomitant increase in delegation, institutionalization, and centralization of leaderships (e.g., Fried 1967; Johnson and Earle 2000; Service 1975). Such institutional luxury was simply not affordable before specific economic (i.e., energy capture threshold) and social (i.e., population density threshold) conditions obtained (Morris 2013; Steward 1955; White 1943). Thanks to their institutional apparatus, modern developed societies have attained levels of coordination that permit cooperation on a global scale (e.g., Ridley 2011; Wright 2000).

In many respects complex state societies exist in part thanks to investments in complex formal institutional systems. Does this imply that before the emergence of the state apparatus human groups had to be of very small size (i.e., associations of kin groups) or, if of greater magnitude, transient and lacking an enduring and stable social order? The ethnographical records on enduring cohesive tribal and ethnolinguistic groups invalidate such views (e.g., Dyson-Hudson 1966; Fortes and Evans-Pritchard 1961 [1940]; Gulliver 1953; Murdock 1981, 1967; Service 1971 [1962]; Steward 1948).

Large coordinated and unified populations without states have been found across the globe (Murdock 1967, 1981). In those decentralized societies we find large coordination of unrelated social agents with competing and potentially conflicting goals, motivations, and incentives without powerful arbiter institutions. Such large polities appear to have successfully countered powerful familistic and nepotistic tendencies, allowing large numbers of individuals to interact within expanded circles of trust, without the help of intricate formal institutional frameworks.

The anthropological records identify several prominent low-cost,<sup>2</sup> informal institutional solutions to the problem of large and extensive social coordination, such as the solutions based on common descent (lineage and clans), residence and moiety principles, age ranking (age-set systems, age grades, and generation-set systems), or combinations of two or more of those dimensions (e.g., Baxter and Almagor 1978; Bernardi 2007; Evans-

1. In state societies, and more so in Western democracies, individuals can typically rely on stable institutional frameworks, which allow them to navigate the social world relatively unencumbered, without having to ascertain systematically and in-depth the honesty or trustworthiness of each agent with whom they interact.

2. By "low-cost" I mean that the overall institutional investment is low. In the low-cost institutional condition, individuals might incur punctual and sometimes significant costs in order to contribute to the system (e.g., offerings for maintaining the channels of cooperation opened). But no formal institutional framework is being created; that would require, e.g., funding for specialists and permanent organizational structures. By contrast, in modern societies, although institutional designs are quite costly (e.g., enforcement with courts and tribunals), the actual cost for an individual is quite small given the size of the taxpayer population. In smaller-scale populations, such complex institutional apparatuses would be impossible to support given the tremendous resources they involve.

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Pritchard 1969; Hornborg 1988; Lévi-Strauss 1949; Lowie 1913, 1916, 1920; Pasternak 1976; Paulme 1971; Peristiany 1951; Service 1971; Stewart 1977).

In this article I focus on an age-based system involving the parsing of the male population into groups of age-mates or coevals in the *Ngilukumong* territorial section of the Turkana, an East African herder population occupying semiarid rangelands in northwest Kenya. Three major questions structure my presentation of the theoretical or ethnographic material: (1) What human psychological dispositions must be overcome to form larger coordinated and cooperative groups? (2) Which psychological dispositions facilitate the formation of age-sets, social institutions that have emerged independently around the world (Bernardi 1952, 2007 [1985]; Stewart 1977)? (3) What is accomplished by the grouping of coevals?

The specifics of the age-set system of the *Ngilukumong* Turkana territorial section of northwest Kenya will permit me to address the consequences of the system for the socialization of men. It will be made apparent how, by tapping into essential aspects of human psychology, dispositions, and motivations, the institutionalization of the ranking of groups of age-mates creates a new reality in which agents have genuine motivations and incentives to extensively cooperate with other social partners. The age-set system limits the risk of individual exploitation in interaction with unrelated agents, which in turn facilitates some diversion of energy, time, and resource investments away from the familial cell for gaining access to the full benefits of extensive cooperation.

## Fieldwork and Methods

The Turkana County, which constitutes the core of the area occupied by the Turkana population, comprises 71,597.80 km<sup>2</sup> of semiarid rangeland. A contested 2009 census tallied the population at close to 900,000 souls (retrieved from Turkana County Information, <http://infotrackea.co.ke>, March 27, 2015). Turkana County still has a very low urbanization level (<15%) compared with the Kenyan average (>30%). The traditional *Ngilukumong* herder groups in the northwestern part of the county, the focus of this article, still rely significantly for their subsistence on donkeys (mainly for transportation), herds of goats, sheep, camels, and cattle (dairy products and direct consumption), and some barter. A cash economy has made rapid progress in the last decade.<sup>3</sup>

The material presented in this article is based on intensive field research among Turkana herder communities. The research was conducted in two different settings: in large pastoralist groups that migrate through vast rangelands and in small

3. For interesting presentations of different characteristics and features of the population, see, e.g., Gulliver (1951, 1955, 1958), Lamphear (1988, 1989, 1992), Koji (1990), Müller-Dempff (1989, 1991), Dyson-Hudson and Dyson-Hudson (1999), Little and Leslie (1999), McCabe, Dyson-Hudson, and Wienpahl (1999), and McCabe (1984, 2004).

nuclei (i.e., trading and administrative centers) located at crossroads of pastoral migration routes and national infrastructures. Excluding preparatory research phases and multiple targeted survey- and experiment-based missions conducted from bases in the small urban nuclei in the Turkana County, the total period of fieldwork spent in remote pastoralist communities approximates 20 months, including a 1-year stay at the end of the 1990s.

Research in the remote pastoral camps was conducted in complete immersion. Reaching those communities typically required up to 2 days to walk from the closest point with easy motorized access, limiting greatly what possessions and provisions could be brought along and necessitating great reliance on local support and foodstuffs for subsistence in the camps. To facilitate insertion in the social world of each camp, close affiliation to a specific household or a group of them was systematically secured. Early at the beginning of the research in the area and for some time afterward, a fair mastery of the Turkana language was achieved, guaranteeing a general understanding of ordinary linguistic exchanges.<sup>4</sup> However, interpreters were always relied on for checking and guaranteeing accuracy of understanding, facilitating exchanges, and (back) translating research tools.

My research among the Turkana has been organized around a few major and interrelated themes: ritual and psychology of ritualized behavior, cooperation and collective action, precaution psychology, and trust. For investigating those themes, I relied on both quantitative and qualitative methods and much participant observation. Male interactions at the tree of men (where adult males rest during the hottest part of the day), during sacrificial ritual ceremonies and political debating and haranguing taking place at meetings and rituals,<sup>5</sup> at collective dances, during conflict handling and resolution, and at departure for or arrival from scouting or warfare activities were systematically investigated through focal follows. Some of those collective activities were observed with great frequency, several dozens of times (ritual, dance, and political haranguing and debating); others were observed much less often given their exceptional nature (warfare and internal collective conflict).

4. Given the agglutinative nature of the Turkana language, I experienced some difficulty achieving ease and fluidity in speech production that would allow the matching of the rhythm of a fast-paced relaxed conversation. Furthermore, after the original phase of extended fieldwork, the lack of sustained practice had a significant negative effect on my active knowledge of the language.

5. Turkana collective rituals typically involve animal sacrifices for consumption. They are performed for their apotropaic potential, helping the unfortunate, or honoring and thanking individuals or groups, among other reasons. Many rituals that gather men take on features of a political arena where harangues are proffered, grievances vented, or debates started. Those ritual practices involve groups of men ranked according to seniority statuses. Such a combination of communal feasting and age ranking is emblematic of Turkana men's ideal view of their world, centered on norms of communal sharing, mutual "brotherly" respect, and deference to seniors (Lienard 2006).

For the investigation of the specific topics of friendship, trust, and cooperation; age-mates and age-sets relations, duties, rights, and responsibilities; the concepts of seniority/juniority, warfare and warriorship, and the perception of typical threats and risks and their associated precautions, I relied on combinations of several research methods: participant observation, experiments, surveys, and semistructured open-ended interviews and informal discussions with individuals at specific stages of their life histories or in focus groups (i.e., age-mates, seniors, juniors) when appropriate.

A great source of insight into the dynamics of male group interactions that is presented in this article also comes from having shared and followed the livelihood of a main *Ngilukumong* community over the years. I know, among other things, its constituent families, its prominent and influential individuals, its age-sets, and the major events and challenges that have recently affected it. I have been given the opportunity to be kept abreast of its general evolution. I have a good knowledge of the various social networks made of strategic alliances of families, friendship bonds, clientelist relations, stock associations, and marriage unions that integrate that community. I have established strong rapports with individuals who readily volunteer openly to discuss complex matters such as enmity, particular individuals' reputations, morality and warrior abilities, trustworthiness of age-mates and other members of the community, internal conflicts, the misdeeds of some, the pains and joys of camp life; in essence, the stuff of social life in a typical traditional Turkana herder community.

## Underlying Psychological Dispositions

### *Function of Nepotism*

Families, or more technically kin groups, are a prominent feature of human societies and have been so deep into the evolutionary past of our species (e.g., Chapais 2008; Davis and Daly 1997; Foley 1996; Draper and Harpending 1988; Lancaster and Lancaster 1987). Kinship systems categorize individuals into descent and filiation groups in systematic ways, establishing a clear discrimination on the basis of consanguinity between in- and out-group members (Barry 2008; Fox 1967; Lévi-Strauss 1949; Rivers 1968).

Detecting kin and distinguishing them from nonkin may be among our evolved capacities (e.g., Lieberman, Tooby, and Cosmides 2003, 2007; Park, Schaller, and Van Vugt 2008). To be functional, the ability to discriminate must come with a whole suite of psychological adaptations that assure that agents are motivated enough to preferentially look after the welfare of the designated targets. Humans appear to be endowed with such full-fledged and intricate kinship psychology (Daly and Wilson 2005), and nepotism—the preferential channeling of time, energy, and resource investments toward individuals on the basis of their respective degree of genetic relatedness—figures at the core of that psychology (Bellow 2003; Chapais 2000; Holmes 2001; Jones 2000, 2012; Lieberman, Tooby, and Cos-

mides 2003; Park, Schaller, and Van Vugt 2008; Tal and Lieberman 2007).

Understood in an evolutionary framework, nepotism is functional. It increases the probability that investment in kin is done proportionally in accordance with the genetic proximity of benefactors and beneficiaries (Jones 2012; Park, Schaller, and Van Vugt 2008). Different kin categories demand different degrees of nepotistic involvement and evoke different altruistic or mutualistic beneficent behaviors (Chapais 2000). In a small-scale world where close kin relations define the boundaries of solidary social units and the limits of individuals' primary and main loyalty, nepotism is clearly adaptive.

However, once the social world extends beyond the clustering of small, tight-knit units comprising highly related individuals, the differential and preferential treatment of kin is likely to contribute to the emergence of conflicts (Bellow 2003; Jones 2012). Distant social agents who, wanting to maximize their social and economic reaches, might wish to associate with others are less likely to share common interests, goals, and objectives, and hence face significant hurdles in their attempts to coordinate into larger social units. Moreover, in such a social world comprising many individuals, the probability of one's objectives directly competing with someone else's is likely to be significantly increased. In such a world, where coordination between unrelated agents could be hazardous and economic and social competitions are exacerbated, differentially treating individuals on the basis of degrees of relatedness is bound to conjure elements of factional and coalitional politics, eventually compromising social order. For the sustained enlargement of social units to occur, the integration of smaller, nepotistic kin groups into larger social and political ensembles is a requisite. Such growth could not happen without some hierarchization, with delegation of authority, duties, and responsibilities, when the need for collective action arises that requires the participation or the consent of large segments of populations, such as, for example, for the coordinated use of commons, the organization of defense, the peaceful settlement of territorial dispute, or the building of collective infrastructure (e.g., Carneiro 2000; Dubreuil 2010; Eisenstadt 1956; Fried 1967; Maybury-Lewis 1984; North, Wallis, and Weingast 2009; Service 1971; Smith 1992:30–31; Vansina 2004).

The problem of generating expanding circles of cooperation is sometimes solved through lineage-based structures. The legitimacy of hierarchies and delegation of authority and responsibility are critical issues in decentralized tribal systems given their particular constituent body made of small, economically autonomous nepotistic kin groups. As put forward by Dubreuil (2010:7), the increased handling of political affairs by kinship groups has allowed tribal groups to address tensions associated with the coordination of larger social contingents. Sahlins (1961), Service (1971), Ember, Ember, and Pasternak (1974), and Pasternak (1976) also see conflict as driving the emergence of unilineal descent groups (with their indubitable rules of affiliations facilitating the formation of stable solidary groups). Lineage-based organizations have been adopted

in tribal systems across the globe to bypass obstacles to the expansion of the circle of coordination. As we will see below, although on the base of very different organizational principles, age-based systems may also be conceived as solutions to that coordination and cooperation hurdle.

#### *Group Affiliation and Emergence and Detection of Norms*

Human beings extensively depend on others for their survival, which explains humans' elaborate psychology for existing in social groups (Kameda and Tindale 2006; Neuberg, Kendrick, and Schaller 2010). Group membership provides invaluable social resources such as protection, succor, and support in the face of adversity (Correll and Park 2005; Kameda and Tindale 2006). Cooperative units and support networks and the sharing of resources they entail curtail the consequences of failures (Kameda and Tindale 2006; Neuberg, Kendrick, and Schaller 2010). As expected, given the great fitness benefits of belonging to cooperative networks, human are strongly motivated to seek affiliations with social groups (Baumeister and Leary 1995; Leary 2010; Neuberg, Kendrick, and Schaller 2010). And on the basis of what is known of the past of our species, it can be inferred that at some point in human evolution, the building and maintenance of cooperative alliances became an evolutionary imperative depending on a series of domain-specific adaptations (Kameda and Tindale 2006; Spoor and Williams 2007; Yzerbit and Demoulin 2010). That cooperative living has been extremely important for the genesis of our species is reflected in the human acute sensitivity to the risk of rejection and, more specifically, to ostracism (Spoor and Williams 2007). It also explains why we are so susceptible to the risks or benefits involved in being the target of reputational gossips (Piazza and Bering 2008).

The proper resolution of coordination problems involved in the formation of groups relies on a set of cognitive abilities, motivations, and preferences that seem to emerge early in the development of a child. Children display an early ability to categorize human kinds into distinct sets with essential properties based on the observation of stable characteristics (Harris 2011; Hirschfeld 1996, 2012; Pascalis and Kelly 2009; Ziv and Banaji 2012).<sup>6</sup> Very young infants readily categorize individuals on the base of age as has been demonstrated in experiments relying on habituation and looking-time paradigms (McCall and Kennedy 1980; Ziv and Banaji 2012). Preschoolers preferentially imitate peers over adults (Ryalls, Gul, and Ryalls 2000; Ziv and Banaji 2012), although not for some essential domains of knowledge with survival properties, where they revert to choosing parental guidance (VanderBorgh and Jaswal 2009; Ziv and Banaji 2012).

6. That ability has behavioral consequences, such as the children's well-documented preferences for adult females' faces over adult males' faces, for novel objects, activities, or food favored by same-age and same-gender individuals or by speakers of the same language (Quinn et al. 2002, 2010; Shutts, Banaji, and Spelke 2010; Shutts, Kinzler, and McKee 2009).

Group efficiency also requires that its members readily grasp the "rules of the game," often implicit, organizing the interaction of agents (Lewis 2002). Once again, children show an amazing ability to infer rules and norms that structure collective coordination and action. Preschool children show awareness of the normative structure of conventional activities (Rakoczy, Warneken, and Tomasello 2008). Children as young as 2 years of age readily understand that normative rules organizing a collective action can be context relative, and they act accordingly (Rakoczy et al. 2009).<sup>7</sup> A recent study investigating how groups of children age 5 structure their interaction in a collective task without prior instruction found that the preschoolers spontaneously created conventional norms to coordinate their actions and invested in the transmission of that information to other naive participants who joined the group at a later stage (Göckeritz, Schmidt, and Tomasello 2014).

Human beings display early in development evidence of competences for building social categories on the basis of observable characteristics, dispositions, and motivations to affiliate with others and abilities to compute organizational norms. Human beings are also sensitive to the threat of social gossip and rejection by a group. Those competences, abilities, skills, and dispositions are essential components of human adaptation to group living.

#### *Relative Age, Seniority, and Hierarchies*

Social dominance theory holds that group-based social hierarchies structure human societies (Sidanius and Pratto 2001:31). The dominant groups secure greater control of material, symbolic, and political capitals than subordinate groups (Sidanius and Pratto 2001:31–32). Sidanius and Pratto distinguish three stratification systems based on the criteria of age, gender, or membership in arbitrary sets such as ethnicities or clans (Sidanius and Pratto 2001:33). Gender and age discriminations are probably more primitive than the third category, which requires a level of sociocultural complexity with surplus and storage capacity to support specialized control apparatuses (Sidanius and Pratto 2001:34).

Age might constitute an adequate proxy for authority, as an older individual is likely to have more experience, greater knowledge and social skills, larger social networks, and more group affiliations than younger individuals. The reliance on cues of seniority as proxy for dominance probably has a long evolutionary history and has been documented among males of several social species of primates (Higham and Maestripietri 2010; Manson 1998). In a comparative analysis, Baker and Eaton (1992) showed that seniority, defined as the duration of membership

7. Preschoolers also take it on themselves to enforce social (constitutive and conventional) norms on others (Koyunen et al. 2014; Schmidt and Tomasello 2012). Furthermore, children as young as age 3 are not indiscriminate in their adoption of rules and norms but selectively learn from specific targets and models (Rakoczy, Warneken, and Tomasello 2009; Rakoczy et al. 2010).



within a group, was a predictor of dominance among men and macaques.

Based on the observation that leadership structures systematically emerge when people get involved in group dynamics, Van Vugt and Kurzban (2007) suggest that humans are endowed with cognitive adaptations for leadership and followership. The spontaneous establishment of leadership facilitates the resolution of problems of collective action, such as (1) how to coordinate individuals with different incentives to reach agreed-on goals and (2) how to persuade others to preferentially adopt a course of action favored by some individuals (Van Vugt and Kurzban 2007:236–237). Group dynamics require cooperating individuals to be able to detect each other's abilities and adopt the proper behavior in the more or less transient local leadership structure that is beneficial to achieving the selected collective goals (Van Vugt and Kurzban 2007).

In specific social situations (i.e., involving group dynamics), evidence of an age difference (a proxy for a potential junior/senior relation) might prompt the adoption of context-dependent strategies such as submissive or dominating behaviors, allowing for the materialization of a leader-follower coordination that, according to Van Vugt and Kurzban (2007), would enhance collective performance. The relative age difference as proxy for authority might very well be an important dimension of human hierarchies, making it a prominent facilitator of natural leadership structures with temporary delegation of authority.

Given its natural convenience (i.e., given the general ease of relative age detection and the wealth of age-specific expectations), the criterion of relative age has often been used in tribal settings to organize hierarchically and to stabilize collectivities of men (Baxter and Almagor 1978; Bernardi 2007; Fried 1967; Gulliver 1958; Kertzer 1980; Legesse 1973; Maybury-Lewis 1984; Pasternak 1976; Prins 1953; Ritter 1980; Service 1971; Spencer 1998a, 1998b; Stewart 1977).

## The Turkana Age-Set Polity

### *Age-Based Sodalities: Associated Societal and Structural Features*

The institutionalization of age-based organization has occurred independently around the world. Whether the process of emergence of age systems can be systematically associated with particular conditions has been the subject of much debate (e.g., Bernardi 2007; LeVine and Sangree 1962; Lowie 1916; Murdock 1967; Stewart 1977). In her comparison between a random sample of African societies with male age-set systems and a similar sample of societies without such institutions from around the world, Ritter makes a persuasive argument that age-set organizations are more likely to be found in (1) decentralized tribal societies (2) frequently engaging in warfare in which (3) seasonal kin groups significantly vary in size and composition, making it hard for descent groups to rely on their dispersed male members to quickly muster war parties whenever defense, retaliatory, preemptive, or predatory military activities demand it (Ritter 1980:98).

The Turkana society of Eastern Africa displays all the typical features highlighted above of an age-set polity.<sup>8</sup> It is strongly decentralized. Permanent and formalized political positions, institutions, and hierarchies do not exist. The particular clustering of resources in the semiarid Turkana ecosystem and the requirements of the various livestock species supporting the herding economy impose the regular divisions of the basic economic units, typically polygynous households or associations of such units under the control of male relatives. Cattle rustling and other forms of warfare activities are part of life (e.g., Dyson-Hudson and Dyson-Hudson 1999; Gulliver 1951; Lamphear 1992, 1988; Little, Dyson-Hudson, and McCabe 1999; McCabe 2004; McCabe, Dyson-Hudson, and Wienpahl 1999; Mkutu 2008; Müller-Dempf 1989; Wienpahl 1984).

### *The Ngilukumong System*

The Turkana age-based system focuses on two essential dimensions: generational ranking and age ranking (Gulliver 1951, 1958; Müller-Dempf 1989, 1991). The Turkana male society is divided between two generations:<sup>9</sup> the *Ngimoru* (Mountains/Stones) and the *Ngirisai* (Leopards). A *Ngirisai* father gives birth to a *Ngimoru* son, and a *Ngimoru* father gives birth to a *Ngirisai* son. Originally the generations seemed to have been ranked in order of succession from an original generation (Müller-Dempf 1989). In the areas where and at the time when my research began, the generational reckoning starting from an original group had been lost. A system of alternation between *Ngimoru-Ngirisai* is now in operation. There is no reference made to a senior generation that would hold the political ritual control over a junior generation. The elders (*ngikasukou*) of the two alternations exert such leadership.

*Ngimoru* and *Ngirisai* simultaneously recruit new members into distinct age-sets. To become a fully recognized set, an age group goes through an initiation (*asapan*).<sup>10</sup> Upon its initiation into the age-set status, the group acquires its official name (see

8. The ethnographic present is used throughout the descriptions. The accounts are based on observations made in large traditional pastoralist camps at a time when the Turkana society was not yet swiftly moving toward its full integration into modern-day Kenya. The system as it is being described here still exists in some significant regards, but it is quickly being transformed through urbanization and economic development. Note, e.g., that a significant percentage of the population of the county does not depend on herding activities for its main source of livelihood anymore but on economic activities available in town or along lake Turkana (fisheries) for specific territorial sections. Furthermore, although cattle rustling and banditry still exist in parts of Turkana County, this has now been somewhat dampened compared with the four decades following independence.

9. Women align on their husband's generation upon marriage.

10. Based on data gathered in a northern territorial section, Müller-Dempf (1989) records an age range of 7 to 10 years within typical Turkana age-sets. The information presented here, stemming from a territorial section south of where Müller-Dempf worked, suggests an age range of about 5 to 7 years.

Table 1. *Ngilukumong* age-sets as observed in 1998

<i>Ngimoru</i> (Mountains/Stones)			<i>Ngirisai</i> (Leopards)		
Name <sup>a</sup>	Translation <sup>b</sup>	Age <sup>c</sup>	Name <sup>a</sup>	Translation <sup>b</sup>	Age <sup>c</sup>
<i>Ngikapelmesekin</i> <sup>d</sup>	Those of the (black) sheep with marked (white) flank	Surviving members 70 and up	<i>Ngingolesuguru</i> <sup>d</sup>	Those of the white-colored-head ox with yellow body	Surviving members 70 and up
<i>Ngibanga</i> <sup>d</sup>	Those of the white sheep with black-circled eyes	65 and up	<i>Ngikwangai</i> <sup>d</sup>	Those of the adornment made of aluminum	60 and up
<i>Ngikwamudang</i> <sup>d</sup>	Those of the animal with cut ears	End of 50s and early 60s	<i>Ngiropiai</i> <sup>d</sup>	Those of the money	In their 50s
<i>Ngilemaniko</i> <sup>d</sup>	Those of the hornless bull	Turn of 50s	<i>Ngilingadomo</i> <sup>d</sup>	Those of the partially barked sticks of <i>edome</i> ( <i>Cordia sinensis</i> )	45 and up
<i>Ngitulyangorok</i> <sup>d</sup>	Those of the spotted-coat animal with circled (black) eyes	40 and up	<i>Ngikoporia</i> <sup>d</sup>	Those of the spotted brown (ostrich) feathers	End of 30s and up
<i>Ngitikotom</i> <sup>d</sup>	Those who grab the gun	In their 30s	<i>Ngimee</i> <sup>e</sup>	Those of the billy goat	End of 20s and early 30s
<i>Ngimugetom</i> <sup>f</sup>	Those of the brown gun	Mid-20s	<i>Ngikoporia lu Ekileng</i> <sup>f</sup>	The <i>Ngikoporia</i> of the knife	Early and mid-20s <sup>g</sup>

Source: Lienard (2003).

<sup>a</sup> Names usually in use at the time the information was gathered.

<sup>b</sup> The etymology or the origin of some of the terms (e.g., *Ngilingadomo*) is often debated and, for some (younger) individuals, altogether unfamiliar. The translations presented here are the ones that were given by a prominent individual in the *Ngilukumong* community where the research was conducted. Other men contributed information to refine the etymology, disagreed, or agreed with the explanations provided in the first place. However, other etymologies exist.

<sup>c</sup> Ages were determined at the time of the interviews on the basis of well-known events and reference points in the past for which dating exists. Those ages are approximations, as most individuals (the more so the older they are) used to determine the time of their birth very generally as having taken place (e.g., many/a few seasons before or after event/season X). Relative ages (e.g., who was born before/after whom) within herding communities are much more accurately determined.

<sup>d</sup> Fully initiated.

<sup>e</sup> Initiation had started; most members still had to go through their *asapan* ceremony.

<sup>f</sup> Approaching initiation, members have started to talk to their elders of their desire and need to go through initiation.

<sup>g</sup> An additional group comprising youngsters at the end of their teenage years was in formation. A single name was mentioned for referring to all those youngsters: *Ngimuriain* (Those of the plateau).

table 1 for an example). Thenceforth it is fully recognized as a corporate group with a particular collective identity. Each “generation” has its independent succession of age-sets.<sup>11</sup> In the *Ngilukumong* age-set system, senior/junior relations are embedded in both the alternations (*Ngirisai* beget *Ngimoru*) and the succession of age-sets (within each alternation).

#### *Advantageous Pooling*

*Security Dilemma.* The Turkana homeland is located in an area that was unstable for long periods after the post-World War II era decolonization. The Pax Britannica was enforced in Turkana until independence after full control of the area was established at the end of the 1930s, drastically limiting raiding activities (Gulliver 1951, 1955; Lamphear 1992). Many Turkana elders I met at the end of the 1990s regularly insisted on the striking difference in ethnic interactions between the time of their youth and during the 1970s, 1980s,

and 1990s. According to them, raiding was significantly dampened before those decades in most areas of the Turkana homeland. The Turkana *Ngilukumong* were peacefully living in close proximity to the Dodos, a tribe now considered an enemy. Based on the recollection of older Turkana men, cattle rustling and other raiding activities seem to have been very limited, and age-sets do not seem to have been recruited for coalitional aggression.<sup>12</sup> The situation was quite different for the entire duration of my research in the area. The age-sets were systematically involved in the scouting of dangerous areas exposed to enemy activities and in the buildup of raiding parties.

Civil wars raged in neighboring Uganda and Ethiopia until their respective stabilization in the late 1980s for the former and early 1990s for the latter (DeRouen and Heo 2007). Sudan went through major social strifes from the mid-1950s to the mid-2000s (DeRouen and Heo 2007). As a direct consequence

11. Southern sections, where apparently the dual recruitment has not existed for quite some time, have a different expression of the system (Müller-Dempf 1989).

12. In discussions with elderly Turkana about the peaceful era before decolonization, nonviolent livestock theft, unrelated to raiding, was systematically mentioned as the typical troublesome event occurring on a regular basis.

of the instability reigning in the zones abutting the international borders of Sudan, Ethiopia, Uganda, and Kenya, the whole region has been awash with weapons, which triggered a systematic ratcheting-up of raiding. The traditional age-set institutions played a role in fueling the violent tribal interactions (Fukui and Turton 1979; Kurimoto and Simonse 1998a; Mkutu 2008; Tornay 2001, 1993; Tvedt 1993).

Tense conditions involving cycles of aggression and retaliation have prevailed for extended periods in the *Ngilukumong* area. Large pastoralist communities (*arigan*) are assembled to maximize the protection of its members while relying on grassland bordering enemy homelands (Lienard 2003). Scouting of the rangeland for enemy presence by groups of warriors (*ajore*) is required (Lienard 2003). Men must escort the herds when exiting or reentering the camps or near the wells when watering takes place, all propitious places and moments to mount attacks (Lienard 2003).

The dramatic atmosphere in those large communities is enlightening for understanding the particular dynamics that sustain violence.<sup>13</sup> Those large communities are typically located along the outer perimeter of the central plain constituting the core of the Turkana homeland. Though peripheral, those areas are essential for the cattle herding economy, as it is there that some of the prime dry-season grasslands are located. Given the close proximity to the enemy, the exploitation of such rangeland requires the agglomeration of smaller grazing units (*adakar*) into larger social units (*arigan*) for defense purposes (Lienard 2003). The objective is to maintain a sizable cohesive community coordinating its pastoral movements and defense strategies. An ideal situation is attained when the temporary herding community reaches a population threshold providing safety in numbers while at the same time the encampment stays sustainable and manageable, that is, it has the water and grassland needed to support its herds and inhabitants for some time and does not require moving too often to new locations.<sup>14</sup>

Attacking such large communities is risky without proper preparation and with forces too weak to repulse counterattacks of camp dwellers. To some extent the clustering achieves its objective; much time generally passes without any enemy onslaught. Nevertheless, fear is a constant of life in such household agglomerations. People feed the rumor mill. Unidentified

13. The following presentation is an ideal and standardized composite model of life in such communities based on formal and informal conversations and observations of events and happenings made while living for extended periods in herder camps. The presentation is thus an analytical construct including information obtained from Turkana interlocutors and directly observed and logical inferences supported by a comprehensive understanding of life conditions in such traditional Turkana herder communities.

14. The size of those *arigan* varies. The availability of grassland and water are limiting factors for the agglomeration of numerous households. In the *Ngilukumong* area where I worked, one such major social unit focusing on cattle herding comprised close to 1,300 individuals distributed between 80 households belonging to one of six grazing units—*adakar* (Lienard 2014).

footsteps have been detected in the vicinity of the camp; they must be those of spies. At some distance from the camps in the bush, multiple tracks converge at a particular location; they surely are tracks of enemy scouts. The time that passed since a previous aggression is abnormally long; the enemy is for certain preparing a major attack. A diviner (*emuron*) has seen in the entrails of a sacrificed animal that a strike is imminent. He warns people to brace themselves for what is coming. Young warriors who have come back from spying on enemy settlements report having noticed some unfamiliar activities. This is indubitable evidence that the enemy is preparing something.

At first, people might dismiss such worries. However, with the increase in frequency of such information circulating in the community, a generalized paranoia starts setting in. Given the telltale signs of increasing and mounting threats, elders and politically influential individuals convene daily meetings where all men of fighting age gather in the wee hours of the morning. Everyone is asked to take stock of the dire situation that the community is more than likely facing. Young men are sent to scout farther afield in the direction of enemy settlements and, upon their return, report to elders and mature men. The information is then fed back the next day at the morning meeting to the assembly of men. The opposing side is certainly engaged in the same process of attempting to guess the intention of the Turkana. The enemy is probably also involved in various defensive maneuvers, increasing the likelihood that actions that were originally carried out with the intent to preempt a surprise attack end up being interpreted as sure signs of the mounting threat of an imminent aggression.

The dynamics described above, sustained by mistrust and fear, generate what is best known as a security dilemma, a zero-sum situation in which one party's gain in safety decreases the security of another (Herz 1951; Jervis 1978). Eventually, one of the opposing sides decides that the menace has lasted long enough and strikes first to avoid being struck by the opponent. In such cycles of strike and counterstrike, that the onslaught be justified as preemptive or retaliatory (it is often interchangeably qualified as such) is not relevant. Given the history of previous aggressions, one is justified to attack, and, in a way, it is always a payback for what one was dealt sometime in the past. Turkana herders readily grasp the inescapability of the "them or us" logic that the fundamental high level of distrust and the lack of external arbiters and enforcers precipitate. Hence, attempting to coordinate with the enemy for long periods of time in more positive ways is viewed as impossible.<sup>15</sup>

15. Truces do happen, though. I was told of a truce that was spontaneously established between Toposa (a population living in South Sudan in a territory along the border with Kenya) and Turkana (comprising grazing communities from several territorial sections) when, driven by an extreme drought that had depleted most habitual dry-season grasslands, both groups of herders eventually met in Kidepo Valley, in northeast Uganda. Though quite fragile, the truce was maintained for some time until both sides retreated back to more traditional grazing areas. Apparently, the

Turkana are well aware that warfare is extremely costly in human, social, and economic terms and that peaceful relations, if they could be maintained, bring great benefits. Most adult and mature men, with whom I was able to discuss openly the prospect and experience of war, have been unabashedly frank about how physically and emotionally draining and frightening going to raid is. However, the open acknowledgment is also generally followed by the expression of a typically apathetic realization that there is not much that can be done, as hostility is very likely always impending.

*Mandatory Participation.* As stated before, an important functional feature of age-set systems is their ability to mobilize contingents of unrelated men when socioeconomic conditions do not permit relying on the cohesive action of corporate kin groups. Their specific conditions of existence place the Turkana in such a position. But there are costs involved in accepting all the entailments of belonging to an age-set system, especially for younger males at entry level (Lienard 2014). Lads will have to tolerate some exploitation from older sets. They will spend years performing service for and on behalf of the male collectivity. That will include dangerous missions, such as faraway excursions to scout for fresh pastures in rangeland exposed to enemy raids and to spy on enemy movements and settlements (Lienard 2003, 2014). But more generally it will require investing in the tedious daily pastoral routines and the constant care and guarding of grazing herds while older males are happy to limit themselves to loose supervision from afar. However, even members of older age-sets incur substantive costs associated with their membership (Lienard 2003, 2014). Age-mates in need expect to be granted access to goods, animals, and support without much complaint or opposition. Members of younger age-sets regularly beg their elders for animals to feast on, often in retribution for services provided to the male collectivity (i.e., fighting, scouting, spying). When planning to marry, a man tours his age-mates' households to ask for animal contributions to the bridewealth. When conflict arises, a fellow anticipates backing from his age-set brethren. In combat situations, even at peril to his own life, a man should rally to the rescue of fighters in delicate positions. All those expectations and duties come at a price, which in some situations might be dire (Lienard 2003, 2014).

Given these costs, what are the perceived and real benefits of membership? The costs do not seem to have been perceived as detrimental enough to nullify the advantages of the system. Acquiescing to the costly consequences of the age-set system should be understood in the context of the intertribal warfare, the lack of alternative means of support outside of the herding subsistence economy, and the consequences associated with exiting the traditional tribal system.

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sheer size of the forces present would have guaranteed dramatic consequences if they had engaged in hostilities, which explains why they did not do so.

Even though he might not wish to, any man growing up in the Turkana traditional setting knows that he will have to engage in warfare activities at some point. The interethnic relations are such that there is fundamentally no other reasonable option to fostering one's affiliations to others to prepare for the eventuality of aggression. Indeed, if such situations could be envisioned, the consequences of not participating and cooperating would be much too great. It would entail extracting oneself from the fabric of society altogether and being exposed to all sorts of internal and external threats (e.g., shunning, plunder, thievery, death) in addition to being cut off from one's single mean of subsistence. So unless one migrates out of the system with no intention to return, participation is the only option.<sup>16</sup>

For youngsters nearing the age of involvement in military activities, the age-set system provides an attractive socializing framework. When not yet initiated, groups of young men often accompany raiding parties in their forays into enemy territory. They typically behave as auxiliaries, staying behind the front line and waiting to escort the animals that have been rustled away and chased in the youngsters' direction, while the rest of the warring party engage the enemy.<sup>17</sup> After having acquired some military skills, the now-young men are progressively involved more directly in actual fighting. Members of older age-sets coach the groups of younger men and supervise the latter's involvement by integrating them into military formations. Older warriors have much to transmit to younger generations. Bonds linking mentors and mentees are naturally established between members of senior and junior age-sets.<sup>18</sup> Under the close scrutiny of their elders, the young men expand their abilities to act smoothly in coordinated fashion. Such situations allow age-mates to learn much about each other's abilities. Some are readily recognized as great warriors or gifted strategists but not good fighters. Others are better kept in supporting positions.<sup>19</sup> The age-set naturally adapts its

16. The increasing urban development and the concomitant economic diversification of the Turkana County in the past decade has lowered the cost of exiting the traditional herding economy.

17. Informants being asked about their memory of their earliest involvement in war activities mentioned those first combat experiences. They often joined the raiding party without modern weaponry, carrying the most rudimentary instruments of war (spears, knives, clubs).

18. Those bonds can be strong and are manifested in many aspects of camp life, as this event, which I observed in 1998, illustrates. In addition to the support of his own age-set, a friend of mine (belonging to the *Ngitikotom*, from the *Ngimoru* alternation), engaged in the courtship of his first wife, received the spontaneous backing of the local members of the *Mgimugetom* age-set in an amazing display of strength and endurance. For an entire afternoon, an evening, and a night until early in the morning, the group of men challenged the females of the *adakar* of the future bride to exacting dances, which involve for the men repeated vigorous jumping and forceful singing. My friend was very much involved in the coaching of the members of the new *Ngimoru* age-set soon to be initiated. He was admired by his juniors.

19. Such open acknowledgment of the weaknesses of individuals in combat always surprised me. The recognition of shortcomings does not

internal dynamics on account of the strengths and weaknesses of its members in order to maximize the success of its collective endeavors.

Given the inescapability of warfare, the prospect of being coached into becoming a skilled member of a solidary fighting unit is attractive on two major counts: (1) the set's collective responsibility and (2) monitoring and policing provided by the community of age-sets. (1) Responsibility for success as much as failure is collective, not individual. Despite the extreme dangers involved (e.g., death, long-term incapacitations, wounds in a high-pathogen-load environment), an age-set-generated coalitional aggression is an attractive proposition for Turkana warriors, as it meets two core requirements of the risk contract of war (Tooby and Cosmides 1988). The risks and dangers associated with participation, though real, are randomly distributed among the participants, and the benefits of the aggression are shared fairly.<sup>20</sup> Age-mates are expected to pool their efforts, abilities, and knowledge to achieve their designated objectives. Such contributions to chosen common goals have the potential to enhance the constancy of the performance of the age-set, hence generally assuring a greater likelihood of success. Furthermore, in situations of failure, given the spread of responsibility, individuals' risks incurred are inherently reduced. (2) Age-set members have strong expectations about what are appropriate age-mate behaviors, obligations, duties, and rights. *Ngilukumong* men insist on the important difference existing between relations between friends and coevals. The former are elective affiliations that are based on af-

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come with scorn or anger if it is counterbalanced with other skills or abilities. As much as some are particularly gifted for matters of war (e.g., are good sharpshooters, are bold, are good at strategy), others excel in other things (e.g., courtship, public speaking, herding, cleverness, business sense). Widely shared contempt for an individual is rare. It is typically directed toward individuals who seem to be lacking abilities in essential aspects of life. Those individuals are not successful herders. They ceaselessly request help and support from others without significantly paying back the favors received. They invite themselves to meals at most inopportune moments. They are lousy warriors.

20. Given the strong egalitarian ethos that rules interactions between coevals, when it is excludable, such as in the case of raided animals, the benefit of the coalitional aggression is shared fairly and on the base of merit within the age-set. The ardor in combat, how much one was exposed during the fighting, the number of "hits" one can legitimately claim, or the number of bullets one fired are all elements taken into account to evaluate the merit of a combatant. Note also that once the whole age-set system is brought into the picture, norms of seniority certainly play a role in benefit allocations. Abject exploitation of juniors rarely occurs, though. The grouping in age-sets guarantees that individuals can easily find the support of their coevals to defend their rights. A strategy often adopted by young adult Turkana who have successfully raided animals is to allocate the latter to members of their social network belonging to older age-sets, hence at the very same time building invaluable social capital and preempting unwelcome requests for animals. For an individual to appropriate any good promised to another one is an unacceptable behavior. It can easily lead to a quarrel or open conflict between appropriator and originally designated beneficiary.

finity between individuals. The latter involve some chance (i.e., being born within a definite period) and do not necessitate any particular closeness or liking.<sup>21</sup> How can such nonelective relations be stable? The strength of the age organization rests on collective monitoring and policing (Lienard 2014). If an individual decides not to comply with his duties and obligations as a member of a set, he is likely to expose himself internally as much as externally to reprobation, shunning, direct retaliation, and, sometimes, punishment.<sup>22</sup>

*Age-Set Niche: Impact on Motivation, Behavior, and Decision Making.* An age-set system seems to be particularly well designed for palliating the Turkana unilineal descent groups' inability to supply the military contingents necessary for the defense of the territory and its inhabitants. The institution has had extensive effects on the general layout and organization of the Turkana society. The age-set organization relies on the agglomeration of unrelated men and requires that they properly coordinate to address various military challenges. The allegiances created are distinct from familial and descent group affiliations, hence opening the social world to the benefits of broader cooperation while at the same time containing the exploitation risks associated with the investment in such extensive social exchanges. In brief, in a world of largely economically self-sufficient basic social units, the cross-kin affiliations permit an expansion of the social horizon (Lienard 2014).

The effects of the institution can also be observed at a more fundamental sociological level. The social ecology of the set exerts specific pressures on the behavior of its members. Upon formation of a set, young adults are required to coordinate their action to act as an integrated unit. This constitutes the ideal conditions for the natural emergence of organizational norms that eventually should facilitate the internal coordination of the corporate unit. Distinct hierarchies for different domains of activity emerge rapidly. A soft-spoken individual has great negotiation skills. He is recognized as the go-to person when members of the age-set need such skills, for example, for interceding on their behalf for resolving a conflict, to assess others' opinions, or to suggest a course of action. Another age-mate has been excellent at directing the participation of the age-set in raids. He is granted more say in strategic matters of war. A third one, who has been very successful at finding animals for feasting on, to offer in sacrifice, or to pay off a credit thanks to his social network, the wealth of his family, or through friendship networks, is considered a precious asset and treated as such by members of his set. Other age-mates are

21. Of course age-mates can be and often are close friends. Sharing such life experiences as courtship and raiding facilitate the bonding of individuals. However, given the size of the territorial section-wide contingent for each age-set, it is rather unlikely that an individual would systematically be close to all his coevals.

22. For the specific problem of the age-set as the locus of Turkana raiding norm enforcement, sanction, and punishment, see Mathew and Boyd (2011) and Baumard and Lienard (2011).

good at conflict resolution, dancing, composing song, or courtship. Some have great dexterity and manufacturing skills that can be of help to fix weapons, to carve tools, or to create adornments. Sometimes an individual combines several of these skills. He is typically very popular and constitutes a social anchor to which others gravitate.<sup>23</sup>

The outcome of the set's collective action is ordinarily subjected to the scrutiny of older age-sets, hence providing an added incentive for the development of internal rules of interaction and coordination that best suits the unit, in accordance with its internal composition, to make it as functional as possible. It is in that sense that the age-homogenous set can be seen as a self-organizing unit. The process of integration is facilitated by dispositions and motivations of great evolutionary and developmental significance, such as the known behavioral preferences for engaging with peers and the ability to develop, infer, adopt, and enforce norms.

Age-mates can count on each other to build social capital, to demand respect, to court, to dance, to eat, to fight, to garner animals required for a bride-price, to protest, to relax, to threaten, or to vent anger. The regular conduct of collective action gives set members ample opportunities to appraise the skills, strength, expertise, or shortcomings of each other and to acquire a precise knowledge of everyone's personality. The deep mutual understanding, in turn, facilitates the spontaneous emergence of temporary leadership structures that have the capacity to enhance the efficiency of collective action. The ecology of the set is also likely to have a fundamental dampening effect on extreme behavior. Indeed, in order to maximize efficiency, internal conflict must be controlled. Thus, consensus building is at the heart of the collective decision-making process of the set.

In the undifferentiated social world of the traditional Turkana subsistence herding economy, the likelihood of social agents of similar age to have a frequent overlapping of their respective utility functions is great. Nevertheless, conflicts of interest are bound to occur on a regular basis at any specific time. For example, an individual may feel particularly adamant about mounting a small raid to rustle some cattle. He takes the lead and attempts to convince others to join him in his endeavor. Another member of the set does not wish to take any risk at the present time. All members would certainly benefit from stolen animals, which could be strategically used to increase their respective status and social visibility (i.e., by giving animals to other men) or to start their own personal herd.<sup>24</sup> Given how interwoven age-mates' fortunes are, everyone has much information about every other mem-

23. Such an individual is easily identifiable, even for an outsider. He has more influence in debates than his coevals. At sacrificial feasts, more individuals share their meat with him (coevals or otherwise). And if he is a younger lad, his presence is widely courted by his age-mates, and he gets much more consideration from his seniors than his coevals do.

24. Discussion with informants made clear that these are indeed major concerns that youngsters have. A family herd is typically under the tight

control of a pater, limiting greatly the access younger men have to animals for achieving personal objectives. Starting one's herd and establishing as large a social network as possible that can be activated in the future are crucial first steps for a young man at the onset of adulthood if he is to be able to marry and start and support a household later in life.

ber of the group and an extensive knowledge of the cooperative history of the set. In such a context, varying utilities at a specific time should not be much of a hurdle to overcome if enough members judge that the collective endeavor is worthwhile. The support provided to the adamant individual will be paid back eventually in the form of help for another collective endeavor favored by another member of the group, and so on. An unwilling individual certainly incurs a cost by agreeing with the general consensus, but his decision will inevitably lead to a return of the favor, which might involve a consensus for which the cost might be born by our intrepid warrior. The dynamic is so well understood by age-set members that exchange within close-knit units of coevals sometimes leads to competitive generosity (particularly at ritual feasting when meat is shared between the participating men). Once again the pooling of efforts and investments that occur within the set allows for imagining more extensive investment in the buildup of future cooperative endeavors that eventually bring increased benefits to all members.

As already alluded to above, age-sets are relevant to many different institutions. Political and ritual participations, social pleading, public courtship, collective dancing, sanctioning, acquisition of resources, getting married, social capital building, internal conflicts and feuding, and so forth, are all endeavors that are likely to involve at some point groups of age-mates either required to act together as units or volunteering their support, backing or, mediation. In fact, most collective actions are likely to evoke the existing age-set structure even if they were not started with the intention of involving age-set groupings. The age-set system seems to be particularly well suited to organize fast coalitional responses in situations of external conflict, but the close extensive male solidarity bonds that the system generates provide positive externalities for all participants as evidenced by the preeminence of the involvement of age-sets in so many collective activities.

### What of the Future?

Spencer (1998b:181–183) sees a fundamental incompatibility between the growth of the market economy and age systems. A market economy comes with greater differentiation of the social world, increased individual specialization, and a diversification of the channels of social mobility. New educational paths, business opportunities, and employments make it easier for individuals to escape traditional networks. In sum, a market economy brings choice. The younger generations are usually better suited to integrate the new economic organization, to extract benefits from their new insertion away from their traditional affiliations, and to gain some affluence thanks to

control of a pater, limiting greatly the access younger men have to animals for achieving personal objectives. Starting one's herd and establishing as large a social network as possible that can be activated in the future are crucial first steps for a young man at the onset of adulthood if he is to be able to marry and start and support a household later in life.

their participation in the cash economy. This generally leads to a well-known reversal of traditional hierarchies. The rapid institutional substitution accompanying the growth of the market economy accentuates the irrelevance of age groupings in the new economic, political, and social reality of the modern nation-state (Kurimoto and Simonse 1998*b*; Spencer 1998*b*).

Until recently large segments of the Turkana population were occupying similar cultural niches and had very similar life trajectories. Assembling and maintaining cohorts of individuals sharing identical occupational focuses, general incentives, motivations, longings, and desires was not much of a hurdle. The Turkana are now quickly embracing modernity. For many in the younger generations, participation in the age-set system will fast become much less compelling thanks to the new institutional framework being systematically implemented in the Turkana region. In the modern context, age parsing does not guarantee anymore that groups will be cohesive—based on the similarity of incentives, goals, and aspirations of its members—as they used to be not long ago. That transformation can best be observed in the various permanent settlements that have been quickly developing in the Turkana County. Increasingly, children and teenagers are being schooled. Some proceed to higher education. Others may start or join a family business or join the emerging blue-collar workforce. Already relative age does not correlate systematically anymore with station in life in that highly fragmented and socially differentiated modern world. The Turkana are now poised to progressively participate more in the national economy, which will make the age-set polity of no relevance for the internal organization of the society.

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# What Explains Patrilineal Cooperation?

by Beverly I. Strassmann and Nikhil T. Kurapati

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Evolutionary anthropologists have proposed that unilineal kinship promotes collective action and that patrilineal cooperation occurs when the reproductive payoff from passing wealth to sons is greater than that for daughters. We assess both of these theoretical perspectives as well as indirect reciprocity and kin selection as possible contributors to patrilineal cooperation in the Dogon of Mali. The mean coefficient of relatedness for males ( $N = 4,724$ ) in 31 Dogon patrilineages is  $r = 0.03$ , which is very low (akin to second cousins). However, relatedness in the 638 work-eat groups (WEGs) that make up the patrilineages is very high ( $r = 0.32$ ), or greater than for half siblings. Indirect reciprocity and collective action explain cooperation among fictive kin in the patrilineage as a whole: the old men at the apex of the lineage help to stabilize cooperation by using their gerontocratic authority to punish cheaters. However, kin selection is a more useful theory for explaining cooperative behavior within WEGs, and both quantitative data and informants' statements show that WEGs are the more important unit for economic activity and family life. As expected for a patrilineal society, the Dogon derive a greater reproductive payoff from passing land and livestock to sons than to daughters.

Patrilineal descent was practiced in 47% of the 857 societies in Murdock's *Ethnographic Atlas* (Murdock 1967). Patrilineages are unilineal descent groups in which membership is passed from father to son down the male line from a common founding ancestor. Although kinship and descent is an old topic, it is one that has been revitalized by theoretical and empirical progress in evolutionary anthropology (reviewed in Shenk and Mattison 2011). We begin by highlighting theory on unilineal descent and patrilineal cooperation with particular attention to functionalist interpretations. We consider norms that establish unambiguous group membership (Murdock 1949), the need to solve collective action or coordination problems (Alvard 2003, 2011; Nolin 2011; Van den Berghe 1979), reproductive payoffs from passing wealth to sons versus daughters (Hartung 1982; Holden, Sear, and Mace 2003; Mattison 2011), paternity certainty (e.g., Strassmann et al. 2012), indirect reciprocity (Alexander 1987), and inclusive fitness (Hamilton 1964a, 1964b). Our goal is to determine whether any of these theoretical perspec-

tives help us understand patrilineal cooperation in the Dogon of Mali, West Africa.

## Theory on Patrilineal

### *Collective Action*

Cultural anthropologists of the twentieth century argued that unilineal descent creates corporate kinship groups with unambiguous group identity (Evans-Pritchard 1940; Fortes, Evans-Pritchard, and International Institute of African Languages and Cultures 1940; Murdock 1949:60–61; reviewed in Alvard 2003). When descent is patrilineal, every man belongs to the lineage of his father; this simple rule of group identity obviates the actual complexity of kin relationships. Only full siblings share the identical network of genetic kin as they alone share both parents. Other sets of kin, such as half siblings and cousins, share some genetic kin but not others. Half siblings share only one parent; first cousins share only one or two of their four grandparents (depending on whether their parents are half or full siblings). Unilineal descent enables a large group to form with nonoverlapping membership and a clear norm as to who belongs and who does not.

Anthropologists have proposed that corporate kinship groups created by unilineal descent promote political solidarity in the context of interethnic strife and warfare (Ember, Ember, and Pasterna 1974; Otterbein and Otterbein 1965; Sahlins 1961; Service 1962) or in the context of the cooperative defense of resources (Goody 1962; Lowie 1920; Radcliffe-Brown 1935). In modern evolutionary terms, unilineal de-

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scents systems help to solve collective action problems (Alvard 2003). It is difficult to organize kin for the purpose of collective action under a kindred system, in which descent is reckoned bilaterally, because of genetic conflicts of interest between kin who share different sets of relatives (Van den Berghe 1979). Alliances would be unstable, and expectations about the persons with whom one should affiliate would diverge and lack uniformity (Nolin 2011). According to Van den Berghe (1979), belonging to a lineage, and sharing in the rewards of collective action, is a small price to pay for not being able to share lineage membership with the totality of one's genetic kin.

Alvard (2003) investigated these ideas in the whaling community of Lamalera, Indonesia, where descent is reckoned patrilineally. He asked whether genetic kinship or lineage membership is more salient in explaining the composition of whaling crews. He found that lineage membership was 2.5 to 4 times more important than genetic kinship. In the Lamalera, whaling crews required 11 persons on average, and the size of sibships was too small for brothers to make up an entire crew. Lineages, on the other hand, were large enough to furnish the requisite man power. Alvard (2003) concludes that the Lamalera data are consistent with Van den Berghe's collective action hypothesis.

Whereas genetic kinship was less important than lineage membership for joining a Lamalera whaling crew, the reverse was true for affiliation during a Yanomamö axe fight. In the Yanomamö, genetic kinship explained 15% of the variation in affiliation between the parties, whereas 2% was explained by affinal relationships, and 0% was explained by lineage identity (Chagnon and Bugos 1979). Similarly, in the Lamalera, genetic relatedness is a better predictor of food sharing by households than is lineage membership (Nolin 2011). It appears that whether lineage membership or genetic relatedness is a more important predictor of affiliation is context dependent (Alvard 2003, 2011; Nolin 2011).

#### *Patriliny or Matriliney?*

Unilineal descent might be helpful for creating corporate kin groups and solving particular types of collective action problems, but additional theory is needed for understanding the form of unilineal descent: patriliney or matriliney. Under patrilineal descent, wealth is passed from fathers to sons, which is an adaptive strategy when wealth enhances the reproductive success of sons more than that of daughters (Hartung 1982; Trivers and Willard 1973). When there is greater variance in male than in female reproductive success, sons have higher potential reproductive success. For example, if a son has more than 40 surviving offspring with multiple wives and a daughter has a maximum of 10 offspring, then the reproductive payoff for a son is four times higher than that for a daughter. Under these circumstances, passing wealth to sons so that they can be polygynous is a better strategy than passing wealth to daughters. A daughter can experience only one pregnancy at a time, whereas

a son can potentially impregnate multiple wives almost simultaneously (Trivers 1972). Cross-culturally, the males who succeed at being polygynous tend to be wealthier than monogamous males, and they tend to have more offspring because of their extra wives (Betzig 2012; Hartung 1982; Irons 1979, 1998; Nettle and Pollet 2008). It is not surprising, therefore, that in polygynous societies parents preferentially pass wealth to sons (Hartung 1982).

Another factor influencing the costs and benefits of passing wealth to sons or daughters is the risk for cuckoldry—defined in evolutionary biology as investment in genetically unrelated offspring (Trivers 1972). A son can potentially be cuckolded if his wife is unfaithful, whereas a daughter physically gives birth, which means that she cannot be cuckolded. Wealth passed to a daughter, however, may be appropriated by the daughter's husband or father-in-law and used to support reproduction by these men with other women. Thus, wealth inherited by a daughter will not necessarily stay with the daughter's genes. In predicting whether a society will practice matriliney or patriliney, the two risks—one for the son and the other for the daughter—need to be taken into account.

Holden, Sear, and Mace (2003) formulated a model to predict whether wealth should flow to sons or daughters for maximum reproductive advantage. Their model considers two factors: (1) the probability of paternity,  $P$ , and (2) the relative benefits of a unit of wealth for a son's reproduction,  $B_s$ , and a daughter's reproduction,  $B_d$ . They argue that when  $B_s = B_d$ , parents should invest equally in sons and daughters. However, because sons may not be the genetic fathers of their wives' offspring, the benefits of a unit of wealth for son's reproduction must be devalued by the probability of paternity,  $P$ . Investment in sons and daughters should be equal when  $B_s \times P = B_d$ , which, after rearranging, is the same as  $B_s/B_d = 1/P$ . When  $B_s/B_d > 1/P$ , then it is more adaptive to pass resources to sons, and when  $B_s/B_d < 1/P$ , then it is more adaptive to pass resources to daughters. Thus, wealth inheritance by sons is adaptive if the additional benefit of resources to sons is sufficient to compensate for the risk of cuckoldry (Holden, Sear, and Mace 2003).

Although this model is elegant and an advance over previous theory, we suggest that it should include a third factor,  $D$ , defined as the probability that wealth passed to a daughter supports her reproduction instead of being diverted ( $D$ ) to support that of other women in her husband's family. Thus, investment in sons and daughters should be equal when  $B_s \times P = B_d \times D$ ; investment should be biased to sons when  $B_s \times P > B_d \times D$ ; investment should be biased toward daughters when  $B_s \times P < B_d \times D$ . Most matrilineal societies do not actually pass wealth to daughters but instead pass it to sister's sons, a practice that reduces the risk,  $D$ , that wealth will be diverted by a daughter's husband or father-in-law.

Holden, Sear, and Mace (2003) point out that their model can explain the association of patriliney with high paternity certainty and matriliney with low paternity uncertainty in cross-cultural studies (Alexander 1974; Flinn 1981; Gaulin and Schlegel 1980; Greene 1978; Hartung 1981, 1985; Kurland 1979). They also

emphasize that patriliney and matriliney have different ecological associations because different kinds of resources are able to benefit the reproduction of sons more than daughters (Holden, Sear, and Mace 2003). For example, animal husbandry is associated with patriliney because in many societies sons can use livestock for bride wealth, whereas livestock inherited by daughters might be used by their husbands to acquire additional wives (Holden, Sear, and Mace 2003). Land has greater benefits for sons if it can be used to support polygyny or if a man without land is unable to attract a wife (Holden, Sear, and Mace 2003).

Holden, Sear, and Mace (2003) tested their model in two African societies, the patrilineal Gabbra and the matrilineal Chewa. In support of their hypothesis, the patrilineal Gabbra derived about three times as much reproductive benefit from wealth invested in sons compared with daughters, whereas there was no sex difference in the benefits of investing wealth for the matrilineal Chewa. In a follow-up study of the matrilineal Mosuo of southwestern China, the effect of land on reproduction was similar for sons and daughters, and daughter-biased inheritance was the norm (Mattison 2011).

The foregoing perspectives suggest two parallel, albeit non-mutually exclusive, evolutionary approaches to the question of what explains patrilineal cooperation. Van den Berghe (1979) and Alvard (2003) follow a tradition that emphasizes the benefits individuals derive from collective action, whereas Holden, Sear, and Mace (2003) emphasize paternity certainty and the relative advantages of son- versus daughter-biased inheritance in different ecologies. Other evolutionary perspectives that might shed further light on patrilineal cooperation are also possible, such as indirect reciprocity (Alexander 1987) and inclusive fitness theory (Hamilton 1964a, 1964b).

#### *Reciprocity and Inclusive Fitness*

Alexander (1987) developed the concept of “indirect reciprocity” to refer to situations in which beneficial acts are directed toward individuals who have been observed cooperating with others. According to Alexander, “reputation” is the means by which cheaters are identified and discriminated against. Nowak and Sigmund (1998) presented a mathematical model of indirect reciprocity that supported Alexander’s verbal arguments. The role of direct (Trivers 1971) and indirect (Alexander 1987) reciprocity in the evolution and maintenance of cooperation in humans is widely accepted (reviewed in West, El Mouden, and Gardner 2011); however, it has not previously been invoked to help understand why the members of patrilineages cooperate with each other.

Hamilton (1964a, 1964b) showed that natural selection will favor genes or traits that promote an individual’s “inclusive fitness.” Under Hamilton’s Rule, a behavior will be favored by selection if  $rB > C$ , where  $r$  refers to the coefficient of relatedness between ego and alter,  $B$  refers to the benefits to alter, and  $C$  refers to the costs to ego (Hamilton 1963, 1964a, 1964b, 1970). As stated by West, El Mouden, and Gardner (2011:233), “inclusive fitness is not just an accounting method, it is the

component of reproductive success an organism can influence and what organisms should appear to be maximizing.”

Theory relevant to understanding patrilineal cooperation is wide-ranging. In the foregoing discussion we briefly highlighted a few of the potential theoretical elements: norms that establish unambiguous group membership, the need to solve collective action or coordination problems, reproductive payoffs from passing wealth to sons versus daughters, paternity certainty, indirect reciprocity, and inclusive fitness. We now turn to a case study of the Dogon of Mali. We ask the following questions: What is the basis for cooperation in Dogon patrilineages? Which of the foregoing arguments are applicable? What new syntheses or modifications of existing theory are needed? Before attempting to answer these questions, it is helpful to consider the main features of Dogon ethnography that are critical to understanding patrilineal cooperation, namely, subsistence, social structure, political authority, marriage, and religion. After establishing the ethnographic context, we present the methods and results of a more fine-tuned effort to discover what the men in Dogon patrilineages are cooperating over and why.

## Ethnography

### *Subsistence*

Traditionally, the Dogon lived along the Bandiagara Escarpment in villages built along the scree slope or higher up on the plateau on exposed rock near to water sources and arable land (Bouju 1984). During the colonial period of the mid-twentieth century, after the threat of slave raiding had diminished, the Dogon established villages along the Seno-Gondo plains to the east of the escarpment (Huet 1994). During the rainy season, they use iron hoes fashioned by the local blacksmiths to cultivate cereal crops (millet, sorghum, rice, and fonio) (Bouju 1984:127–128; Huet 1994; Paulme 1940). In the cool dry season, villages that have a durable water source grow onions as a cash crop, and the revenues are used to purchase millet after poor cereal harvests caused by drought, locusts, or poor soils (Strassmann and Warner 1998). The Dogon practice animal husbandry on a small scale compared with nearby pastoralists such as the Fulani, who are cattle herders. The main livestock for the Dogon are sheep and goats, although wealthier families might own cattle (Strassmann and Warner 1998).

### *Social Structure and Political Authority*

The Dogon have three castes: farmers, blacksmiths, and leatherworkers; some villages also had slaves until the famines of the early twentieth century (Jolly 2004:438; Paulme 1940). The fundamental family unit for the Dogon is the work-eat group (WEG), defined as the people who work together in the millet fields during the rainy season and who eat from the same harvest (Strassmann and Warner 1998; see also Bouju 1984:90–92, 153). WEGs have two or three generations of living males plus their spouses and children. Members of a WEG respect the

directives of the WEG boss, called the *gini gono ku banga*. WEG bosses have considerable authority because they are the patriarchs who make the day-to-day decisions and direct the labor of the people who work together in the cereal fields. The rule that determines the identity of the WEG boss is simple: he is the eldest male in the WEG. Throughout Dogon country, WEGs are nested in patrilineages (*gini*) that are nested in villages (*ana*) that are nested in clans (*tige*) and tribes. According to mythology, the ancestors of the four Dogon tribes were brothers who arrived together from Mande (Huet 1994).

Above the level of WEG boss, male authority is vested in the oldest man of the lineage. This elder has a more important religious role than the WEG boss because he is responsible for rites associated with worship of the male ancestors shared by the lineage, including the performance of sacrifices and maintenance of the ancestral house for the lineage, known as the *Gina* (Strassmann informants). The eldest of the lineage heads is the most powerful person in a Dogon village. Strassmann observed this high elder exhorting people to participate in collective actions associated with small development projects that she organized at the people's behest (e.g., a dam, a dike, a road, and a well). She also observed him standing on his rooftop and announcing that livestock needed to be penned to stop them from eating young shoots of millet.

The concept of village chief was introduced by the Toucouleur and the French to enable the collection of a head tax; the imposition of chiefs to assist the colonial government to collect taxes was a pattern that prevailed throughout francophone Africa (Manning 1998). Although chiefs interacted with colonial officials and, after independence in 1960, with functionaries of the Malian government, they have less power in internal matters than lineage elders; importantly, chiefs enjoy no special rights to land.

### Marriage

Traditionally, Dogon spouses came from different lineages (Paulme 1940) although strict exogamy is no longer the rule. Over at least the past 30 years or longer, no formal exchange of women between lineages has occurred at the study site. The Dogon are polygynous, and the custom was for men to have up to two wives at one time or, more rarely, three (Paulme 1940). However, under the influence of Islam, a few men now have four wives (Strassmann 2003). A more in-depth discussion of Dogon marriage (Bouju 1984:57–63; Paulme 1940) and the reproductive consequences of polygyny can be found elsewhere (Strassmann 1997b, 2003, 2011).

### Religion

The Dogon have one god, *Ama*, and their religion is integrated with the agricultural cycle (Strassmann informants). Spiritual appeals for continued subsistence occur at the *Bulo*, a time for sacrifices to ask God for a good rainy season and a plentiful harvest. The *Bulo* occurs at the approach of the rainy season in

late May or June and is marked by sacrifices of blood or millet porridge at the altars to *Ama* and the shrines for the cults of *Binu*, *Yomoru*, and *Lebe* (Bouju 1984:139; Calame Griaule 1968:49; Griaule 1940; Strassmann informants). Only men perform sacrifices or practice the rites associated with these cults. Young boys don a mask of leaves from a particular tree (*Lannea acida*) and chase their juniors (and little girls) with a whip (Bouju 1984:142; Griaule 1938:271; Pern, Alexander, and Time-Books 1982). Men dance with umbrellas or other props, such as the fur of wild animals. The Dogon New Year, called *Goru*, is celebrated at the end of December and is the time to thank God for the millet harvest. During *Goru*, there are sacrifices at the ancestral house of the lineage (the *Gina*), when millet beer, millet porridge, or chicken blood is poured over the *Wageun*, which represent the ancestors. The oldest lineage head of the village is the first and foremost person to offer benedictions for the new year (Strassmann informants).

The other main religious events are the *yimi yana* (funerals) and *dama*, which usually take place in April and early May, respectively. Masked dancing is performed at both, although on a costlier and grander scale for a *dama*, which signifies the lifting of mourning for a deceased man. The Dogon ceremonies (*bulo*, *goru*, *yimi yana*, and *dama*) require the preparation of millet beer and food and are occasions for socializing and hosting large numbers of visitors. A *dama* is an event in which the old men are in charge and the whole village participates—the women as spectators and in service roles such as preparers of food and millet beer (Strassmann informants). The *Sigi* happens every 60 years and begins in the village of Yougo Dogorou, then goes from village to village (the next one will begin in 2027). In the *Sigi*, men of multiple villages line up by age to dance in the formation of a giant snake, the *Lebe* (Griaule 1948). In males, power and rights to land increase directly with age (Bouju 1984), and the *Sigi* underscores the male age system. Informants stated that a man who tries to jump the queue will die. A *dama* cannot be performed for a man who has not participated in a *Sigi*. Moreover, until a man's *dama* has taken place, his soul cannot join the ancestors during the *goru* rites. At the study site, the Dogon religion was still vibrant throughout the 1980s; it is now more localized, and Islam is rapidly winning converts (Strassmann et al. 2012).

## Methods

### Study Site

The study population consisted of 9,675 people who belong to one clan that lives in 12 villages on the Bandiagara Escarpment in Central Mali. To protect subject anonymity, we are withholding identifying information about the population. Informed consent was obtained from each participant, and this study was approved by the village elders, the Malian government, and the University of Michigan Health and Behavioral Sciences Institutional Review Board (H03-00001208-R2). For two and a half years (1986–1988), Strassmann lived in a small

house in one of the 12 villages, and by 2015 she and her team from the University of Michigan had conducted more than 10 person-years of fieldwork. The research was carried out from a base in the original study village, and the 11 other villages were accessed on foot, as they are within 4 km. French is the official language of Mali, but it is not widely spoken at the field site. Hence, Strassmann conducted most of her fieldwork in a dialect of the Dogon language called Tòro Sò.

#### *Calculations of Relatedness*

Patrilineal pedigrees were generated from oral histories (Strassmann et al. 2012; CA+ online supplement A). Kurapati wrote a program in Python (ver. 2.7, 64 bit, <http://www.python.org>) that reads a .csv spreadsheet that contains data for each individual in each patrilineage: person's ID, father's ID, mother's ID, patrilineage ID, WEG ID, sex, year of birth, and survival status in the year 2015 (alive or dead). For each pair of living males belonging to the same patrilineage, the algorithm identifies, in a nonredundant fashion, all the different ancestors that each pair has in common and calculates their coefficient of relatedness through each unique closest common ancestor. The program also separately calculates relatedness through closest common ancestors that are male versus female. The mean relatedness for each patrilineage is the average relatedness across all pairs. For the WEG relatedness calculations, the program similarly calculates and averages the relatedness between all possible pairs of living males belonging to the same WEG. The program is publicly available at [https://github.com/ntkurapati/relatedness\\_analysis](https://github.com/ntkurapati/relatedness_analysis).

#### *Village Map*

A map was made in 1986 of the village of 460 residents that Strassmann lived in during her fieldwork in the 1980s, and it is published here for the first time. Distances were estimated by counting paces between points after calibrating the researcher's number of paces per meter using a retractable metal tape measure. Compass bearings were used for the calculation of angles. At that time GPS was not yet available for use in research. The map has not been updated to reflect changes occurring after 1986 because we are more interested in the historical situation than recent influences from outside.

#### *Field Measurements*

Fields were measured using a compass to determine angles and a meter tape and pacing to measure the sides (CA+ supplement A; Strassmann and Warner 1998). The results have been used in the calculation of a wealth variable that has been used in statistical models in several publications (e.g., Strassmann and Warner 1998). Here we go beyond this earlier work by providing more information about land and crops and their control by lineages.

## Results

### *Residence*

Coresidence is one manifestation of cooperation. Evidence that the men of a lineage live together would therefore strongly suggest that they are also cooperating. Hence we tested the hypothesis that the compounds of WEGs of the same lineage are closer together to each other than they are to WEGs of other lineages in the same village. As shown on the map (fig. 1), we found that this expectation was supported: the WEGs of lineages 1, 3, and 4 are segregated in their own neighborhoods of the village.

The prediction was only partially supported for lineage 2, which is exceptionally small and had only four married males who lived amid lineage 1. Based on the residential proximity between lineages 1 and 2, one might predict greater cooperation between these two lineages than for lineages living farther apart, such as lineages 1 and 4. The map also suggests that lineage 4 is less integrated with the other lineages of the village because it is the only lineage for which no compound abuts a compound of another lineage. The lesser integration of lineage 4 predicts that it might also be less integrated in other realms, such as land ownership and religion (see below).

Three out of 64 (5%) of married men lived matrilocally with their mother's brother, and the rest lived patrilocally. Matrilineal residences are noted on the map by a *d* next to the WEG number (fig. 1). These men were exceptional in that they were better integrated with their matriline than their patriline. Based on physical proximity, the anthropologist (Strassmann) was more integrated with lineage 1 than with the other lineages. She lived in a house (*j*) that belonged to lineage 1, and she was considered a daughter of a man in lineage 1 who was also the chief of the village.

### *Genetic Relatedness*

Knowing the genetic relatedness of the men of a lineage and a WEG is helpful for understanding the potential for kin selection to operate at either or both of these two levels (Hamilton 1964a, 1964b). The overall mean coefficient of relatedness between the males ( $N = 4,724$ ) in the 31 patrilineages was  $r = 0.030$  (SEM = 0.0004). This value ranged from  $r = 0.006$  in the largest patrilineage with 587 living males to  $r = 0.150$  in the smallest lineage with only five living males (fig. 2A). The mean relatedness through male ancestors was 0.023 (SEM = 0.0003) and through female ancestors was 0.008 (SEM = 0.0001); thus, 75% of the overall relatedness was through male and 25% through female ancestors. The foregoing analyses imposed no age restriction and instead included all living males in the lineages. Restricting the analysis to males born before 1980 who were at least 25 years of age did not greatly alter the results. The mean coefficient of relatedness between adult males (age 25 years and older) in the 31 patrilineages was  $r = 0.028$  (SEM = 0.0005) and the percent relatedness through male and female ancestors was 73% and 27%, respectively.

## A Dogon Village:

## Proximity of residence by patrilineage and work-eat group (WEG) membership

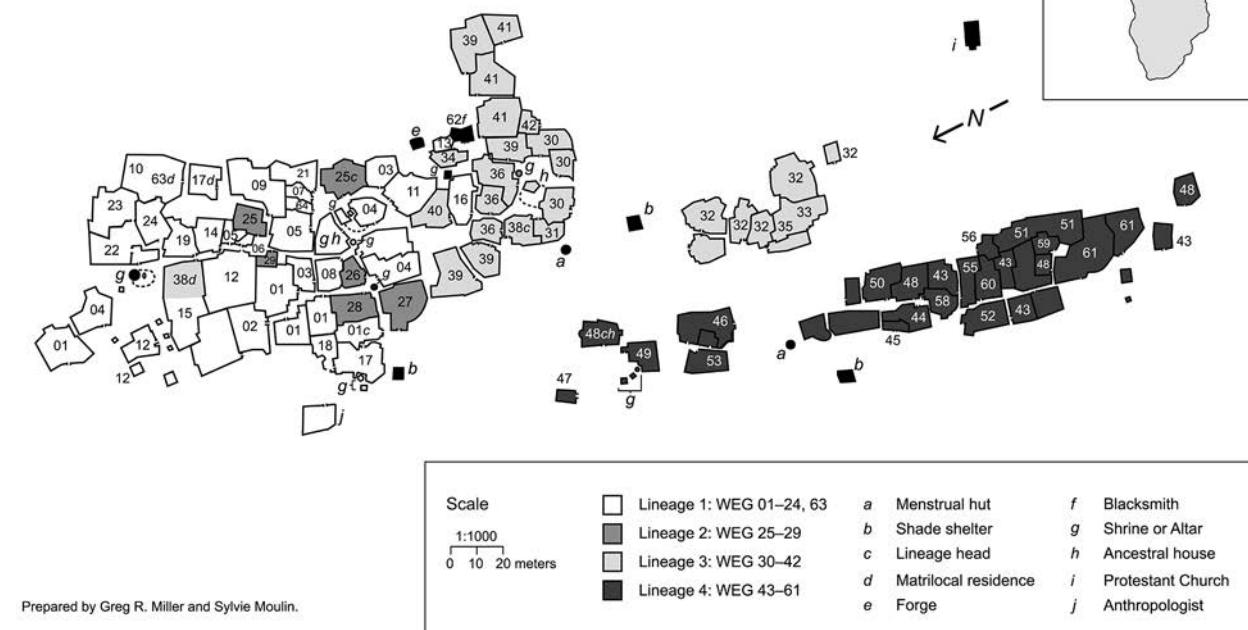


Figure 1. Map of the primary study village showing proximity of residence by patrilineage and work-eat group (WEG) membership. A color version of this figure is available online.

The 31 lineages were made of 638 WEGs. Whereas the mean relatedness of the males in the 31 patrilineages was very low, the mean relatedness of males belonging to the same WEG was high (figs. 2B, 3). The overall mean coefficient of relatedness between the living males (of all ages) in WEGs was 0.316 (SEM = 0.002; fig. 3). The mean number of living males per WEG was 7.3 with a range of 2–44, and the mean number of females in these same WEGs was 7.4 (range 0–63). As our focus was on the relatedness between males, we omitted WEGs from all analyses if they had <2 living males. The largest WEG in the 12 villages had 106 living people (43 males and 63 females). If the analysis was restricted to persons born before 1980, the overall coefficient of relatedness between the living males was 0.274 (SEM = 0.002).

In summary, the mean relatedness of males belonging to the same patrilineage was 0.03, indicating a separation by five meioses (generations) on average (see Hill et al. 2011; Lukas et al. 2005). The mean relatedness of males belonging to the same WEG was 0.32, which is slightly over two meioses and is higher than the average relatedness of half brothers ( $r = 0.25$ ; fig. 3). Thus, mean relatedness within lineages is very low, but mean relatedness within WEGs is high. We also compared the Y STR haplotypes for the men of the four lineages in the primary study village. The men of the four lineages have essentially the same haplotype, with differences at only one or

two of 14 loci that were consistent with mutation (Strassmann et al. 2012).

### Defense

Corporate kinship groups created by unilineal descent have been hypothesized to promote political solidarity in the context of interethnic strife and warfare (Ember, Ember, and Pasterna 1974; Otterbein and Otterbein 1965; Sahlins 1961; Service 1962). Before colonial times, Dogon villages were situated in defensive locations that were meant to thwart Mossi, Fulani, and Toucouleur slave raiders who saw the Dogon as desirable prey because they were not Muslim (Bouju 1984:20; Huet 1994:53–63). The village in figure 1 is hidden by a rocky mount to the east and to the north; to the west it is protected by a gorge. Informants referred to it as a “hidden village.” They said that in the nineteenth century the people of lineage 4 lived for a time on the other side of the gorge, where their old house footings are still visible, but after losses to slave raiders they came back to the present side.

Dogon villages are also known for architectural features that serve the purpose of defense, including narrow streets that twist and turn to thwart cavalry and confuse strangers (Bouju 1984; Huet 1994:98). These features are evident on the map in figure 1. Villages built on the talus of the cliff can be steeply sloped and full of boulders, making them even

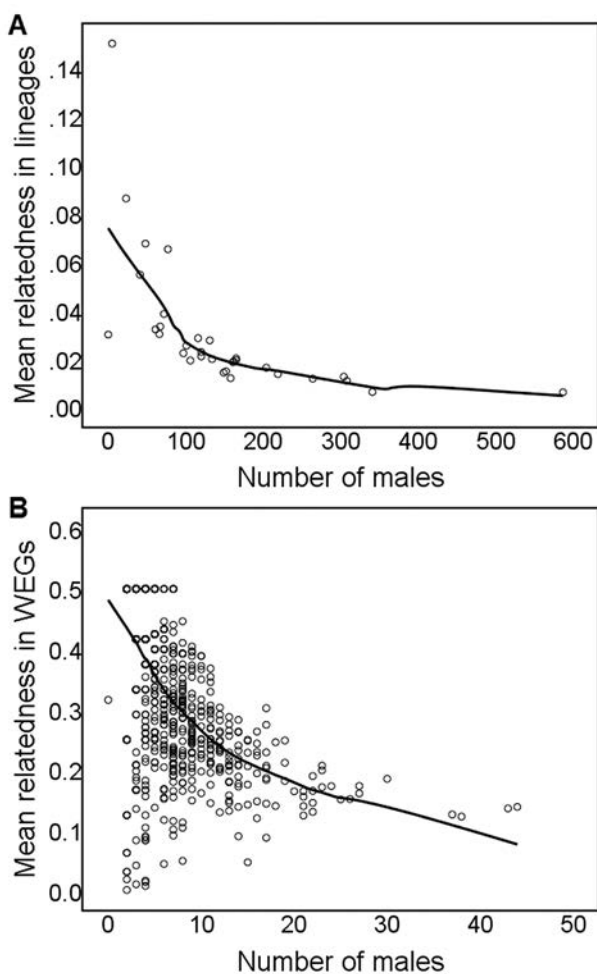


Figure 2. Mean relatedness in lineages (A) and work-eat groups (WEGs; B) by number of living males present in the lineage and WEG, respectively. The curves were fit using Loess nonparametric regression (Cleveland and Devlin 1988).

more difficult to attack (Cazes 1993). In sum, village location and architecture played an important role in defense. We interviewed informants to find out whether lineages played a role in the defense of persons during slave raids. Informants said that lineages played no role; instead, each person would individually seek to hide in bushes, caves, and in secret rooms hidden in the older houses. The raids came unexpectedly and took people by surprise.

#### Land Ownership

It has been hypothesized that the members of unilineal descent groups cooperate in the defense of land (Goody 1962; Lowie 1920; Radcliffe-Brown 1935). To begin our scrutiny of this hypothesis, we considered the different kinds of crops cultivated and the number and area of fields for each of the four lineages in our primary study village. Ac-

cording to our data, the village cultivated a total of 538 fields in 1986, including 244 millet fields, 63 fields sown in millet and sorghum, 36 sorghum fields, 93 fonio fields, and 102 rice fields (fig. 4A). The area of the 538 cereal fields was 137 hectares. In 1986, the population of residents (excluding both transient visitors and the four-person blacksmith family) was 456 people. The hectares cultivated per person for lineages 1, 2, 3, and 4 were 0.28, 0.27, 0.34, and 0.25 hectares per person, respectively. Overall, a mean of 0.3 hectares was cultivated per person.

Areas under cultivation—as well as rocks, streams, and other topographic features—have names. The 137 hectares of cereal fields were at 94 different named locations, and in the dry season, onions were cultivated on 4.4 hectares of gardens at 17 different named locations (fig. 4B). The most common pattern was for the cereal fields at a given location to be owned by only one of the four lineages (fig. 5A). The next most common situation was for two lineages to cultivate fields at the same location. It was rare for three or four lineages to farm fields at the same location (fig. 5A). The total area cultivated at locations that had two lineages was larger than at locations that had one lineage and was much larger than for locations that had three or four lineages (fig. 5A).

We tested the hypothesis that two pairings were more common than expected by chance: lineage 1 with 3 and lineage 1 with 2. This hypothesis was based on knowledge that the women of lineages 1 and 3 share a single menstrual hut (see map in fig. 1) and that lineages 1 and 2 reside in the same neighborhood of the village (fig. 1). The results support the hypothesis that lineages 1 and 3, but not lineages 1 and 2, were more likely than expected by chance to farm at the same location (fig. 5B). Thus, the data on fields support the expectation that lineages 1 and 3 are affiliative. Lineage 3 also farmed less land than expected by itself (fig. 5B). We also tested the hypothesis that lineage 4 was less likely than expected by chance to farm where the other lineages were also farming. This hypothesis was based on the knowledge that lineage 4 is physically farther separated from the other

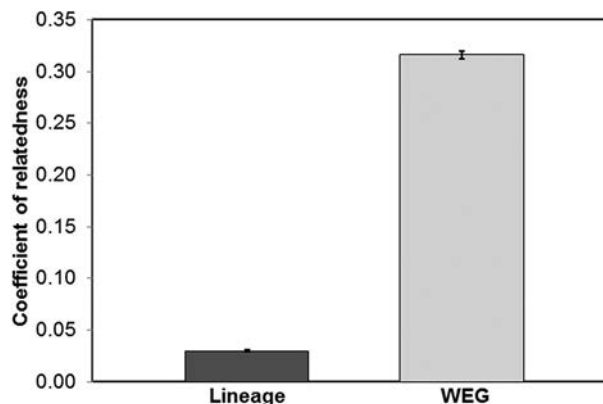


Figure 3. Comparison of the mean ( $\pm 2$  SEM) coefficient of genetic relatedness for males in lineages and WEGs (work-eat groups).



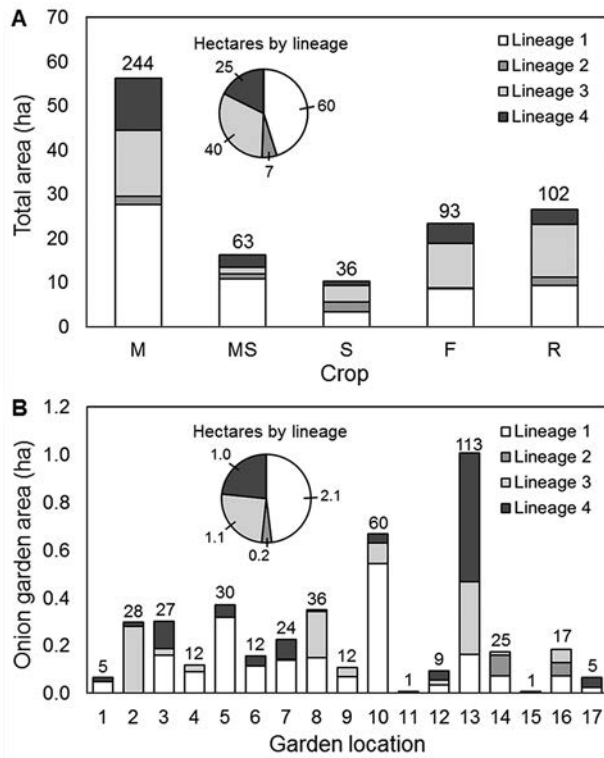


Figure 4. A, Total area (ha) farmed by each lineage for each crop. M = millet; MS = millet and sorghum; S = sorghum; F = fonio; R = rice. Numbers above the bars refer to the total number of fields planted in each type of cereal crop. The pie graph shows the total area farmed by each lineage across all crops. B, Total area (ha) of onion gardens farmed by each lineage at each garden location. Numbers above the bars refer to the total number of onion fields farmed at each location. The pie graph shows the total area of onion gardens for each lineage across all locations. A color version of this figure is available online.

lineages of the village (fig. 1). The results confirm that lineage 4 does farm more area by itself than expected by chance (fig. 5B). Thus, lineage 4 is less affiliative with the other lineages in regard to land.

In sum, most locations for cereal crops are farmed by the members of only one lineage, implying that the lineage that cultivates a given site has been able to defend it and keep out unwanted members of other lineages. The two lineages that were most often farming at the same location were lineages 1 and 3. When we queried informants about this result, they attributed it to the fact that the founders of these two lineages were full brothers. Ethnographers have reported that full siblings are much more affiliative than half siblings in the Dogon (Bouju 1984:47; Strassmann 2011).

*Land Inheritance*

The land of the primary study village is under four different kinds of ownership with different implications for inheritance. The types of ownership and the approximate per-

centage of the total area of land farmed by ownership type are as follows: intervillage fields <1%, lineage fields 24%, lineage segment fields 11%, and WEG fields 64%.

Intervillage fields are owned by three lineages in the primary study village (lineages 1, 3, and 4) and four lineages in two nearby villages that trace ancestry to the same person. He was a great hunter who originally came from another village where he had committed a murder, causing him to be expelled and forced to found his own lineage. Lineage fields are owned by an entire lineage and are near to the family compounds for that lineage in a village. Lineage fields trace back to the earliest days of the lineage when land was more plentiful and people did not have to walk any distance to farm. Together with the intervillage fields, they are among

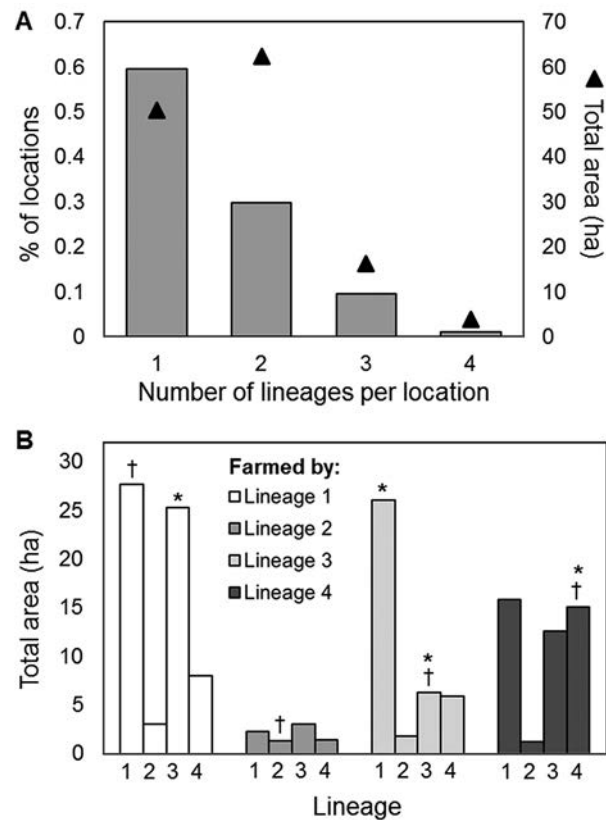


Figure 5. A, Percentage of locations (bars) farmed by one or more lineages (N = 94 locations). Area of locations (triangles) farmed by one or more lineages. B, Total area (ha) of locations that each lineage farmed exclusively by itself (daggers) as well as the area that each lineage farmed in locations where another lineage also had fields. Asterisks indicate statistically significant standardized Pearson residuals. We can be 95% confident that lineage 1 farmed more area than expected in locations where lineage 3 also farmed. Conversely, lineage 3 farmed more area than expected in locations where lineage 1 also farmed. Lineage 3 farmed less area than expected in locations where it farmed by itself. Lineage 4 farmed more area than expected in locations where it farmed by itself. No significant associations emerged in pairings that include lineage 2. A color version of this figure is available online.

the oldest. When the most senior man of a lineage has died, a redistribution of fields occurs immediately after the second *bulo* following his death (Strassmann informants). The man who is now the oldest gets the best of the lineage fields and the next oldest gets the second best, the third oldest the third best, and so on by order of age (Bouju 1984:104–105; Strassmann informants).

It is helpful to consider an example of the increase in land for a WEG boss who has become the oldest man of his lineage. In 1986, a man in WEG 18 was 58 years of age, and three living males were older than he was in his lineage. The family was so poor that they sold the aluminum door to their house, and they invited the anthropologist to join them to eat grilled rat. In 2015, this same man was 87 years of age and he had become the oldest man in his lineage. The area of cereal fields that his family owned had increased from 1.9 to 6.5 hectares, and the quality of the land had also improved. In 2015 he was blind and physically powerless, yet his seniority entitled him to the best lineage fields. This elder now had so much land that he loaned out 2.1 hectares, and he also had to leave fields fallow for lack of sufficient labor in his WEG.

Lineage segment fields circulate from WEG to WEG within the lineage segment rather than across the entire lineage. WEG fields are owned by an individual WEG and are inherited by the sons of the WEG boss, with the oldest son getting the best land. In the primary study village, 64% of the land was owned by WEGs and only 24% by lineages; thus by land area, WEG fields were more than twice as important as lineage fields. Hence, although we found some support for the hypothesis that the members of patrilineal descent groups cooperate in the defense of land (Goody 1962; Lowie 1920; Radcliffe-Brown 1935), cooperation to defend land at the level of the WEG was more prominent.

### Religion

As the Dogon religion is integrated into the agricultural cycle, and each lineage performs sacred rites before planting (*bulo*) and after the harvest (*goru*), we considered the hypothesis that religion is an arena for collective action on the part of lineages (see Atran and Henrich 2010; Irons 2001; Purzycki and Arakchaa 2013; Sosis and Bressler 2003). Altars and shrines for particular lineages imply cooperation and coordination by the lineage members, especially by the males who perform the sacrifices and libations. When an altar or shrine is associated with a given lineage, it functions on behalf of that lineage, assisting with the desire for fertility, good health, and a successful millet harvest so that the lineage may grow and prosper.

A shrine or altar that serves multiple lineages in multiple villages belonging to one clan requires clanwide cooperation. At our study site there is a sacred grove of trees with red flowers, and this religious site protects the entire clan of 12 villages. According to informants, each lineage of each village of the clan was in a rotation to provide a human sacrifice for the grove. To capture a victim, four or so young men would

roam the bush looking for a person who was alone and vulnerable. They would kill him on the spot and collect his blood as a libation more powerful than millet porridge, beer, or animal blood. A finger would be cut off as proof that the blood was human. If a lineage did not comply, then it had to give a field to the lineage that procured the victim. Such a field was paid in blood and could never be retrieved. That human sacrifice existed in the Dogon is agreed on by all of our informants as is its modern replacement by the sacrifice of dogs. For example, a dog is still sacrificed at each *dama*.

At the opposite extreme from clanwide religious sites are the fetishes that people keep in their homes and granaries. These derive their power from the lineage altars and shrines. They can be personal or belong to several related males, such as a father and his sons; the cooperation and coordination they require is minimal.

To gain a better understanding of who was cooperating and coordinating with whom, we examined the affiliations of each of the religious sites in the primary study village. The sites that are within the confines of the village are shown on the map in figure 1, and others are in the vicinity of the village, making a total of 19 sites in all. Four sites were shared by lineages 1, 3, and 4 that descend from the common ancestor who was a great hunter (mentioned above); among the other sites, five were exclusively for lineage 1, three were exclusively for lineage 2, two were exclusively for lineage 3, and five were exclusively for lineage 4. We observe a parallelism with the situation for cereal cropland ownership in that lineage 3 had less land than expected at locations where it was the sole lineage farming cereals (fig. 5B), and it also had only two religious sites exclusively for itself. The other two large lineages (1 and 4) had five sites each. Thus, lineages that controlled more cereal crop locations by farming them exclusive of other lineages also had more lineage-specific altars and shrines. It is possible that this result is mere coincidence; however, that seems unlikely given that the productivity of the land and the resulting prosperity of the lineage is the main function served by the sacred sites and by the two Dogon fetes of *bulo* and *goru*. Perhaps lineages that had more cropland to defend and to cultivate also had greater recourse to supernatural help.

The Dogon religion promotes the collective interests of group members at a variety of social levels: the family, the lineage, the clan, and the tribe. Our informants stated that the lineage-level altars and shrines are more important than personal or WEG-level fetishes. Religion and agricultural pursuits are integrated because a major function of religion is to promote a successful harvest, on which fertility, health, prosperity, and the growth of the lineage ultimately depend.

### Paternity Certainty

In the Dogon, land is a scarce resource that can be inherited, and men in wealthier WEGs are more likely to be polygynous and to achieve higher reproductive success than men in poorer WEGs (Strassmann 2003). According to theory dis-

cussed above (Hartung 1982; Holden, Sear, and Mace 2003; Trivers and Willard 1973), the Dogon should therefore practice patrilineal, but only under two conditions: paternity certainty is high, and resources passed to daughters are vulnerable to appropriation by husbands or fathers-in-law. Both of these conditions hold. Paternity certainty in the Dogon is greater than 98% (Strassmann et al. 2012), which is comparable to that of the societies having the highest levels of paternity certainty (Anderson 2006; Larmuseau et al. 2013). Moreover, resources passed to daughters (especially land and livestock) are easily diverted, and it is not surprising, therefore, that daughters inherit only a few bowls, jewelry items, and other portable goods of low value (compared with land and livestock) from their mothers and maternal grandmothers (Strassmann informants). Thus, the Dogon are a good fit with the hypothesis that people practice patrilineal when it pays off reproductively.

The Dogon are also a society in which men go to great effort to protect paternity certainty, which is accomplished through the help of menstrual taboos embedded in the indigenous religion (Strassmann 1992, 1996; Strassmann et al. 2012). In the 1980s, the Dogon were a natural fertility population with a median of nine live births per woman; even today, contraceptive use is rare. The taboo that requires a Dogon woman to spend five nights sleeping at a menstrual hut forces her to reveal to her husband and to his entire lineage the timing of the fecund part of her interbirth interval. Dogon women of reproductive age do not experience a “regular, monthly period” unless they are infertile (Strassmann 1997a; Strassmann and Warner 1998). Instead, they spend 9 months pregnant and a median of 20 months in lactational amenorrhea often followed by only one or two ovulations and menses before becoming pregnant again (Strassmann 1997a; Strassmann and Warner 1998). People know that a parous woman who is menstruating has come out of lactational amenorrhea and will soon conceive. Thus, the husband and his lineage are especially vigilant of a fertile woman who has menstruated. If she commits adultery, then the offspring will be rejected, especially if it is a son who will inherit land (Strassmann 1992).

The hypothesis that Dogon menstrual taboos promote paternity certainty has previously been tested, and we will only briefly summarize the main evidence. It might be expected that women cheat on the menstrual taboos by going to the menstrual hut whenever they feel like it and skipping out at other times. However, hormonal data showed that the women respected the taboos so as to secure paternal care for their offspring (Strassmann 1996). Further, in a genetic study of 1,706 father-son pairs, cuckoldry (which refers to a son not having been sired by his putative father) was more than twice as common if his mother did not go to a menstrual hut. In particular, the prevalence of cuckoldry was 1.3% if his mother used the menstrual hut and 2.9% if she did not. It was possible to do this comparison because the advent of world religions (Christianity and Islam) brought release to some women from the menstrual taboos (Strassmann et al. 2012).

Informants shared the belief that the menstrual huts enabled men to “witness” the timing of women’s menses so as to make informed guesses as to the probability of paternity. These informants came from many different villages and made similar statements across a time span of 30 years (Strassmann 1992; Strassmann et al. 2012). They also stated that menstrual blood will desecrate the religious objects and sites that protect against famine and illness; however, these pollution beliefs can be understood as part of the enforcement mechanism for getting women to obey the taboos. The menstrual hut was viewed by the Dogon as so important that traditionally it was the first structure to be built when a new village was founded. In sum, a large body of evidence supports the hypothesis that the menstrual taboos of the Dogon promote paternity certainty.

What role is played by lineages? It turns out that lineages do play a role as the members of a lineage collectively monitor the reproductive status of their set of wives. The more pairs of eyes that watch a woman, the less likely it is that she can hide the truth about being pregnant from adultery. The fact that the lineage as a whole participates is shown by a strong tendency in Dogon villages for there to be one menstrual hut (*punduru*) for the women and one shade shelter (*toguna*) for the men per patrilineage. For example, the village of Tiogou has five lineages, five menstrual huts, and five shade shelters. The women at the menstrual hut are usually in full view of the men sitting under their shade shelter. When the shade shelter is not very close to the menstrual hut, then the hut is close to a well or other place that people walk past so that the women are easily observed.

The primary study village is unusual in that it has three shade shelters and two menstrual huts—almost as if there were a missing menstrual hut. Informants said that there always had been only two menstrual huts in their village. As shown on the map (fig. 1), the women of lineages 1, 2, and 3 share a menstrual hut, and the women of lineage 4 have their own menstrual hut. It makes sense that the women of lineage 4 have a separate menstrual hut because their men are less affiliative with the men of the other lineages in multiple respects discussed above. Because the men of lineages 1 and 2 share a single shade shelter, it is expected that their women share a menstrual hut. It is curious that the women of lineage 3 also share the same hut. However, as shown on the map, the two shade shelters for these three lineages are both positioned so that the men under them can see the women at the communal menstrual hut.

Two possible interpretations exist as to the role of lineages in mate guarding the wives of their members (Strassmann 1992, 1996; Strassmann et al. 2012). One possibility is that if a man in the lineage is cuckolded, then the entire lineage is cuckolded because the descendants of the cuckold will gain access to lineage fields. To avoid this outcome, men may watch over each other’s wives. We could call this collective action to protect the “purity” of the lineage, or descent from a common ancestor. Another possibility is that the men of the

lineage help to mate guard each other's wives through indirect reciprocity. Our data favor the latter hypothesis because the men of a lineage are not very closely related in the first place; hence, cuckoldry of the lineage hardly makes a difference. However, it matters a great deal for a man to be 50% or 0% related to his offspring.

## Discussion

What explains patrilineal cooperation? To answer this question, we will consider the Dogon data in the light of the hypotheses that focus on collective action (e.g., Alvard 2003; Nolin 2011), patrilineality versus matrilineality (e.g., Hartung 1982; Holden, Sear, and Mace 2003; Mattison 2011), paternity certainty (Strassmann et al. 2012), indirect reciprocity (Alexander 1987), and inclusive fitness (Hamilton 1964a, 1964b). These hypotheses are not mutually exclusive.

### *Collective Action*

The men who belong to the same lineage live together in the same neighborhood, which suggests that they are cooperating. Otherwise, they might naturally disperse. In particular, the men of a lineage cooperate and coordinate to worship at their sacred sites. One site required lineages to cooperate and coordinate with the other lineages of the clan in 12 different villages. In the primary study village, there were a total of 19 sacred sites, of which four were shared by three lineages and 10 were for individual lineages. A sacred site for a lineage implies integration across the lineage and the need for the men of different WEGs to come together not only on their own behalf but also on behalf of the lineage as a whole. Thus, collective action is an important part of patrilineal cooperation. The oldest man of the lineage shoulders a greater part of the burden to enforce collective action because it is he who has primary responsibility for seeing that the proper sacrifices are performed during the fetes of *bulo* and *goru*, and he is also responsible for maintaining the ancestral house for the lineage (*Gina*; Strassmann informants).

In return, he is rewarded by being entitled to the lineage's best land—another important arena for collective action by lineages. Religion and agricultural pursuits are integrated because a major function of religion is to promote a plentiful millet harvest—from which all else follows (Strassmann informants). Dogon lineages collectively defend cereal fields, and two social norms help to reduce conflict: (1) the person who first brought the land into cultivation is the owner—after he dies the fields are inherited by his descendants—and (2) among the descendants, rights to fields respect seniority by age (Bouju 1984:105). Most locations where cereal crops were planted were farmed by the members of only one lineage, implying that these sites were successfully defended. Lineages 1 and 3 farmed at the same location more often than expected by chance, and they were also affiliative in other realms. We are unsure why that is the case; however, informants were satisfied by the explanation

that the founding ancestors of these two lineages were full brothers.

### *Patrilineality or Matrilineality?*

Among the Dogon, land is both a heritable and defensible resource, and it is used by males to increase their reproductive success through polygyny (Strassmann 2003). Paternity certainty is greater than 98% (Strassmann et al. 2012), and the risk that land inherited by daughters would be appropriated by husbands is high. Thus, Dogon males get a better reproductive payoff from bequeathing wealth to sons than to daughters. This area of theory is helpful for explaining why the Dogon practice patrilineality instead of matrilineality (Hartung 1982; Holden, Sear, and Mace 2003). However, it cannot explain why there is cooperation between the different WEGs of the lineage or between different lineages of the same clan. Theory on collective action and patrilineality versus matrilineality provides complementary explanations for patrilineal cooperation; neither framework is sufficient on its own.

### *Paternity Certainty*

The reproductive payoff from passing wealth to sons needs to be multiplied by the probability that the son is a genetic offspring (Holden, Sear, and Mace 2003). Thus, the high paternity certainty (>98%) of Dogon males is helpful for understanding patrilineal cooperation. Dogon males do not have a passive attitude toward ensuring their paternity. Instead, they have embedded in religion the belief that menstrual blood will desecrate sacred objects, forcing menstruating women to sleep at a special hut. Use of the menstrual huts reduced cuckoldry by more than 50% (Strassmann et al. 2012).

### *Indirect Reciprocity*

The men of the lineage mate guard each other's wives through indirect reciprocity. Each man pays the cost of not cuckolding his fellows in exchange for the benefit of being more secure in regard to his own paternity. The lineage elders help to prevent cheating by taking land away from any man in the lineage who breaks this social contract (Strassmann et al. 2012). The elders are powerless to punish men from other lineages; however, when the mate-guarding system is working, the men from outside pose less of a threat. We posit that defense against cuckoldry is one of the major arenas for cooperation by the men who belong to the same patrilineage.

### *Inclusive Fitness*

The mean relatedness of males belonging to the same patrilineage was 0.03, indicating a separation by five generations on average (see Hill et al. 2011; Lukas et al. 2005). On account of this low level of genetic relatedness, kin selection (Hamilton 1964a, 1964b) is unlikely to explain patrilineal cooperation.

The mean relatedness of males belonging to the same WEG was 0.32, which is a separation of slightly more than two generations and is higher than the average relatedness of half brothers ( $r = 0.25$ ). Because relatedness within WEGs is high, kin selection is a viable hypothesis to explain cooperation in WEGs. Based on relatedness alone, we cannot assert that kin selection is operating. However, we can conclude that the benefit-to-cost ratio for a good deed would not need to be ridiculously high in Hamilton's Rule (Hamilton 1964a, 1964b).

Ethnographers working from different epistemological traditions agree that kinship by blood is important to social interactions in the Dogon (Bouju 1984:21; Paulme 1940; Strassmann 2011; Strassmann et al. 2012). For example, they have noticed that WEGs tend to split apart along lines of genetic relatedness and that entry into the cash economy has accelerated this process. WEGs are prone to becoming nuclear families (albeit sometimes with a polygynous WEG boss). Large extended family WEGs have lower mean genetic relatedness, and they are becoming less common (see fig. 2B). Ethnographers also agree that reciprocity is more frequent among relatives than among nonrelatives in the Dogon (Bouju 1984). Further, they agree that the Dogon reject extramarital children (Paulme 1940), especially if they are male and entitled to inherit land (Strassmann informants).

In the primary study village, 64% of the land was owned by WEGs and only 24% was owned by lineages. Even the lineage fields are not worked by the lineage as a whole; instead, they are worked by WEGs. Farming is the main source of livelihood for the Dogon, and it is done in groups in which the average coefficient of genetic relatedness among males is 0.32. Lineages do serve a function, especially in the realm of religion; however, economic work is done at lower levels of social organization where genetic relatedness is high. Average genetic relatedness of men belonging to the same patrilineage is so low ( $r = 0.03$ ) that patrilineal kinship is "fictive" rather than genetic. However, it would be a mistake to permit the fictive kinship of patrilineages to obscure the genetic kinship of the social units that make up patrilineages. These units, or WEGs as we have called them, are the units that raise children (Strassmann 2011) and that provide the family with the means of subsistence.

At the study site, the Dogon are rapidly converting to Islam and, to a lesser extent, Christianity (Strassmann et al. 2012). WEGs but not patrilineages will endure the process of religious conversion. The newer religions are weakening the social fabric of patrilineages because they do not have any lineage-specific religious sites or activities that bring men together for collective action on behalf of the lineage. The world religions are not linked to the Dogon agricultural cycle, and they have no religious or political roles for lineage elders (Strassmann informants). They also do away with menstrual huts and the system of communal mate guarding (Strassmann et al. 2012). A famous quote by a Muslim man shows the ambivalence he feels about these changes: "As a planter, for

the millet, the women and the children, one stays with the Dogon religion; for commerce and politics one follows Islam" (Parin, Morgenthaler, and Parin-Matth y 1966:387).

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# The Evolution and Development of Inferential Reasoning about Ethnic Markers

## Comparisons between Urban United States and Rural Highland Peru

by Cristina Moya and Robert Boyd

CA+ Online-Only Material: Supplement A

Social scientists have long argued about the relationship between ethnic phenomena, symbolic markers, and cultural traits. In this paper, we illustrate the potential of functionalist cultural and genetic evolutionary models to reconcile these debates. Specifically, we argue that we must take seriously the role of cultural similarity in delineating certain category boundaries if we are to understand the origins and development of ethnic stereotyping. We examine whether symbolic markers—namely, sartorial ones—are privileged in the development of social stereotypes by comparing how children and adults in the urban United States and rural highland Peru perform a categorization task. We find that arbitrary sartorial markers motivate generalizations about novel traits in all samples except among US children, even when they crosscut body morphology, emotional expression, and socioeconomic cues. Unlike children in the United States, children in the Peruvian sample demonstrate an even stronger reliance on sartorial and work site cues than do adults of the same community. This suggests a role for early-developing evolved biases that guide learning and require appropriate cultural inputs or different niches for adults and children. We document further cross-cultural variation, in that US participants privilege socioeconomic cues to occupational status more than other cues, whereas Peruvian participants rely on sartorial cues more than other cues, indicating the importance of cognitive rules for learning locally relevant social taxonomies.

Unlike other primates, humans symbolically mark group identities and categorize others according to these markers. The use of personal ornaments, like ochre and shell beads, dates to the Middle Paleolithic (d'Errico and Vanhaeren 2009; Henshilwood et al. 2011), although it is only in the more recent archaeological record that we get clear evidence that markers mapped onto important social identities. Ethnoarchaeologists have devoted much effort to studying how to use ethnographic analogy to infer identities and patterns of behavior from stylistic variation in the material record (David and Kramer 2001; Jones 1997). The enterprise revealed much variation in the ways boundaries were constituted, the extent to which symbols carried information, and how markers were associated with other norms. This work has necessarily been observational and focused on the production side of stylistic variation. At the same time, psychologists have been using experimental methods to

explore receiver-side perceptions of arbitrarily marked social groups (Baron et al. 2014; Brase 2001; Rhodes and Gelman 2008). However, this work is rarely informed by the range of ethnographic variation in social group boundaries and tends to conflate functionally distinct social categories.

In this paper, we investigate the cognitive mechanisms humans use to learn about the culturally structured social worlds they inhabit. If humans have been using symbolic markers for much of their evolutionary history—for example, to communicate about interaction norms (Barth 1969; Wobst 1977)—it is plausible that they have evolved expectations that such markers will be informative. We use ethnographic and experimental data collected from children and adults in Huatasani, Peru, and Los Angeles, California, to determine whether heuristics for predicting strangers' behaviors on the basis of their symbolic markings develop reliably in these two cultural environments. The results shed light on the likely genetic and cultural evolutionary processes responsible for our stereotyping of symbolically marked groups. First, we describe a coevolutionary framework for understanding ethnic stereotyping and how it can help reconcile primordialist and constructivist debates about ethnicity in anthropology. Second, we outline competing hypotheses about why stereotypes based on sartorial markers are common and how they develop. Third, we describe the methods and ethnographic contexts where we conducted the stud-

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ies. Finally, we discuss the inductive reasoning experiments and how they speak to the evolutionary and developmental origins of social category-based stereotyping.

### A Brief Coevolutionary Account of Ethnic Stereotyping

Minimally, social scientists define ethnicity as identities that are self-ascribed. However, this does not exclude categories, such as gender or age set, that may require different analytical tools, given that they crosscut residential groups. A commonly implied additional entailment for a category to be ethnic is that membership is descent based or, more minimally, that it depends on having an attribute that is perceived as inherited by descent (Chandra 2012). Such definitional limitations are useful but presuppose the answer to the question of how people delineate boundaries, and they do not seem to capture identities that rely more on performative attributes (e.g., Astuti 1995). For the purpose of this paper, we will define the set of categories of interest as those that are symbolically marked but are not defined by demographic attributes that tend to vary within society, like age and gender. This working definition helps us frame the question around a function—namely, how humans learn and form stereotypes about symbolically marked clusters of individuals when category membership cannot be determined from other visible features, like age and gender.

Humans have culturally evolved niches where symbolically marked clusters of individuals play a prominent role and can change the developmental, cultural, and genetic selection pressures (Odling-Smee, Laland, and Feldman 2003). This means that any complete account of ethnic stereotyping is likely to be a coevolutionary one (Moya and Henrich 2016). In response to these new social groups, further cultural evolutionary processes likely gave rise to shared beliefs about the ethnic boundaries, children's learning strategies likely changed, and natural selection may have acted on human cognition to help children learn these taxonomies. We explain such an account in multiple steps, reviewing (1) a functionalist approach to stereotyping, (2) how clusters of cultural traits and intentional marking can culturally evolve in ways that foster stereotyping about symbolically marked groups, and (3) how cognitive systems must develop to accommodate cultural variation. We then outline several predictions about (4) how categorization should develop across cultures and (5) the mechanisms that can be used for detecting meaningful symbolic boundaries. We end the introduction by describing the previous research on the cognitive development of symbolic group categorization.

#### *Why Stereotype?*

Stereotypes are the result of categorization systems that simplify and reduce real-world variation. This makes it easier to respond quickly to environmental variability, especially when one does not have complete information. However, this nec-

essarily means placing different people in the same category, increasing the risk of errors from overgeneralization. An individual-level functionalist approach predicts that social categorization systems carve up the world in ways that facilitate useful predictions about strangers. Note that these are often, but need not be, accurate (see CA+ online supplement A). In contrast, most psychological theories regarding social categorization focus only on proximate motivations that shape stereotypes—for example, wanting to maximize the distinctiveness of one's own group or have positive self-esteem by thinking highly of one's group (Brewer 1991; Greenwald et al. 2002; Turner et al. 1987). Importantly, these motivations have not been robustly documented across cultures and may be at odds with ultimate adaptive (i.e., fitness-relevant) functions. For example, it is unclear that overestimating one's group's ability to defeat others in combat would be favored by natural selection, compared with an accurate cautious perception.

Useful concepts should have at least the following three features: (1) They should balance the benefit of simplification against the errors this creates (e.g., optimize the trade-off between being able to make quick predictions about new people and coming to incorrect conclusions because of overgeneralization; Coley, Medin, and Atran 1997), (2) they should lead to predictions that allow individuals to meet adaptive goals (e.g., choosing reliable interaction partners or avoiding hostile strangers; Cottrell and Neuberg 2005; Hunn 1982), and (3) they should rely on easily detectable cues to group membership (e.g., visually or aurally salient cues). Next we discuss how cultural evolutionary processes tend to give rise to group boundaries that meet these criteria for promoting useful concepts.

#### *Evolution of Cultural Clustering and Markers*

A number of cultural evolutionary processes can produce clustered distributions of cultural traits across geographic and social landscapes.<sup>1</sup> For example, copying others who are similar to oneself, imitating high-status locals, or doing whatever the majority of others do can evolve under a wide range of circumstances (Boyd and Richerson 1985; Henrich and McElreath 2003; Perreault, Moya, and Boyd 2012). These learning rules increase within-group homogeneity. Furthermore, unlike social learning in nonhumans, our faithful imitation (Lyons, Young, and Keil 2007; Tennie, Call, and Tomasello 2009), the intergenerational accumulation of cultural knowledge (Boyd, Richerson, and Henrich 2011), and the functional interdependence of cultural features can increase the set of traits that covary along the same cluster boundaries.

These mechanisms produce information-rich social boundaries satisfying the first condition for making concepts useful. The fact that the boundaries can map onto coalitions, social

1. By clustered distributions, we mean nonuniform ones where multiple traits covary. Cultural traits can be behaviors, skills, norms, or institutions that are primarily acquired via social learning.



networks, or people with different interaction norms and skills means that they may promote fitness-relevant predictions about with whom, when, and how to interact. This satisfies the second requirement of useful concepts. Finally, signaling ethnic identities can evolve, for example, to prevent interacting with others with different norms in coordination games (McElreath, Boyd, and Richerson 2003). Many ethnic markers seem to have culturally evolved to signal group membership in larger anonymous societies (Moffett 2013). These include sartorial cues, tattoos, dialectical variation, and even traits previously considered to be only functional, like point shape (Wiessner 1983). People may categorize others even if no one signals their group membership (see CA+ supplement A), but selection for signaling produces clearer signs, thus making it easier to identify a stranger's group membership. This ease of identification meets the third condition of boundaries that would promote useful concepts.

The empirical evidence that clusters of cultural traits map onto symbolic boundaries is more mixed. In examining the social significance of bead headband styles, Wiessner (1984) found little evidence that these tracked linguistic boundaries. Instead, styles diverged most at boundaries of interaction, where communicating one's norms would be particularly important for coordination (McElreath, Boyd, and Richerson 2003). Similarly, stylistic variation maps onto only some ethnic boundaries in northern Kenya—that is, those with higher between-group competition over limited resources, often despite frequent social interactions across the border (Hodder 1982). Other broader-scale work suggests that language phylogenies explain much variation in cultural traits, particularly in domains related to social organization, suggesting some linguistic boundaries would predict social norm variation (Mathew and Perreault 2015; but see Towner et al. 2012).

This evidence that stylistic markers are contingently associated with social and cultural behavior parallels debates about the nature of ethnic identities. Constructivist theories emphasizing the contingent, political, and constructed nature of ethnic identity have supplanted more primordialist approaches stressing the deep history of, bounded nature of, and cultural content associated with ethnic groups (Gil-White [1999] reviews these positions). While strong primordialism is rare, several practitioners of a culture area approach to anthropology in the early twentieth century proceeded with empirical work as if ethnic groups were unproblematic, discrete cultural units of analysis (Wissler 1927), and more recently, some archaeologists have been critiqued for similarly static understandings (Sackett 1990). The fact that, in several social contexts, strategic ethnic shifts decouple identities from norms, values, and other institutions (Barth 1969; Moerman 1965; Wimmer 2013) and that group membership signaling is often strategic (Wiessner 1983) led many social scientists since the mid-twentieth century to reject notions of ethnicity that rely on cultural similarity.

We believe unlinking our understandings of ethnic categorization from culture is premature, as it is the cultural nature of

ethnic phenomena that differentiates them from groups in other primates and social animals.<sup>2</sup> Furthermore, a functionalist approach to cognition requires an understanding of the material, real-world patterns that concepts reflect. This means that people's perceptions of ethnic categories are unlikely to be completely arbitrary or divorced from some cultural content, even as they constrain the real-world variation that is deemed relevant.<sup>3</sup> An outside (or etic) perspective on these phenomena still benefits from an inside (or emic) perspective for understanding which elements of cultural repertoires are deemed important for delineating different social boundaries and engaging in predictable, fruitful intergroup interactions. Recognizing that ethnic phenomena are unlikely to emerge from a unitary cognitive architecture (Moya and Boyd 2015) also suggests that cultural content may be functionally relevant for some ethnic processes but not for others. For example, only a few cultural norms may be relevant to coordinating intergroup interactions or in-group cooperation. This may help explain some of the discrepancies in the literature and why only some traits covary with symbolic markers that are meant to signal adherence to a subset of relevant norms.

#### *Categorization Systems in Culturally Variable Worlds*

If social landscapes have symbolically marked cultural clusters, and if predicting others' behavior is beneficial, children should be adept at learning about these. The diversity of ethnic boundaries throughout space and time and the fact that intraethnic social categories delineating roles (Bloch 2016), like age sets and genders, are often symbolically marked means that learning mechanisms must be capable of reliably acquiring a range of possible associations. Much as with language learning, a developing child has to be equipped with the capacity to learn any number of social taxonomies that human societies have culturally evolved (Moya 2013).

Even plastic learning systems require rules to guide development. Heuristics biasing attention or expectations toward common indicators of cultural-cluster boundaries (e.g., language, dialect, and intentional sartorial choices) may facilitate the acquisition of useful stereotypes. However, to accommodate diverse social worlds, these mechanisms require inputs from one's social environment to develop properly. For ex-

2. Concepts of culture do not even figure in psychological theorizing on stereotyping. In the constructivist literature, it is more common to de-emphasize the relevance of cultural differences. For example, in her attempt at defining ethnicity, Chandra claims that "features such as a common culture, common territory, common history or a common language are variables that sometimes distinguish ethnic identities rather than the constants that define them" (2012:10).

3. As an analogy, consider that color categories are a function of the physical properties of light and that our perceptual systems dismiss much of this real-world information, making us think that only those light waves with frequencies between the red and blue parts of the visible spectrum exist.

ample, even if certain heuristics privilege categorizing others on the basis of sartorial markers, a developing child would still have to determine which kinds of clothing differences matter. Are ornaments or hairstyle part of the marker? This suggests mechanisms akin to prepared-learning adaptations may be important, making it easier to learn certain associations than others. For example, children socially learn which animals are dangerous more readily than which are carnivorous (Barrett and Broesch 2012), humans and monkeys readily learn to fear snakes (Öhman and Mineka 2001), and US adults readily learn associations between aversive stimuli and novel minimal outgroups created in the laboratory and marked by shirt color (Navarrete et al. 2012). If this account is accurate, some, but relatively little, experience with real social groups that are sartorially marked would be necessary to trigger expectations that other clothing markers will be socially meaningful and worth stereotyping.

Children must also be capable of updating such readily learned associations. For example, in contexts where linguistic or sartorial cues are not indicative of important cultural norms, but religious affiliation is, children must be capable of updating their concepts to reflect the latter boundary. Not only is human cognition designed for massive cultural learning (Henrich 2015), but humans have also likely evolved to be effective at teaching their children norms (Csibra and Gergely 2009; Kline 2015). Furthermore, we culturally evolve developmental environments that facilitate the acquisition of locally appropriate concepts (Flynn et al. 2013).

## Deriving Predictions from a Coevolutionary Account

### *Predictions about Developmental Trajectories across Cultures*

For the above reasons, it is useful to study the development of social concepts across cultures, to reveal both the genetically evolved heuristics that children use in forming stereotypes and how they learn culturally variable beliefs. Different theoretical accounts make different predictions about the cross-cultural and developmental patterns of clothing-based stereotyping. (1) If genetically evolved biases to privilege sartorial cues for stereotype formation are at play, we expect greater cross-cultural similarity between children's reasoning and more divergence among adults. Additionally, these biases may make children rely on clothing-based generalizations more than adults do, particularly in cultural contexts where adults have learned that sartorial markers are not the primary markers of socially meaningful boundaries. (2) Alternatively, humans may use structured learning rules that evolved for forming broader sets of associations to learn about the relationship between clothing markers and other traits. These mechanisms might parallel those that elephants use to learn that certain human populations—that is, those with Masai ethnic markers—threaten them (Bates et al. 2007; McComb et al. 2014), despite no evolutionary history of sartorial marking in their species. This account predicts that children would rely on clothing stereotypes

less than adults do, since they would have to acquire such beliefs. It is also possible that humans use cognitive mechanisms that evolved specifically for reasoning about symbolic markers in addition to a broader set of individual and cultural learning mechanisms.

Recognizing that children inhabit different social developmental niches and face different adaptive challenges than adults (Flynn et al. 2013) suggests additional functionalist predictions. For example, while younger children are dependent on adults to make social decisions for them, they do not need sophisticated categorization rules. Only as children expand their social networks do they start facing the problem of quickly predicting the behavior of potential interaction partners. This suggests a possible curvilinear relationship between age and clothing-based stereotyping; young children may have weak stereotypes about sartorial markers but start using them even more than adults as they start interacting with others independently. A curvilinear pattern could be consistent either with a prepared-learning account or with children having developmental niches where clothing markers matter more for them than for adults.

We wish to be clear that children are socialized agents and members of their respective cultural worlds. We do not intend to interpret their responses as the output of asocial evolved cognitive processes alone. Rather, in the course of learning about their respective local social taxonomies, we expect children to bring to bear both the information that they have socially and individually learned, and evolved conceptual structures that facilitate this learning.

### *Predictions about Mechanisms for Distinguishing Ethnic Symbolic Markers*

Assuming people do form stereotypes about others on the basis of their sartorial markers, what is it about this cue that distinguishes it from other dimensions along which a stranger could be categorized? If the fact that the sartorial marker is a signal—that is, that it evolved to communicate information (Maynard Smith 2004)—motivates people to infer that others with the same clothing are similar, then they should also infer similarity on the basis of individuals' emotional facial expressions. If people infer resemblance on the basis of any low-level feature of a figure, then they should be equally likely to make clothes-based and body shape-based inferences, because these characteristics cover nearly the same surface area of a person. If people infer that others are similar on the basis of the social relevance of their shared cue, then they should be equally likely to predict others' behavior on the basis of their sartorial markers and their having the same intraethnic role (e.g., occupation). Finally, it is possible that sartorial markers promote more similarity inferences if these are cognitively privileged as ethnic markers that convey information about cultural-cluster membership.

For this study, we investigate these four cues (i.e., emotional expression, body morphology, occupational role, and clothing

Table 1. Summary of functional features of social cues

Social cue	Functional affordance				
	Signal	Covers figure's surface	Socially salient	More stable	Evolutionary history as ethnic marker
Emotional expression	Yes	...	...	...	...
Body shape	...	Yes	...	Yes	...
Clothing style	Yes	Yes	Yes	...	Yes
Job location	...	...	Yes	...	...

Note. Each row represents a social cue used in the study stimuli. The columns represent functional affordances associated with each cue and correspond to various hypothesized cognitive rules motivating category-based predictions. If a cue has one of the features hypothesized to be important, the relevant cell is marked "Yes."

style) to differentiate between these hypotheses (see table 1 for summary of cue affordances and fig. 1 for sample stimuli). Incidentally, comparing how people reason about these cues allows us to test two other hypotheses. First, markers that are stable and difficult to fake may be privileged indicators of ethnic group membership (Cohen 2012; Nettle and Dunbar 1997; Sosis, Kress, and Boster 2007). While none of the cues we chose are costly signals, body morphology would be the most difficult one to change in a short period of time. Furthermore, morphological traits are often perceived to be more intergenerationally stable (Moya, Boyd, and Henrich 2015). This means that, if temporally stable cues promote more inductive inferences, participants should rely most on body morphology cues to categorize other individuals. Second, if very low-level visual salience is important to categorization, then our participants should predict similarities primarily on the basis of the occupational cue, because it represents a larger surface area (the background) of the image.

#### Previous Research on Reasoning about Symbolic Boundaries

While some evidence suggests that there are evolved biases for language-based stereotyping (see CA+ supplement A), most data on how people reason about sartorial cues has been conducted while addressing broader questions about social group reasoning. For example, Hirschfeld (1995) finds that 3-year-old children infer that characters with similar clothes would be similarly clad throughout development and would resemble each other, but only when clothing indicated the character's occupation. When occupation was pitted against clothing color, children responded that the former was more stable through the life course (Hirschfeld 1995). More commonly, sartorial indicators such as color are used as minimal markers for novel groups that are assigned in the laboratory (Dunham, Baron, and Carey 2011; Mahajan and Wynn 2011). However, these data do not show that sartorial cues are privileged for motivating inferences and in-group preference, since similar research on the minimal group paradigm with adults reveals that other arbitrary bases of categorization, such as overestimating dots on a screen, may engender similar in-group preferences (Tajfel et al. 1971).

Furthermore, demonstrating mild preferences toward arbitrary in-groups does not directly speak to how much children are willing to generalize on the basis of these minimal categories. Other experiments show that children are willing to draw novel inferences about individuals on the basis of their

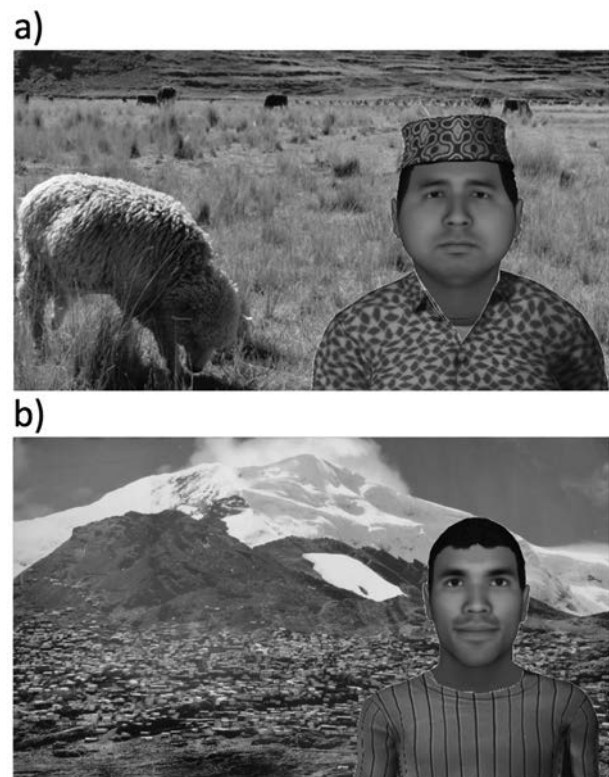


Figure 1. Examples of stimuli used in Huatasani. The character represented in *a* has the following cue values: sad facial expression, fatter body morphology, geometric shirt and cap clothing style, and low-wealth rural job. The character represented in *b* has the opposite features: happy facial expression, skinnier body morphology, gray striped clothing, and high-wealth urban job. Across characters, the category cues were, in fact, crossed with each other, meaning that being happy, skinny, in a high-wealth work site, or dressed in gray striped clothing were not correlated at all with each other (see CA+ supplement A for Los Angeles stimuli and wider variation). A color version of this figure is available online.

wearing similar shirt colors and that they do so to the same extent as they use race and gender (Diesendruck and Weiss 2014). However, these inductive inferences are trumped by information about similarity on other cultural traits (e.g., food preferences) when these are at odds with the visual markers. This suggests that shirt color may act as a placeholder for information about cultural-cluster membership until a better predictor is offered. Furthermore, other developmental psychologists have failed to show generalizations based on appearance alone in young children (Baron et al. 2014; Rhodes and Gelman 2008). The study by Baron et al. (2014) did find that adding labels to the visual markers promoted inferences, supporting other research showing that labeling can efficiently transmit information to children about the important ethnic markers in their environments (Heyman and Gelman 2000; Rhodes, Leslie, and Tworek 2012). These mixed results may stem from the fact that shirt color is not clearly interpretable as a signal of group membership on its own.

The fact that the sartorial cues used in much of this literature are intentionally simple (e.g., shirt color) and often reflect within-population variation limits our ability to extrapolate from these data to reasoning about more complex ethnic markers. In contrast, Hirschfeld and Gelman (1997) used more complex stimuli and showed that midwestern US children and adults do infer that more foreign clothing styles predict foreign language use. While children in this sample predicted language use most on the basis of race and dwelling style, they still used sartorial stereotypes as well, and adults used clothing style the most in their predictions. US adults also reason as if culturally acquired and intentional markers (e.g., a serpent tattoo) have high cue validity, meaning that people expect others to have the marker if, and only if, they are members of a group (Brase 2001). However, they do not commit the same logical fallacies on the basis of less clearly intentional and culturally acquired cues, such as having attached earlobes. In most societies where shirt color has been used as a sartorial marker in social cognition experiments, children probably have more experience with shirt color varying within populations (much as earlobe morphology does) than they do with it being used as a signal of group membership. For this reason, we use more complex sartorial cues that combine geometric design, shape, and color in our experiments. This allows us to investigate the development of social category inferences on the basis of a plausible cue to cultural-cluster membership and ethnically structured social relations.

## Methods

### *Sites and Participants*

The experiments were performed in two sites with very different social taxonomies: Huatasani, Peru, and Los Angeles, California. The US participants were affiliated with the University of California at Los Angeles (UCLA) and represent an urban and cosmopolitan demographic. Huatasani is a rural

village in the Peruvian highlands situated along the Quechua-Aymara linguistic boundary.<sup>4</sup> Most people at this site engage in subsistence agro-pastoralism, but families supplement this activity to varying degrees with labor migration to mines or cities and as merchants.

Social boundary concepts in Huatasani differ in several ways from those more often studied by US psychologists. In contrast to the racialized and essentialized ethnic taxonomies of the United States, Peruvian adults along the Quechua-Aymara linguistic boundary do not express primordialist sentiments about any of the local social groups. Furthermore, differences in market integration represent an important cultural boundary in the Peruvian fieldsite and are decoupled from markers that commonly denote ethnicity elsewhere, like language or religion. Sartorial markers, on the other hand, are commonplace to demarcate members of large categories in the Peruvian highlands, not just to delineate minority subgroups (e.g., punks or Mennonites), as is more common in the United States.

Different sampling strategies were used at each site. In Los Angeles, all interviews took place on the UCLA campus. Thirty-three second graders (mean age: 7 years) were recruited from the UCLA Lab School, and 52 undergraduate students (mean age: 20 years) signed up via the California Social Science Experimental Laboratory (CASSEL). In Huatasani, 167 people of more variable ages were recruited (see table 2 for age and gender distribution). The 34 children less than 9 years of age are used for comparison to the Los Angeles child sample, while the 86 adults over 18 years of age (mean age: 42 years) are compared with the UCLA undergraduate sample. See CA+ supplement A for full developmental analysis using the Peruvian sample. In Huatasani, adult community members were recruited through snowball sampling with the help of a local research assistant, while children were recruited via schools and along with participating parents. Most interviews were conducted in Spanish, and a few interviews were conducted in Quechua, but we do not expect this to have posed a barrier to participation (see CA+ supplement A for recruitment details).

### *Experimental Design*

Participants were told that they would be introduced to fictional characters and asked to make predictions about them. A single character's image (the exemplar) appeared on a computer screen with text describing a rare trait he had (e.g., liking banana tea; see CA+ supplement A for full list). On the next screen, participants were shown a grid with images of 16 men and asked to predict who else among them would have the same trait (e.g., would also like drinking banana tea). Once participants had chosen as many characters as they thought

4. C. Moya has conducted ethnographic fieldwork since 2007 in Huatasani and had lived there for a year at the time of this interview.

Table 2. Participant age and gender distribution across sites

Age (years)	No. participants (% male)	
	Huatasani	Los Angeles
7–8	34 (62)	33 (52)
9–10	27 (74)	...
11–18	20 (40)	...
>18	86 (33)	52 (52)
Total	167 (46)	85 (52)

would share the trait, they proceeded to the next screen, where they were introduced to a new character with a new rare trait, and the process was repeated. Adult participants in Los Angeles made predictions about 16 traits, whereas all other samples were asked about a randomly assigned subset of nine traits (see CA+ supplement A for other protocol differences across sites). These were pretested in Huatasani with two local assistants to ensure that the traits were understood but were not associated with any known social boundary. The order in which the traits were presented and which pictures were used as exemplars were randomized for each participant, while the position of images in the grid was randomized within participants for each screen.

The characters' images were generated using FaceGen software and varied along four dimensions: emotional, bodily, sartorial, and occupational cues (see fig. 1).<sup>5</sup> Each character could have a happy or sad facial expression (emotional), be fatter or skinnier (body shape), wear a gray striped shirt or a shirt and cap with green geometric shapes (sartorial), and stand in front of an office environment or a tractor (occupational). To ensure cultural relevance, the occupational cue was changed for Peruvian participants to either a recognizable background of the largest mining town in the region or a field with sheep, like those outside the village. This mining versus agro-pastoralist divide corresponds to important differences in market integration and wealth, much as the office and tractors in the US stimuli correspond to socioeconomic differences between white- and blue-collar occupations. All of these features were varied independently so that there was no association between the cues. This resulted in 16 possible target characters for the grid (i.e., one character who shared all the traits with the exemplar, one who shared none, four who shared a single cue, and so on; see CA+ supplement A for sample grid).

### Analysis

We ran multilevel logistic regression models predicting the probability of choosing that two characters are similar given that they share each of the four possible cues (coded as four independent dummy variables). Each model included interaction terms between shared cue and participant age category

(as parsed in table 2) to test whether the effect of a shared cue changes with development. Models for each site were run separately. Because we have multiple observations per participant (i.e., they were asked about several traits), we include a random effect for participant in our models to deal with their nonindependence. We have a wider age range of participants in Huatasani, so we examine the developmental trajectory in more detail for that site, considering both finer gradations of intermediate age categories and continuous age models in CA+ supplement A.

### Ethnographic Context of Sartorial Marker Use

Sartorial markers are important indicators of various social identities in the Huatasani region, both of ethnic-like boundaries and intraethnic roles. Participants claim that Aymara-speaking women prefer brighter colors (e.g., fuchsias) than do Quechua-speaking women. However, these distributions are largely overlapping, and participants believe there is no discrepancy in the clothing of Aymara- and Quechua-speaking men. Furthermore, this linguistic boundary does not motivate many ethnic phenomena in this region (Moya and Boyd 2015). Huatasaneño adults form few stereotypes about this language boundary compared with market-integration boundaries (Moya 2013). Nor do they treat linguistic identities as biologically transmitted or stable (Moya, Boyd, and Henrich 2015), and cooperation is not organized at the scale of language categories (Moya and Boyd 2015).

At the regional provincial level, there are some traditional stylistic differences in handmade clothing items and textiles that mark individuals' (usually women's) geographic origin. These can still be used to identify strangers from specific regions during market days in a neighboring regional hub. However, such markers do not distinguish Huatasaneños and are increasingly rare among the younger generation outside of ritual celebration days.

Sartorial markers feature prominently during ritual dance and music competitions. On these occasions, musical groups wear matching costumes that distinguish them as a cooperative unit. These can range in elaboration from idealized traditional garments—ostensibly from different regions—to color-coordinated everyday wear. The musical groups are organized along community or neighborhood lines, but they often have “collaborators” from distant towns in the Altiplano.

Most importantly, sartorial differences are clear indicators of degrees of market integration and can signal that one engages in cultural practices associated with more rural or more urban lifestyles. Market integration differences are more clearly marked in women. Rubber-tire shoes (*ojotas*), large skirts (*polleras*), certain hat styles (e.g., bowler hats), and woven carrying cloths (*q'epis* or *awayus*) are associated with indigenosity and rural residence. Several younger women who had worked in larger cities spoke of switching clothing styles depending on their residence. Some of them preferred to wear pants and caps but, while living in Huatasani, conformed to

5. The tool can be found at <http://www.facegen.com>.

rural norms of wearing skirts and larger hats after being reproached for “thinking themselves men.” These boundaries marking differential market integration in the region blur the distinction between ethnicity and roles. One may argue that such boundaries are becoming more ethnic in nature insofar as they correspond to regional cultural clusters (Moya and Boyd 2015) and delineate the set of norms and rules that guide individual decisions and interactions (Barth 1969).

It is difficult to compare the extent and significance of sartorial variation in the Peruvian highlands with that among our participants in Los Angeles. While clothing options abound in the United States, few of these are associated with social identities, and few ethnic or immigrant communities use distinct sartorial markers. However, the number of minority subgroups that use stylistic differences to mark cultural norm adherence, even on a college campus (e.g., goths, jocks, and hippies), may rival the variation and social significance of sartorial cues in the Huatasani region. Experimental research in the United States suggests that clothing choices affect first impressions (Davis and Lennon 1988), although a study performed on our same Los Angeles student population suggests that natural variation in sartorial style similarity does not affect cooperation (Gervais et al. 2013).

## Results

Figure 2 shows how sharing a social cue (e.g., emotional expression, body shape, clothing style, and job site) affects people’s beliefs that two characters will share another trait. We report odds ratios (ORs) from regression models (i.e., the odds of believing the characters share a trait given that they share a cue relative to the odds of believing that they share a trait if they do not share a cue) along with their 95% confidence intervals (CIs). This means that the larger the values, the more heavily participants rely on this social cue to make predictions about new characters.<sup>6</sup> In CA+ supplement A, we examine whether people made more assessments of similarity about some traits and if there were interactions between trait and cue type. There are few consistent interactions, so we treat all traits the same as repeated observations for the remaining analyses.

### *Developmental Patterns in Huatasani*

Huatasani children broadly resemble adults in the extent to which they rely on different cues. Both adults and children in Huatasani rely most heavily on the characters’ clothing to make inductive inferences (fig. 2a). Both discard emotional expression information as a basis for making predictions. Across development, Huatasaneños also rely to a similarly

moderate extent on characters’ body morphology to draw similarity inferences. However, children rely on sartorial and occupational information more than do adults. Children under 9 years of age show 1.31 times the odds of making a clothing-based inference compared with adults (95% CI: 1.08–1.59) and 1.45 times the odds of making an occupation-based inference (95% CI: 1.21–1.77).

A more detailed examination of the developmental trajectories in the Huatasani sample reveals that the greater reliance on the occupation cue in childhood is restricted to children under 9 years of age (fig. 2a). On the other hand, the greater use of the sartorial cue increases in 9–10-year-old children before decreasing in teenagers. Continuous age models of socialization processes confirm an earlier and steeper reduction in the use of occupational cues than in the use of sartorial cues to make similarity inferences (see CA+ supplement A).

### *Developmental Patterns in Los Angeles*

The effect sizes are all significantly lower among Angeleno children than among adults, meaning that children were less sensitive to all cues when making their decisions (fig. 2b).<sup>7</sup> There may be methodological and motivational reasons why US children generally show smaller effect sizes than any of our other samples (see protocol differences in CA+ supplement A). As evidence of this, we see that children in Los Angeles are the only ones who believe that the characters are less likely to share a novel clothing trait if they are depicted wearing the same sartorial cue (see CA+ supplement A). Therefore, for the US site, it may be more insightful to compare the relative effects that the different visual cues have on predictions of similarity within each age category separately.

Even focusing on the within-age-category patterns confirms that the US samples less clearly resemble each other. However, in the United States, both children and adults rely on the occupational cues more than other cues to make inferences. Adults rely nearly as heavily on sartorial cues as they do on occupational ones (OR: 2.18 and 2.29, respectively), whereas children rely on clothing only half as much as they rely on occupational cues (OR: 1.11 and 1.20, respectively). Instead, US children believe body shape to be nearly as predictive of novel trait similarity (OR: 1.19) as occupational cues are. Much like both Peruvian samples, US adults perceive body shape as having low (though significantly greater than zero) predictive power (OR: 1.42). Finally, US adults are the only sample to use emotional expression at all in their inferences,

6. Reassuringly, none of the effects are significantly below one, indicating that participants never thought that sharing a visual cue decreased the characters’ likelihood of being similar on a novel trait.

7. Los Angeles children were not shy in making inferences about similarity generally. On average, they responded that 55% of targets shared the novel trait with the exemplar. This number was 45% for US adults and 47% and 40% for children and adults, respectively, in Huatasani.

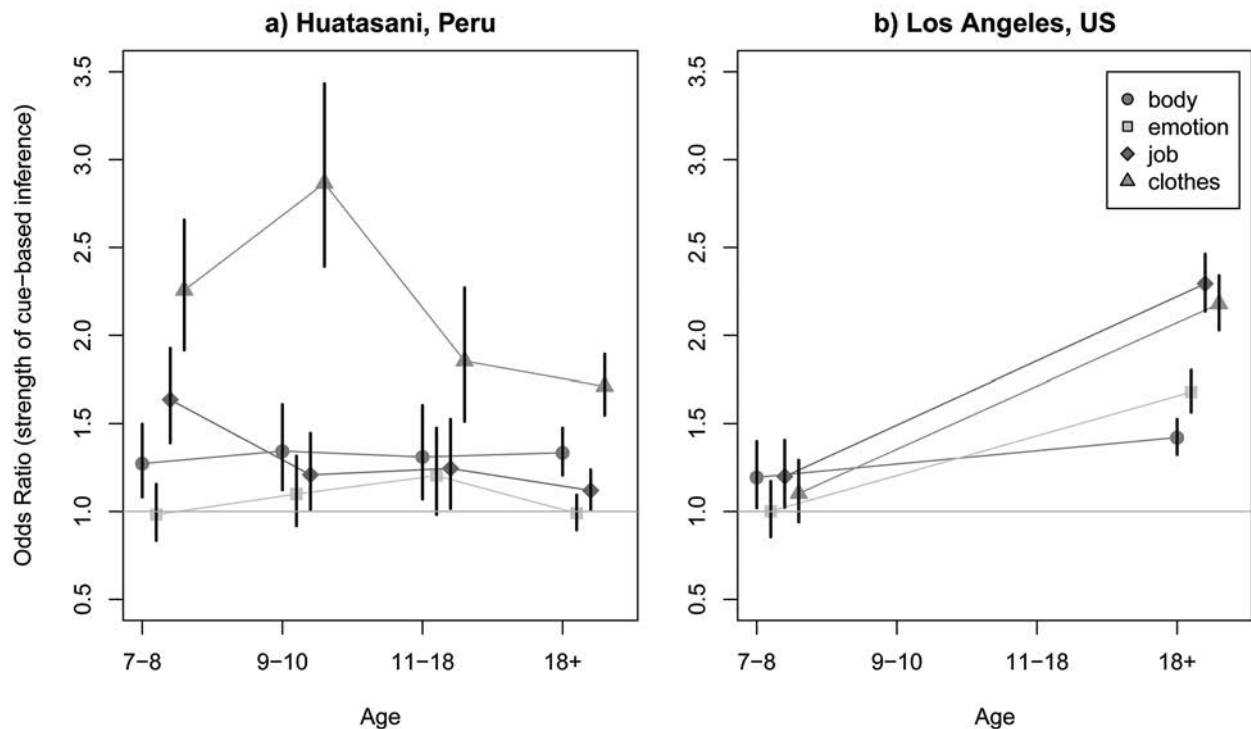


Figure 2. Developmental trajectory of cue reliance in Huatasani (a) and Los Angeles (b). Effects of characters' sharing a cue (i.e., body morphology, emotional expression, job location, and clothing style) on the odds that participants believe them to share another trait are plotted against age in years. The Los Angeles sample did not include children or teenagers of intermediate ages. Odds ratios greater than 1 indicate that participants are more likely to expect characters to have the same trait if they share a social category cue. A color version of this figure is available online.

although they rely on it significantly less than they do on either occupational or sartorial cues.

## Discussion

Our results indicate that people primarily base inferences about others on the socially meaningful cues that they share—namely, in this study, clothing style and occupational background. The developmental trajectories do not show evidence of cross-cultural diversification in adulthood from a more similar set of categorization rules in childhood, as one would expect if children's responses reflected universal prior expectations. Nor do adults' responses converge, as would be expected if the people were learning about similar niches in the two cultural contexts. This suggests we have to look at each site's developmental process in more detail. These patterns do provide two important insights, one theoretical and one methodological. First, the developmental trajectory we see in the Huatasani sample shows that children prioritize occupational and sartorial categories more than adults do when predicting who will resemble each other, unlike in the United States (Hirschfeld and Gelman 1997). This suggests either that children use different heuristics than adults do for the task or that, in Huatasani, children and adults have different developmental niches. Second, standard developmen-

tal psychology recruitment strategies that target undergraduate populations for adult samples and local elementary schools or neighborhood parents for child samples are likely sampling from different populations and thus underestimating cultural continuity across generations. Below, we discuss what the patterns with respect to each cue reveal about how humans parse their social worlds and then return to this last methodological point.

### *Emotional and Body Morphology Cues*

Emotional facial expressions that evolved to communicate information about transient affective states were seldom used as a basis of inference. This means that a cue being a signal is not sufficient to promote stereotyping.

The fact that people relied little on body morphology for making inferences about the characters suggests that participants do not simply use any stable property of a person or any feature that covers the person's body as a basis for inferring similarity.<sup>8</sup> This casts doubt on accounts that expect

8. US children provide the one exception to this pattern in relying nearly as much on body morphology as they do on their highest ranked cue (occupation). We discuss possible interpretations of this in CA+ supplement A.

stronger effects for social boundaries that are marked with genetically inherited or stable cues. It also supports previous research showing that visual salience alone is not an important contributor to children's memory for social categories (Hirschfeld, 1993), to generalizations based on them (Baron et al. 2014), or to inferring traits are stable across time (Rhodes and Gelman 2008). While morphological cues are not developmentally privileged bases for categorizing others, they clearly become racialized in several cultural contexts (Kinzler et al. 2009; Kurzban, Tooby, and Cosmides 2001; Pietraszewski et al. 2015). This suggests that visually salient features of others likely require social or individual learning for children to map their relevance to an ethnic boundary or social role.

#### *Occupational Cues*

The strong reliance on occupational cues associated with socioeconomic status in most of our samples suggests that people are prone to make generalizations on the basis of socially meaningful categories, even if such social boundaries are recent historical innovations and vary within groups. The occupational cues at each site were different but locally relevant, and they had significant status connotations. In the United States, they denoted class, and in Peru, they denoted market integration differences. These socioeconomic categories in complex societies have acquired many features of ethnic categories. For example, in the United States, educational endogamy has been increasing (Mare 1991), and in the Peruvian highlands, market integration differentials imply a suite of other cultural characteristics and map onto regional origins (Orlove 1998).

Two additional pieces of evidence suggest that the occupational cues we used were developmentally privileged as a basis of generalization. First, Huatasaneño children relied on these cues significantly more than did adults at the same site. Second, both the US and Peruvian children weighed the occupational information highly relative to most other cues despite the beliefs diverging in adulthood across cultures. This is consistent with children sharing panhuman biases for privileging occupational or status cues as a basis for making generalizations about others. However, it is not clear why biases for stereotyping occupational categories specifically would have evolved. While such socioeconomic specialization within a society is relatively recent in human history, it is possible that socioeconomic or occupational differences are processed by cognitive mechanisms for reasoning about status hierarchies or within-group roles. American infants show some understanding of dominance relations (Thomsen et al. 2011) and by age 5 exhibit sensitivity to novel social groups' status (Horwitz, Shutts, and Olson 2014), suggesting these might be reliably developing intuitions. Another possibility is that the location backgrounds we used as occupational cues connoted geographic, and therefore ethnic, origin, especially for children in Peru who were more likely to be unfamiliar with the

mining context. The same visual stimuli can have different social interpretations at different developmental stages in Huatasani as children learn about their local social geography.

We were also surprised that adults in Huatasani relied relatively little on the occupational information, given the importance of market integration in shaping social identities in the Andes and at this site specifically (Moya 2013).<sup>9</sup> This result, and the contrasting high levels of occupation-based categorization among Angelenos, may be due to differing perceptions about the mutual exclusivity of the activities. The majority of people who engage in mining in the Huatasani area also engage in agro-pastoralism. This means that adult participants could have interpreted our occupational cues as temporary indicators of where the character happened to be. In contrast to the Andean context, few people in the US labor market can simultaneously work in both white- and blue-collar jobs. This means the visual cues to occupation could more safely be used to assess characters' socioeconomic roles in the United States than in Peru.

#### *Sartorial Cues*

While Angelenos privileged occupational cues, Huatasaneños in both age groups relied most on clothing cues to make predictions. Low-level differences in image processing are unlikely to account for this cultural difference,<sup>10</sup> so we focus on possible explanations for the intersite differences that are specific to social cognition.

The fact that our Peruvian participants and adults in Los Angeles treated a fictional clothing marker as highly predic-

9. The discrepancy between these studies may be due to several methodological differences. First, the earlier study forced participants to make a language- or occupation-based prediction, meaning that the higher rates of occupation-based stereotyping may have reflected the relative unimportance of the Quechua-Aymara boundary to locals. Second, occupational cues in this study reflected real-world locations and subsistence strategies, whereas the sartorial cues were fictional. We have found that making social category labels fictional increases reliance on ethnonymic inferences relative to occupational ones at this site (Moya 2013). This means the fictional nature of the clothing marker could have swamped people's reliance on the occupational information. Third, the occupational information was presented via verbal labels in the earlier study, whereas in this study it was presented via visual reference to the locations associated with agro-pastoralism and mining. This visual cue may have been too oblique a reference to market integration for participants in Huatasani.

10. It may be that participants in different sites attend to different parts of images. For example, researchers have shown that people from the United States attend to features of focal objects relatively more than to image backgrounds compared with Chinese participants (Chua, Boland, and Nisbett 2005). We lack direct comparisons between US and Peruvian highlanders on holistic image processing. However, given the previous evidence that US participants tend to focus on objects in the foreground, this low-level explanation would predict that our US participants would rely more on the clothing and body morphology cues than the occupational cue provided in the background. However, we find the opposite result.



tive of other behavioral traits suggests the readiness with which humans imbue sartorial cues with social significance. The novel nature of the clothing marker could have motivated people to reason that this cue was more likely to be associated with rare traits (Risen, Gilovich, and Dunning 2007), if participants knew that the real-world occupations, body builds, and facial expressions were not associated with the novel traits. This may be part of the mechanism people use for parsing ethnic boundaries if they expect novel ethnic markers to be more common than novel body types or facial expressions, for example. This is consistent with the fact that novel category labels increase ethnolinguistic generalizations more than occupational ones at this site (Moya 2013). It may also explain why known cultural attributes that are not clearly signals do not motivate much essentialism in children (Baron et al. 2014; Rhodes and Gelman 2008). However, this proximate explanation alone cannot account for the cross-cultural and developmental variation in reliance on the sartorial cue.

Huatasaneño children rely on clothing-based predictions even more than do adults in the same site. This bias is exaggerated in middle childhood and starts attenuating in the teenage years. This early-developing bias is consistent with a role for evolved mechanisms that privilege intentional cultural markers, such as clothing style, in early development when forming and learning stereotypes. However, it is worth noting that US children in our study are relatively indifferent to sartorial information. Previous research on Canadian children similarly found that 4-year-old children failed to generalize traits on the basis of shared visual features (hats or body color) unless the fictional groups were labeled, although 7-year-old children and adults did so on the basis of the visual stimuli alone (Baron et al. 2014). This means that, if evolved biases for forming stereotypes about sartorially marked boundaries exist, they do not develop reliably in young children across all contexts.

The curvilinear developmental trajectory for reliance on clothing-based stereotyping in Huatasani (fig. 2) is consistent with either the importance of age-specific developmental niches or with a prepared-learning process that requires triggering with some social experience. The most plausible difference in developmental niches is the fact that children's teachers dress in a more market-integrated fashion than do their parents.<sup>11</sup> While this feature of the educational system persists in high school and is visible to adults, by adolescence people have broader social networks and can more accurately estimate the importance of clothing style in the region. Alternatively, a prepared-learning mechanism that requires appropriate inputs to develop expectations that sartorial markers denote information-rich boundaries can also produce such a

11. School uniforms also differentiate pupils of different schools, but this is not associated with meaningful cultural differences, since the three elementary schools in town have different uniforms but correspond to very similar neighborhoods.

curvilinear developmental trajectory; early experiences can produce strong associations that then attenuate with further learning. The US children in our sample may be missing such a triggering experience (e.g., if individuals in their social worlds are fairly homogeneously clad).

The cross-cultural differences in children's reasoning are worth further analysis. Mechanisms for privileging sartorial markers should not be particularly important until children start expanding their social networks and meeting strangers. For Angeleno children, this developmental phase probably starts later, given their few opportunities for independent movement and partner choice. This means that quick stereotype formation is a less critical task for them, given their coddled developmental niche. Parents in Los Angeles engage in more supervision of their children and control their social networks more than do parents in Huatasani due to the heavy reliance on cars in the city and differences in parenting norms.<sup>12</sup> This implies that children in Huatasani need to start making adaptive social inferences earlier in their lives than do children in Los Angeles.

Furthermore, educational institutions in each site promote different kinds of associations with sartorial markers. The institutions in Peru homogenize sartorial variation among their pupils by mandating uniforms. This means that the Peruvian children should be less likely than the US ones to believe clothing differences among peers are meaningful. On the other hand, sartorial differences between teachers and the pupil's parents are much more marked in the Peruvian context than in the United States. These stylistic differences between parents and teachers in Huatasani represent important distinctions in market integration and regional origin.<sup>13</sup> This means that children in our Peruvian sample may be more attuned to the importance of sartorial differences as social group markers among adults because of their educational institutional niche. Future longitudinal or experimental learning studies can help disambiguate between prepared-learning accounts and one that relies exclusively on broader learning rules responding to differences in socioecological niches.

#### *Methodological Considerations for Developmental Work*

The general resemblance between the Huatasaneño adults' and children's responses speaks to their shared cultural context. CA+ supplement A further shows the positive relationship between child and adult responses across specific traits. For example, Peruvian adults and children thought that characters who wore the same clothing would also share a ritual, whereas both adults and children thought those who wore

12. This is consistent with previous findings that US adults believe parents socially influence their children, but Huatasaneños do not (Moya, Boyd, and Henrich 2015).

13. While some of the teachers are from Huatasani, the vast majority are from larger cities in the region and only stay in Huatasani during the school week.

the same clothing would not necessarily have the same plant knowledge.

In contrast, it is troubling that the US samples of adults and children do not resemble each other much beyond their relying most on the occupational cues. In fact, there is no association between how much children and adults in Los Angeles made predictions about various traits given shared social cues (see CA+ supplement A). This might reflect our having sampled US children and adults from different cultural populations.<sup>14</sup>

Sampling different populations of children and adults also affects the kinds of social network structures that each are exposed to. Across cultures, children likely have access to fewer sources of information about social categories outside their kin networks than adults do. This generational difference in network breadth is likely to be larger in the United States than in the Peruvian samples and may partly account for the noncorrespondence in adults' and children's responses. This is because both (1) the US sample of children is particularly self-selected and (2) the adult US sample reflects a university environment that facilitates expanding and diversifying social networks.

While we followed a standard sampling strategy in developmental psychology for recruiting participants in Los Angeles, our results should serve as a warning against such practices and as motivation for doing ethnographically informed community-based research, particularly when intergenerational socialization processes are relevant to the research question. The two potential sources of bias described above suggest that much of developmental psychology might be underestimating the importance of social influence when adopting similar university-based sampling strategies.

## Conclusion

Symbolically marked social categories are pervasive and appear to be an important part of human evolutionary history. Therefore, it is worth considering whether human social cognition bears evidence of design for reasoning about these complex cultural landscapes with variable ethnic boundaries and intraethnic roles. We focused on the possibility that evolved biases, such as prepared-learning rules, favor the use of sartorial markers as the basis of novel stereotypes.

First, we show that our participants in Huatasani, Peru, and adults in Los Angeles, California, relied heavily on novel sartorial markers to make predictions about strangers. This

suggests a cross-cultural tendency to develop stereotypes on the basis of unfamiliar, but intentional, clothing cues. Reviewing the predictions from table 1, this is not simply because the clothing serves as a signal, is stable, or visually covers the characters' surfaces, since facial expressions and body morphology did not promote as many inferences about similarity.

Despite these similarities across the adult populations, the developmental pathways in reasoning about clothing style differ in the two societies. This means that adaptations for social categorization fundamentally rely on cultural inputs to develop. The developmental patterns we document in the Peruvian highland site suggest that children are even more biased in their use of sartorial markers than are adults. This may reflect evolved biases, such as prepared-learning rules, that privilege symbolic markers when forming associations, the particular significance of clothing markers in Huatasani's elementary schools, or both. However, Angeleno children rely relatively little on sartorial markers when deciding which characters will resemble each other. This implies that any evolved mechanisms at play rely on cultural inputs, and are supported by adaptations for social learning. Social institutions and developmental niches shaped by pedagogists may also facilitate the acquisition of these beliefs.

We also find that occupational information associated with socioeconomic status most promoted beliefs about behavioral similarity in both US samples. This suggests that class categories may be acquiring more ethnic features in the US context insofar as people perceive them to be information-rich and socially meaningful boundaries or that they trigger psychological expectations about intraethnic roles.

The relatively greater importance of occupational cues in Los Angeles and sartorial ones in Huatasani suggests that evolved learning mechanisms may more generally promote stereotype formation about socially meaningful categories according to local context. However, the fact that, across such different contexts as Huatasani and Los Angeles, most participants relied heavily on novel sartorial cues to make inferences about rare traits, and that children in Peru did so even more than adults, points to people's willingness to imbue arbitrary symbolic markers with meaning and generalize on their basis. Any such biases only make sense in light of a coevolutionary history; living in culturally evolved social groups produced new selection pressures for acquiring appropriate and helpful ethnic concepts.

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14. UCLA undergraduates come from around the world, although primarily from California, and have quite a range of family backgrounds: 69% of participants identified as being of East Asian origin, and only 35% were English monolinguals. While we do not have the comparable statistics for the child population from Los Angeles, the children were predominantly of European American origin. These children also represent a more homogenous and privileged segment of the Los Angeles community, attending a private elementary school.

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# Unity versus Interdisciplinarity

## A Future for Anthropology

by Alan Barnard

This paper explores the failure of anthropology, at least since the 1970s, to look at the big picture: what the four fields can contribute to each other. It focuses on kinship as a key example, on other aspects of sociality, and on language and symbolic thought. I argue that an understanding of humanity as a whole, and especially hunter-gatherers, is important for grasping the nature of the human species. Cultural or social anthropology progressed to a large extent through kinship studies, and it is here also that we should look. The transformation of a Ju/'hoan kinship structure to a Khoe one is used as one key example. The deeper history of language itself is another. After these examples, I return to general issues, including the ways in which the diverse branches of anthropology, especially social anthropology and linguistic anthropology, serve to enlighten each other.

My main point in this paper is very simple. All kinship systems possess similar attributes, the explanation of which requires input from the entire range of anthropological sciences. I include here prehistoric archaeology, biological anthropology, anthropological linguistics, and social or cultural anthropology too. Related fields are implicated as well: evolutionary psychology, cognitive science, and so on. That is why a unified science of anthropology is useful, once we step beyond ethnographic and human biological understandings toward fully evolutionary ones. Of course, the timescale is often very different between evolutionary anthropology and kinship studies. This is especially true where evolution implies changes over millennia and kinship assumes social change over just a few centuries. This paper will touch on both.

Let me take up general issues first, before returning to my kinship examples and then to wider issues once again. If there seems to be an emphasis on social or cultural anthropology and on linguistic anthropology, that is because these are the fields I know best. The interplay between them, at any level of evolutionary development, could equally apply to the other fields as well.

### The Four-Field Approach and Understanding Prehistory

I use the words “prehistory” and “prehistorian” in a very broad sense, to include not only archaeologists but also anatomists,

neuroscientists, geneticists, primatologists, linguists, and social anthropologists who have a theoretical interest in prehistory. Even to think about such issues entails a way of thinking that is largely foreign to anthropology today. It is nevertheless both necessary for anthropologists to do this and interesting for the future of the discipline as a unified science.

I have not always been in favor of a four-field approach, but in recent years I have come to the conclusion that such an approach is best. Otherwise, it is too easy for biological anthropologists to retreat into concerns that leave them out of touch with the richness of cultural diversity in the world and for social (or cultural) anthropologists to remain ignorant of advances in palaeoanatomy, neuroscience, genetics, and many other fields that directly affect our perception of what it means to be human. This is, after all, what anthropology in its widest sense is meant to be all about. In particular, such an approach is necessary to reunite anthropology with its past as well as to stave off encroachment by social sciences with different understandings of humanity. Of all the social sciences, only anthropology is in a position to see the bigger picture, and only with an eye to human biology is it in a position to effect the changes in understanding that are needed.

Human evolution has existed for far longer than humanity as we know it. Humans have evolved through revolutionary changes in social life, and these have both biological and cultural foundations. How many cultural revolutions were there? I would say three, four, maybe five or six, throughout prehistory from *Australopithecus* to *Homo sapiens sapiens*. Most certainly were both biological and cultural. And at least one, if we include the Neolithic, was cultural alone. Only by seeing human evolution from such a broad perspective can we begin to understand the parts of anthropology that are my main interest at present: notably, kinship and language. I see

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these as ultimately interrelated and related, too, to the acquisition of symbolic thought and even the evolution of religious ideologies (see Ellis 2011; Wilson 2011).

Yet the steps entailed in this evolution are complicated. Broadly, prehistorians (and especially the archaeologists among them) fall into two camps. Either they believe in one really big revolution, or they believe in no revolutions at all. The actual number of revolutions does not matter as much as the idea of searching for such revolutionary changes in society, or for cultural advances, or, for that matter, for the debates that can emerge from seeking them. An example of an advocate of the “one-revolution” view is the social anthropologist Chris Knight. The clearest examples of the “no-revolution” view are from archaeology. In particular, Sally McBrearty and Alison Brooks, in a paper published in the *Journal of Human Evolution* (McBrearty and Brooks 2000), argue that both the fossil record and the stone-tool evidence point to a gradual development of *H. sapiens* and the *H. sapiens* brain.

Knight, in *Blood Relations* (1991) and in many articles since (see, e.g., Knight 2010; Knight, Power, and Watts 1995), has argued on the basis of cultural evidence that there was one revolution. This was a revolution of the sort that McBrearty and Brooks refer to as “the revolution that wasn’t.” Its date has changed through the years, but basically, to Knight it is a revolutionary overthrow of patriarchy and of hierarchy in general, which is now believed to have occurred perhaps 130,000 years ago. It may have been earlier, or it may have been later, but from about that (very approximate) date we have modern humans and modern, symbolic culture, with at least primitive language. Language is important here, since it marks the ability of humans to formulate religious ideas. In Knight’s view, the earliest symbolism preceded language, and language followed from symbolic thought. The first symbolic revolution, according to Knight, was one of deliberate menstrual synchrony and the control of male authority by this female act. Clearly, Knight’s vision comes from social anthropology, but it has implications for other anthropological sciences too.

Archaeologist Clive Gamble’s book *Settling the Earth* (2013) deals in part with the ubiquitousness of three-stage theory. It is also a book that combines a biological interest in brain expansion with a sociohistorical interest in population increase and dispersal. In an earlier book, *Origins and Revolutions*, Gamble (2007) argues that neither the symbolic revolution nor the Neolithic revolution really occurred. Instead, he sees human cultural evolution, or rather material cultural evolution, in terms of a gradual shift from an emphasis on implements (e.g., stone axes) to an emphasis on containers. According to Gamble, such items of material culture have been important symbolically and apparently also in terms of identity, that is, through the ability to carry more things. Gamble has already crossed the boundaries that conventionally separate different branches of anthropology. Yet he has done so by venturing into areas where few have the ex-

pertise to pull such ideas together. Particularly in a yet earlier book, *Timewalkers* (1993), he explores these by asking questions such as “How many species?” (53), “Why Africa?” (74), “Where and how does speciation take place?” (74), “Can you force hominids to change their ways?” (89), “What is hunting?” (117), and “What happened to the Neanderthals?” (144). The style may be rhetorical, but these questions hint at difficult but real issues that anthropologists rarely seem keen either to examine or to debate.

So we have revolutionaries, such as Knight, and we have gradualists, such as McBrearty, Brooks, and Gamble. My own model lies roughly, if I can put it this way, in between. I do believe in revolutions but would emphasize their plurality. I accept the idea of a punctuated equilibrium, with a degree of gradualism too. Nineteenth-century polymath John Ferguson McLennan explained it this way; his main concern here is with whether individuals or groups make up societies:

All the evidence we have goes to show that men were from the beginning gregarious. The geological record distinctly exhibits them in groups—naked hunters or feeders upon shell fish leading a precarious life of squalid misery. This testimony is confirmed by all history. We hear nothing in the most ancient times of individuals except as being members of groups. The history of property is the history of the development of proprietary rights *inside* groups, which were at first the only owners, and of all other personal rights—even including the right in offspring—it may be said that their history is that of the gradual assertion of the claims of individuals against the traditional rights of groups. (McLennan 1970 [1865]:162)

In other words, the first property owners were not individuals, but groups. Ownership progressed through “history,” or what would soon (following Lubbock 1865) be known as “prehistory.” We have an ever-increasing assertion of rights by the individual against the group. There does remain, though, the question of rights not merely in material things or in people but also in knowledge. I-language aside (language for thought, as opposed to for communication), language could only ever be the property of a group. After knowledge of how to make artifacts comes a means to transmit this knowledge, in other words, language for communication. A recognition of “ownership” is also implied here, and both ownership and the socialist and individualist tendencies that define it result from increasing group size, changes in the ability to communicate over distance, global migrations, and the expansion (and collapse) of kinship structures.

In short, most everything is implicated, and material, social, and kin relations are interrelated. This is the premise I started with when I began to think about the origins of language, and what led eventually to the conclusion that several leaps were necessary in the evolution of language.

## The Coevolution of Kinship and Language

Social and cultural evolution rest in the development of kinship, and possibly its future does as well (see Lévi-Strauss 1966). My own theory of the coevolution of kinship and language was presented in two earlier papers (Barnard 2008, 2009). Let me outline the theory very briefly, but without all the arguments for it or all the biological or linguistic technicalities. The biological and social basis of humanity lies in *Homo sapiens* hunter-gatherer society as this existed at the dawn of language and of symbolic thought. It is, of course, from the earliest symbolic representations that human society in general evolved, and understanding this evolution is crucial to knowing the nature of humanity.

It is known that with increasing neocortex size came changes in cognitive abilities and an increase in the optimal, and actual, size of social groups (Aiello and Dunbar 1993). The size of neocortex, and in fact of the brain as a whole, correlates quite exactly with observed group size for all primates, though certainly with caveats for *Homo sapiens*. *Homo sapiens*'s "natural" group size is, or should be, about 150—known sometimes as "Dunbar's number." We would assume that fossil hominins fitted these patterns, although the presence of language, of course, enables humans to form larger units than might otherwise have been the case. According to Robin Dunbar's (2003) calculations, we would expect australopithecines to have lived in groups of 65 or 70, *Homo habilis* in groups of 75 or 80, *Homo erectus* perhaps 110, *Homo heidelbergensis* or so-called archaic *H. sapiens* 120 or 130, with modern *H. sapiens* about 150. Of course, other physical factors also play a part: ecological relations, for example.

My notion of three kinship revolutions is based essentially on linguist Derek Bickerton's (Calvin and Bickerton 2000:129, 136–137) notion of three stages of language: protolanguage, rudimentary language, and full language (see fig. 1). These map neatly onto three stages in the evolution of social and especially kinship structures. Protokinship involved the sharing of food, sharing of ideas, and sharing of techniques of toolmaking within groups. Rudimentary kinship involved exchanges, possibly of people as well as things, between groups. And full kinship involved the evolution of more precise rules for sharing and exchange.

In earlier books and papers, Bickerton (e.g., 1990:177–181) had argued against a gradual development of language and instead for a catastrophic birth of language. This coincided with the "cognitive explosion" that I refer to as the "symbolic revolution." Yet his later model (with neuroscientist William Calvin) suggests the three phases described here. Protolanguage contains words and phrases but as yet no sentences. The later simple sentences and the rudimentary-language phase that characterizes their formation are products of protolanguage plus a specific knowledge of such things as who is grooming whom or who is in dispute with whom. Full language entails complex syntax, including, for example,

grammatical agreement between subject and verb. It is probable that in the first instance some form of linguistic communication was signed rather than spoken (Arbib 2012; Corballis 2002) and that from this language as we know it eventually emerged.

What I have called the "signifying revolution" marks a stage at which hominins are capable of using words and therefore classifying things. I see this as a phase very loosely reminiscent of Lewis Henry Morgan's (1871:448–466) notion of the earliest human society and the developments toward what is today called the "Hawaiian" classification. For Morgan, the earliest societies were characterized by promiscuous sexual intercourse, with later refinements including the cohabitation of brothers and sisters, the sharing of spouses in common, and ultimately the "Hawaiian" form of classification. I have suggested that this revolution occurred at an early time of the genus *Homo*. At first, there may have been an incest taboo, or there may not have been one. We do not know for certain when the incest taboo emerged. Relationship terms to distinguish legitimate from illegitimate mates or terms to indicate generation or collateral distance may have been yet to evolve. Yet the recognition of various relationships should logically follow from the earliest use of protolanguage. The ability to classify is one step away from the ability to name; it would thus accompany the early use of common nouns. This could indeed mark a very early use of language, and the development of relationship terminologies and therefore of an incest taboo may be implicated.

If the first phase of language and kinship is perhaps at least vaguely reminiscent of Morgan's era of primitive promiscuity, the second phase, following what I have called the "syntactic revolution," for me resembles McLennan's (1970 [1865]) theory of the dawn of exogamy. McLennan believed that a shortage of food led to female infanticide, which in turn led to a shortage of women and then to polyandry as the norm. Each woman would be married to more than one man, and therefore the genitor of any child would be difficult to determine. Descent was matrilineal, but this changed when men adopted the practice of bride capture. They began to steal wives from other tribes and thus gained control of their own wives and families. The battles that ensued led, in turn, to a desire for peace. Peace came as an exchange of women that replaced the practice of bride capture, and this led in turn to patrilineality and patriarchy. At least, this is how McLennan saw it. The details of an actual transition here are lost in time, although there does remain an implicit concern with property and with groups.

Nevertheless, the signifying revolution brought the recognition of categories such as mother (and possibly father), brother, sister, son, daughter, and mate. The syntactic revolution brought much more. With rudimentary syntax comes the ability to formulate complex kin descriptions and therefore perhaps the recognition of mothers' brothers and mothers' sisters. If Dunbar (2003) is right that *H. heidelbergensis* group size had increased to 120, we could certainly imagine

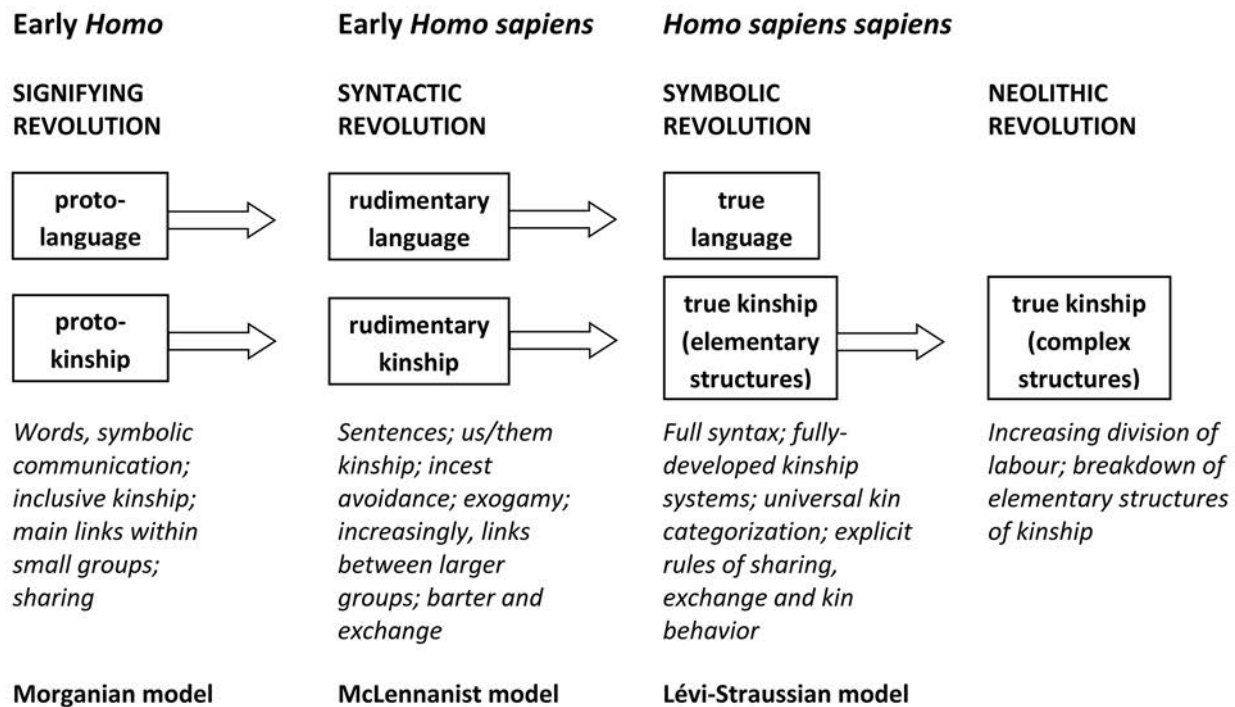


Figure 1. The coevolution of language and kinship; adapted from Barnard (2011:133).

smaller bands interacting with other bands in the same group and with other groups. The increase in neocortex size suggests a level of intentionality and the transmission of knowledge about resources, populations, and kinship. Dunbar has suggested that the earliest “archaic” *H. sapiens* or *H. heidelbergensis*, along with Neanderthals, probably filled a “bonding gap.” They did this through the development of sophisticated communication through chorusing, and possibly dance, before the development of full language. At this stage, we would anticipate, too, the strong possibility of rules governing mating exogamy, although not yet its full fruition as part of a typical hunter-gatherer social structure. A social structure in which everyone is classified as some kind of “kin” is the norm for hunter-gatherers. Yet this development would have to wait until the complete development of symbolic thought and what I have (again, loosely) referred to as a “full” kinship system.

The symbolic revolution was, in a sense, Lévi-Straussian: true kinship coincides with the emergence of elementary structures (Lévi-Strauss 1969 [1949]) and universal kin classification (Barnard 1978). Virtually all hunter-gatherer societies today also have universal kinship systems. Any strangers who might have cause to engage in marital alliance, or possibly even the trade of material goods, would be fitted into kin relations. Since society itself is definable entirely on a kinship basis, everyone must belong to a kin category in relation to anyone else: this is what universal kinship is. What makes a language a full language is its use of complex syntax and

agreement between subject and verb. What makes a kinship system a full kinship system is essentially that it recognizes a distinction between a possible and a prohibited mate. It will also, on both sides of the family, classify relatives according to rules of agreement. If I call someone “son,” he calls me “father,” and so on (see Tax 1955 [1937]:29). Just as no one speaks half a language, so too no one can live in a society in which there is only half a kinship system or in which people play by different rules. Kinship systems, like languages, evolve and must reach a point where they become fully formed. Of course, people have through kinship virtually always been able to manipulate categories, but that is not the point. The crucial thing is that kinship evolved, and it evolved in a sequence at least approximately according to a scenario like this.

Beyond what I have defined as a third phase, we have, in a sense, a fourth. This is the phase of modernity, when both elementary structures and universal kinship break down and hunter-gatherer society gives way to the Neolithic.

### The Naro Kinship Terminology

Let me now take the formation of the Naro kinship system as my key example of social change in action. Of course, this does not represent evolution on the scale of that of hominins in general, but it does show an example of the ways in which different subdisciplines in anthropology can shed light on the



same problem. If the evolutionary example outlined above represents the origin of language in the abstract in the distant past, this next one on rapid social change represents the origin of a language in recent history.

The Naro are a traditionally hunting-and-gathering people of western Botswana and eastern Namibia. They are also known as Nharo or Naron, and they number about 14,000. I did field research with the Naro beginning in 1974, and this section of the article is based on my early work as well as on the recent discovery of a language shift and its implications for reinterpreting Naro kinship and social structure.

The land of the Naro is adjacent to that of the more famous Ju/'hoansi (!Kung), who live to the north. The Naro and Ju/'hoan languages are unrelated, and the kinship terminology structures are very, very different: Naro makes parallel/cross distinctions, and Ju/'hoan makes lineal/collateral distinctions. However, the two terminologies share a rare feature: a naming system in which namesakes are considered "grand-relatives." This enables universal kin categorization through rules of namesake equivalence. For example, my sister's namesake is classified as my "sister," and the incest taboo is extended through such equivalences. The two languages also seem to share a word for "grandrelative" but little other vocabulary and no grammatical features worth mentioning here. The cultural similarities otherwise are also few, though significant: the existence of *xaro* (*hxaro*), for example, and of the custom of what are arguably bridewealth and childbirth prestations, known as *kamane* in Naro or *kamasi* in Ju/'hoan—though not in all dialects. The last syllable each case, *-ne* or *-si*, is simply a plural suffix. Neither or these two words occurs generally among San or Bushman groups, and indeed *kamasi* may be a loan word, and the customs surrounding this institution may have been introduced from the outside. *Xaro* is the formalized gift-giving exchange system described by Polly Wiessner (e.g., 1982). It overlies a network of rights to use resources on the land of other *xaro* partners. In Naro it is known by the verbal form, which is /'āe.

In the past, I regarded Naro kinship as essentially a simplified Khoe or Khoe-Kwadi (their language family) kinship system with some Ju/'hoan or Kx'a (their language family) features. Khoe-Kwadi and Kx'a are separate Khoisan language families, not genetically related but part of a *Sprachbund*: a language area that came into being by convergence rather than divergence. Khoe-Kwadi has only relatively recently become regarded as a distinct language family, and the notion of a single Khoisan family of some 300,000 speakers and about 30 living languages has long since been discredited (see Vossen 2013). Yet, as I have hinted above, the Naro very likely once spoke a Kx'a language and shifted from it to what eventually became Naro (Pickrell et al. 2012). The findings here are based on both linguistic and genetic evidence. The former include, for example, the presence of pharyngialized vowels and compound verbs in Naro, though not in other Khoe languages (see Güldemann 2008:122–123). The prospect of accounting for such a transition at first frightened me,

but as we shall see, the explanation is not as difficult as at first it may seem.

I once published an essay on the "conjectural history" of Khoisan kinship and presumed it to be definitive (Barnard 1988). However, it is worth thinking again about the transition the Naro must have made to such a different kinship structure. This is not to reject anything I have written in the past but rather to give it a different twist. We need to think through that transition in light of the now fairly clear language shift. Further technical detail has been published in a recent article about this language shift (Barnard 2014), but here let us consider simply the meaning of it for the people who lived through the period. This shift, of course, has evolutionary implications. The interesting thing is that these implications are relevant to and borrow from the several fields of anthropology. The exact time depth of contact and transition is not easy to ascertain, but let us assume that it was not long after the arrival of Khoekhoe in southern Africa, some 2,000 years ago. The present-day populations presumably have been living in their present locations for about or near that length of time. Contrary to popular myth, hunter-gatherer groups, at least in southern Africa, are fairly stable in location.

Let us assume further that the present naming system of the Ju/'hoansi was then in existence more or less as it exists now. Given the present-day linguistic obscurity of the meaning of the names themselves, or at least most of them, this is quite likely. And it is plain that the Naro kinship system today is very much a cross between the two systems: it has elements of both. Basically, Naro has Ju/'hoan naming rules but a simplified Khoe kinship structure. The latter works because of the equivalence of alternate generations. Finally, let us assume the stability of the kinship systems before the language shift. This is also very likely in view of the known stability of all the Khoisan systems, including both the terms themselves and the structures. The structures of the known kinship systems are all as expected: there are Ju/'hoan-like (lineal/collateral) distinctions in the case of all Kx'a groups and Naro-like (parallel/cross) distinctions in the case of all Khoe-speaking groups. This is in spite of more than 1,000 years of language separation for the Khoe speakers. We know this because of sound shifts in words, especially for herding culture, among them "cow," "sheep," and "milk."

All these systems make a distinction between "joking" relatives and "avoidance" relatives, and this is absolute: for example, same-sex siblings and terminological equivalents are joking, and opposite-sex siblings and terminological equivalents are avoidance. The distinction is mainly for regulating the incest taboo and for quasi-incest regulation, such as determining how close one may sit next to someone of the opposite sex. There is no in-between status; one is either my joking relative or my avoidance relative: everyone is either one or the other, although the intensity of actual joking or avoidance behavior does depend on a number of factors: age, actual relationship (mother-in-law/son-in-law is the strongest avoidance relationship), and so on.

Both the Ju/'hoansi and the Naro practice universal kin classification (Barnard 1978). This means that anyone in such a society will classify everyone they meet according to kin category. The category non-kin literally does not exist, and therefore it is important for people to know how to classify everyone in the entire society. This works through personal names, and even anthropologists are given such names in order to fit them into the system, whether it be Ju/'hoan or Naro. My Naro name happens to be !A/e, and anyone else who possesses this name is my "grandrelative." The name !A/e occurs in both Ju/'hoan and Naro. The term for grandrelative designates grandrelatives among both Ju/'hoan and Naro, although the word is different. It is *!u n!ā'a* (masculine) or *txū ma* (feminine) in Ju/'hoan (see Marshall 1957, 1976:201–251). Unusually, the equivalent word in Naro is not a Khoe word. It is *tsxōo* or *mama*, which, with additional number-gender suffixes, also means cross-cousin and cross-uncle or cross-aunt. The two terms are in essence synonymous, though grammatically different (*tsxōo* takes both a prefix, such as "my," "your," or "her," and a number-gender suffix, but *mama* does not take a prefix).

The full set of terms in Naro, without prefixes or suffixes, is as follows:

<i>mama, tsxōo</i>	Grandparent, cross-uncle, cross-aunt, cross-cousin, cross-nephew, cross-niece, grandchild, namesake, spouse's namesake, spouse's joking relative
<i>tsxōo-/oa</i>	Cross-nephew, cross-niece, grandchild
// <i>ōo</i>	Parent, parent's same-sex sibling, adult child
<i>ao</i>	My father (no prefix)
<i>ai</i>	My mother (no prefix)
<i>sao</i>	Someone else's parent
<i>ki</i>	Elder sibling (real or classificatory)
<i>lōe</i>	Younger sibling (real or classificatory)
<i>khoe</i>	Spouse, spouse's same-sex sibling (who is also <i>mama</i> and <i>tsxōo</i> )
<i>kx'ao</i>	Husband, sister's husband (woman speaking) (who is also <i>mama</i> and <i>tsxōo</i> )
<i>g//ae</i>	Wife, brother's wife (man speaking) (who is also <i>mama</i> and <i>tsxōo</i> )
<i>/ui</i>	Sibling-in-law, spouse's avoidance relative

As it happens, the Naro structure is ideally suited to the naming system, since grandrelative terms are the same as cross-uncle/cross-aunt terms. This means that it will not matter whether one is named for a second-ascending-generation relative or a first-ascending-generation relative: the terms are the same.

### The Ju/'hoan Kinship Terminology

However, among the Ju/'hoansi it does matter. Names in both societies ideally pass from grandparent to grandchild, and names are gender specific. In Naro the terms for grandparent and cross-uncle or cross-aunt are identical, but in Ju/'hoan the terms for uncle and aunt are *tsu* and *g//a*, re-

spectively. Among the Ju/'hoansi when one runs out of names for grandparents, one has to name a child after an uncle or an aunt. Therefore, since the names are what are truly important, the structure of the kinship terminology changes when that happens. Ju/'hoan grandparents become uncles and aunts, and uncles and aunts become grandparents. It is this that caused the Marshall family such confusion when they began their research on Ju/'hoan kinship. The Ju/'hoansi, in other words, have two different terminology structures: one for when a child takes his or her grandparent's name, and another for when he or she bears the name of an uncle or aunt.

The basic structure, when ego bears the name of a grandparent, looks like this:

<i>!u n!ā'a</i>	Grandfather, cousin (M), grandson, namesake, grandfather's namesake, spouse's joking relative
<i>txū ma</i>	Grandmother, cousin (F), granddaughter, namesake, grandmother's namesake, spouse's joking relative
<i>tsu</i>	Uncle
<i>g//a</i>	Aunt
<i>mba</i>	Father
<i>tae</i>	Mother
<i>!ui</i>	Elder sibling
<i>tsi</i>	Younger sibling
<i>!ha</i>	Son
<i>≠xae</i>	Daughter

Also important is the so-called *wi* relationship. In this, when classifications might otherwise conflict, it is the older person who classifies the younger.

The alternative structure occurs if ego bears the name of an uncle or an aunt: the uncles and aunts on the side of the family where his or her name comes from are called by the grandrelative terms, and not uncle or aunt. Thus, the first ascending generation on that side are the "grandparents," the "cousins," and the "grandchildren" (these are equivalent statuses), while the second ascending generation are the "uncles" and "aunts" and the "nephews" and "nieces." Terminologically then, the generations are reversed, though only on that side of the family. My father's brother or my father's sister is my "grandparent" if I am named after him or her, and my grandparents are my "uncles" and "aunts." In my own generation, I have terminological "uncles" and "aunts" rather than cousins. The other side of my family remains unchanged for me—although not necessarily for my siblings: they might bear the names of our parents' siblings and be classified accordingly. As one might imagine, this caused the Marshalls some confusion, as indeed it may do for Ju/'hoan children too.

### The Transition

What can we say about the transition? For a start, it appears to have been one-way: the ancestors of the Naro originally, or at least very long ago, spoke a Kx'a language and subsequently acquired the Khoe language we now know as Naro.

Such a shift is rare in the ethnographic record. So what caused it in this case? My answer is simple but straightforward.

1. We must stop thinking about “the Naro” as a population resembling that of the 14,000 or so Naro alive today. The population was undoubtedly very much smaller, as indeed was the rather larger Ju/’hoan population.
2. We must not assume that just one language was present. In reality, there may have been many languages spoken in a linguistically complex community that solidified as “the Naro” and “the Ju/’hoansi” only in more recent times. Even here, there is evidence of much earlier borrowing from a Kx’a source to Khoe, as well as the later shift from Kx’a in the Naro branch of the Kxoe subfamily (Güldemann, forthcoming).
3. We know that language determines kinship structure, not the other way around. While doing fieldwork in 2011, in fact, I met a N!aqliaxe individual who could speak languages in five different language families. Although this skill is unusual, it does hint at the possibilities long ago, especially, though not uniquely, among hunter-gatherers living in relatively small communities. N!aqliaxe, the only Kx’a language spoken in southern Botswana, is a linguistic isolate. It has fewer than 50 speakers in total, all of whom are over 60 years of age. It is surrounded by speakers of G/ui and G//ana (Khoe-Kwadi family), Taa (Tuu family), Tswana (Bantu family), and, as a second language, Afrikaans (Indo-European family). Naturally, his children, brought up speaking other languages, have acquired and operate in other kinship systems: those of the adjacent languages.
4. Of course, with so many languages around, as undoubtedly there must have been, it is unlikely that spouses always both spoke the same language, at least as native speakers. Moreover, it stands to reason that it is extremely unlikely that having just one language was the norm. Much more likely is that everyone spoke several languages. This is the norm among hunter-gatherers worldwide, both today and in the recent past. For example, the N!aqliaxe man mentioned above probably speaks some eight languages—although I do not know that for certain.
5. This being the case, it is possible that elements of more than one kinship system were present at the same time or that individuals operated within whichever system was governed by the language they were speaking. This happens in Australia, for example (see, e.g., Maddock 1972). When children acquire a new language, they take the kinship system that goes with it.
6. However, it is in the nature of kinship systems that they are “regular.” No one speaks half a language or has half a kinship system. Often, if not always, pidgins quickly become creoles (see McWhorter 2005), and in kinship what Sol Tax (1955 [1937]:29) once called the “rule of uniform reciprocals” dictates in one generation what happens in

the next. If I call someone “son,” he will call me “father.” If I call someone “sister’s son,” he will call me “mother’s brother,” and so on. This may not always occur so neatly, but normally it will be expected.

7. Putting all this together, we can assume that the very small population was multilingual and that for some reason part of the population diverged. The latter part of the population acquired the Khoe language that came to be Naro, and it allowed this language to become dominant. What became the Naro language brought with it the Khoe kinship structure but retained the Ju/’hoan naming customs as well as some cultural features, specifically the customs of //’ãe and *kamane*. This small group subsequently abandoned the Ju/’hoan kinship system almost entirely, and the system became Khoe.

Only one element of a Khoe system still exists: the terms for grandparent and aunts and uncles are not Khoe but are presumably derived from a Ju/’hoan, or at least a Kx’a, source. These non-Khoe terms replace the Khoe word *n//uri* or *n//odi*, in some languages today spelled *//nuri* (with appropriate number-gender suffixes), which is otherwise found universally among Khoe-speaking peoples. Of all the Khoe-speaking peoples, only the Naro and their linguistic relatives the Ts’aokhoe are missing this term. This includes the Khoekhoe herding groups as well as the traditional hunter-gatherers and the “River Bushmen” too: they all have it.

The differences between Naro and Ju/’hoan kinship structures are significant. Yet when seen in long, evolutionary terms, they are not as problematic as it might seem. Other parts of the world are also linguistically diverse, particularly Australia and New Guinea. The island of New Guinea, for example, has some 1,100 languages. Many are spoken by very small populations: the mean number of speakers for a language in Papua New Guinea is 3,752. A community may number only 50 to a few hundred people, and a local group may occupy a territory of just a few square miles (Nettle 1999:70–74). Given migration, cultural diffusion, and intermarriage, people will certainly be aware of each other’s languages, and multilingualism is highly likely. The situation is similar in Australia, where in 1770 (the time of first European settlement) more than 200 languages were spoken. The governor, Arthur Phillip, wrote to Sir Joseph Banks of his astonishment that the inhabitants of Botany Bay were using different words from people who lived only 40 miles away (Dixon 1980:9–10).

Only by recognizing the genetic basis of the discovery that “Naro” were once “Ju/’hoan”-like, the similarities in kinship classification across the languages and language families represented by these two groups, and the fact of the transition from a tiny set of multilingual groups to larger and more monolingual ones can we see the full picture. In other words, Naro kinship can easily be understood, but only through a broader framework than “the Naro kinship system” as we have it today.

## Other Possibilities

In North America, the four-field department is the norm. In many other parts of the world, including the United Kingdom, where I am based, it is not. At the same time, in the United Kingdom both students and professional anthropologists blithely employ the term “anthropology” when they really mean “social anthropology,” even in phrases like “anthropology differs in this regard from biological anthropology” (which I have heard more than once). Only the former is actually regarded as the real thing. In my course called Human Origins and the Genesis of Symbolic Thought, I have had many student essays with such a usage, even though the first essay question was, in fact, “What are the barriers in applying ideas from social anthropology to the study of human origins?” Plainly, some of the students had not gotten, by that point, the idea of the course—nor, perhaps, of the question itself (see also Barnard 2011, 2012).

Adam Kuper and Jonathan Marks (2011) commented a few years ago on the lack of coherence in the anthropological sciences. In the 1980s, departments in North America divided into biological and social (or cultural) wings, with hardly much interaction between them. In the spirit of journals such as *Current Anthropology* and *American Anthropologist*, the discipline must wake up to the fact that this larger discipline is changing rapidly. This is borne out in biological anthropology by publications such as Katherine MacKinnon’s (2014) recent review of that subfield. She points out, for example, that “hobbits,” Denisovans, and interbreeding with them and with Neanderthals, as well as 400,000-year-old DNA, new fossils, new stone tools, and so on, are all making this field quite exciting. But where is social anthropology in this? Indeed, how might social anthropologists in general explain the transition from Ju/’hoan-like kinship to Naro-like kinship?

Within social anthropology (or linguistic anthropology), Harold Conklin’s (1969:54–56) study of Hanunóo pronomial usage is a classic case of this. In his analysis, Conklin replaces the “traditional” distinctions of person (first, second, and third), number (singular, dual, and plural), and inclusion (inclusive and exclusive) with three other pairs: minimal membership and nonminimal membership, inclusion of speaker and exclusion of speaker, and inclusion of hearer and exclusion of hearer. The result is an intrinsically satisfying matrix along these axes, rather than a rather messy “solution” with blank spaces where nonexistent pronouns “might” occur. Or imagine that if a kinship system has exactly 12 kinship terms, being able to account for 9 or 10 of them is not explaining the system. One needs the whole thing, because that is what a system is.

Perhaps that is the crucial distinction between our discipline and sociology: we seek answers that conform to local realities. We are more interested in explaining systems than in collecting data. This is not to suggest that there is necessarily anything wrong with the idea of a comparative sociology, but rather that anthropology does have its own, rather

different tradition. Anthropology as a whole seeks an understanding that is at least attempting to capture a truth that our informants might broadly agree with. That is why we seek explanations both from the inside and from the outside. What the future holds will depend on how strong our anthropological tradition really is. For this, we as a discipline should assert our independence from other social sciences as well as our need for an anthropological foundation for our findings (see also Parkin and Ulijaszek 2007). By “this,” of course, I mean foundations within a wider framework defined as anthropology in its broadest sense.

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# The Rift between Science and Humanism

## What's Data Got to Do with It?

by Polly Wiessner

The greatest division in our field between a more scientific anthropology and a humanistic one lies largely along theoretical lines. However, the debate over the use and value of etic data, observer-oriented objective data measured from the outside for explanation, and emic data, actor-oriented subjective data from the inside for interpretation, has also been vehement. Here, a case study comparing violence among the Ju/'hoansi (!Kung) Bushmen of the Kalahari and Enga of Papua New Guinea is used to show (1) how cultural institutions structure aggression and violence, for better or for worse, and (2) how the complementary use of data from the inside and outside is essential for understanding cultural institutions and their effect on cognition, motives, emotions, and corresponding actions and social selection pressures. A challenge for anthropology will be to work out how to collect and apply data from the inside so that it can be used systematically to help interpret and contextualize data collected by external observers. Such efforts will require understanding of how knowledge is generated, distributed, exchanged, and controlled.

*The plain fact of the matter is that many social scientists literally do not know what they are talking about and cannot communicate with each other because they cannot ground any significant portion of their discourse in a coherent set of describable observational practices.* (Harris 1976:379)

*The great problem for the science of man is how to get from the objective world of materiality, with its infinite variability, to the subjective world of form as it exists in what, for lack of a better term, we must call the minds of our fellowman.* (Goodenough 1964:39)

The data debate has been a hot one for decades. Long-term fieldwork involving interviews, recordings, and participant observation yields a rich array of data. But, after data has been coded into numbers to test scientific hypotheses, the picture is stark, because much of the material in notebooks and audio files remains untouched. It is not surprising that those pursuing more humanistic agendas react to the omission of history, personal perceptions, cultural realities, motivations, meaning, symbols, and emotions in seeking to understand human behavior as reductionist, mechanistic, and deterministic (Sahlins 1976). The vehement debate over the use and value of etic data, observer-oriented objective data measured from the outside for explanation, and emic data, actor-oriented subjective data from the inside for interpre-

tation (Pike 1954), began in the 1960s between cultural ecologists and symbolic anthropologists (Ortner 1984). It has been accentuated with postmodern interpretive approaches and remains as acrimonious as ever.

A number of approaches in the “scientific camp” that have emerged over the past decades have renewed the need for the use of both emic and etic data. One is Richerson and Boyd’s (2008) dual-inheritance theory that humans have both a genetic and a cultural heritage (Henrich and Gil-White 2001; Mesoudi, Whiten, and Dunbar 2006; Richerson, Boyd, and Henrich 2010; Shennan 2001). Cultural heritage plays a major role in human evolution because the transmission of behaviors via imitation allows for rapid adaptation to changing environments. Attention has been focused on trying to establish principles of the transmission of traits through teaching, learning, and imitation to build an inheritance of cumulative culture (Henrich 2016). Emic data can provide deeper understandings of when and why people imitate innovations and why at times imitation leads to maladaptation. Emic data have also been profitably used in behavioral ecology for topics such as marriage (Shenk 2016) and relations to environment (Bird et al. 2016).

Culture does not usually come in single traits but in packages, that is, institutions composed of rules, beliefs, practices, and norms that bring about regularity in behavior (Greif 2006). Economic anthropologists have adopted theory from institutional economics (North 1990), compatible with behavioral ecology, to understand how cultural institutions are constructed and developed. Institutions provide important adaptations to reduce the transaction costs of social and economic exchange and to make cooperation possible in larger groups formed of distant kin or non-kin (Acheson 1988; Ens-

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minger 1992, 1997). Self-interested actors, in turn, constantly push the limits of institutions to alter them to their advantage and generate innovations. Because actors must build on existing institutions, history matters.

Institutions lay down the parameters of competition and cooperation and channel behavior accordingly. Etic data are essential to describe their workings and emic data to understand why people are motivated to do much of what they do—or at least why they think they behave in a certain manner. All human societies have relations of power that are played out in cultural institutions, whether between individuals, coalitions, or corporate groups, generating the pulse of human societies (Wolf 1999). Ideologies may be used to mask agendas to others or even to self. Even within one community, beliefs can differ greatly between generations, sexes, or within hierarchies and affect motivations. Emic data can help elucidate these. For instance, among the Enga of Papua New Guinea, young men participated in bachelors' cults because they believed that a mythical spirit woman would transform them into mature, handsome, and marriageable men if they did not engage in contaminating sexual relations with human women. Older men were not particularly concerned with the spirit woman but with how they could discipline young men and keep them out of marriage until they were 28–35 years old, profiting from their labor in the meantime.

Cultural institutions create a significant force in the selective landscape (social selection; Boehm 2012; Nesse 2009; West-Eberhard 1979). They also contribute to the web of competing motives in the human repertory. Those who play successfully within the rules, or adjust rules and meanings effectively to bring about new developments, win partners in cooperation as well as perks and privileges. Human cultural niches are formed by interrelated institutions, for example, rules and rituals of the game to initiate young men, arrange marriages, or govern property and exchange. Understanding human cultural niches involves asking (1) how institutions shape the cognition, motivations, emotions, and corresponding actions of actors in different contexts and (2) how agents exercise power to alter institutions to meet their interests within the limits of social and environmental constraints, and who benefits. These two questions are shared with approaches widely used by cultural anthropologists such as practice theory (Bourdieu 1977; Giddens 1979; Ortner 1984; Sahlins 1985). The construction, maintenance, and reproduction of cultural institutions and the niches they generate feeds back on genetics, epigenetics, and ontogeny (Fuentes 2009; Gettler 2016; Hewlett 2016; Jablonca and Lamb 2007; Nepomnaschy and Flinn 2009). An integrated use of data from the outside and from the inside will greatly enhance understanding such processes.

### The Role of Emic and Etic Data in Understanding Aggression

Evolutionary approaches to aggression and coalitional violence have provided the battlefield for some of the most emotionally

charged debates in anthropology. Arguments of Freud, Lorenz, and others proposing that aggression is an instinctual drive with a phylogenetic basis have raised fears that human societies will be eternally plagued by inner demons (Eibl-Eibesfeldt 1989). Works such as those of Chagnon (1988), suggesting that aggression is linked to reproductive success; of Wrangham (1999), that coalitional killing is an expression of a drive for dominance over neighbors; and of Bowles (2009), that between-group aggression selected for within-group parochial altruism, have further fueled the controversy. Some of the debate has shifted to whether there was “a time before warfare” when peace prevailed among our forager forefathers (Fry 2007; Fry and Söderberg 2013).

Cultural institutions play a major role in channeling aggression in all human societies. They incorporate a wide range of motives beyond land and women that promote the interests of actors or coalitions. Coalitional strategies in simple societies often combine aggression and affiliation to reach political ends: to renew bonds between group members after loss; to establish balance of power as a means to facilitate intergroup exchange; to build reputation and attract supporters; to forge intergroup alliances; or to reap benefits via subsequent reconciliation. Relevant questions for understanding the role of aggression in the cultural niche include, how are aggression and affiliation managed by cultural means to the benefit and detriment of individuals, alliances, or social groups in human societies, and what did differential success in this enterprise mean for our political evolution?

Aggression is one area of human behavior where biologically based predispositions and cultural institutions mesh to play a significant role in structuring perceptions and behavior. It is also an area where social selection pressures are strong. Here I will draw on etic and emic data to compare aggression in two very different societies: the peace-seeking Ju/'hoansi (!Kung) foragers of Namibia and Botswana, and the warring Enga horticulturalists of Papua New Guinea.

The comparison between the Ju/'hoansi and the Enga will be structured along four dimensions of aggression. These are universally found in human societies and thus appear to have some evolutionary roots.

1. *Sanctioning of aggression.* Aggression is a tool used in all cultures for acquisition and defense in a competitive world. Applications, goals, means, and expressions of aggression are sanctioned by cultural institutions. Reasons for aggression may include anything from women and resources (Ember 1982; Ember and Ember 1992) to revenge (Boehm 1984; Gat 2006; Keeley 1996; Otterbein and Ottenbein 1965; Pinker 2011) to defense of sacred values (Atran 2016; Atran and Ginges 2012; Atran and Henrich 2010).

2. *In- and out-groups.* Aggression is meted out following concepts of in-groups and out-groups constructed from biological and socially defined kinship. Out-group members are frequently dehumanized to remove empathy when violent conflicts arise (Eibl-Eibesfeldt 1989; Leidner and Castano 2012; Waller 2002).

3. *Revenge*. Retribution is a universally found sentiment in human societies that may have its roots in deterrence (Boehm 1984; Daly and Wilson 1988; McCullough 2008; McCullough, Kurzban, and Tabak 2013; Pinker 2011). Cultural rules, norms, and beliefs concerning the need for revenge and when and how it should be carried out vary widely, as does its role in deterrence.

4. *Reconciliation*. Most human societies and some primate societies have forms of reconciliation to contain aggression. There are many means of reconciliation, some involving the exchange of material goods (De Waal 1990; Eibl-Eibesfeldt 1989; McCullough 2008; Van der Dennen 1990).

## The Data

The emic data I will use here for the Ju/'hoansi come from 174 conversations noted in 1974 (Wiessner 2005) and 68 stories told at night and recorded between 2011 and 2013 that have been transcribed and translated by a team of Ju/'hoansi trained by Megan Biesele (Wiessner 2014). Good stories are not always true, but to be compelling they must "ring true." Events may be exaggerated, expanded, or omitted, but certain facts, norms, values, and human quandaries must resonate with the audience and thus contain valuable information. Future work must supplement material from conversations and stories with systematically collected narratives giving the different perspectives of individuals who witnessed violence. Quantitative data will be taken from the annotated demographic database collected for Nyae Nyae from the early 1900s to the 1980s by John Marshall and Claire Ritchie and updated by Wiessner until the present. Lee (1979) has also carried out an excellent study of Ju/'hoansi homicide, though the homicide rates that he calculates are much lower than those presented here.<sup>1</sup>

Qualitative data for the Enga come from historical traditions dating back some 300 years, systematically collected by Polly Wiessner and Akii Tumu (Wiessner and Tumu 1998) and supplemented by more than 100 interviews about modern wars, detailed notes of more than 200 customary court cases concerning intergroup conflict, and perspectives from people from different walks of life. Quantitative data or rates of violence come from (1) historical traditions, (2) the work of Meggitt (1977), (3) a three-generation genealogy of one clan, including causes of death collected by Wiessner and Larsen Kyalae, and (4) systematic data on warfare collected between 1990 and 2011 from customary court records (Wiessner 2010; Wiessner and Pupu 2012).

## The Ju/'hoan Bushmen

The Ju/'hoansi (!Kung) are foragers who inhabit northeastern Namibia and northwestern Botswana (Lee 1979; Lee and

DeVore 1976; Marshall 1976; Wilmsen 1989). The study population numbers about 2,000 today, with most Ju/'hoansi settled in permanent villages living from a mixed economy (Biesele and Hitchcock 2010; Wiessner 2003). Unlike some foragers, Ju/'hoansi were not encapsulated by hostile neighbors but maintain regular interaction with surrounding groups of Tswana, Herero, and Kavango agropastoralists. Before about 1970, Ju/'hoansi made a living from hunting more than 40 species of animals and gathering over 100 species of plants (Lee 1979). People lived in land-holding bands of some 25–40 people with strong egalitarian ethics and poorly developed leadership. Bands had few communal activities except for trance healing and meat sharing when large animals were killed. Leaders had the power to persuade others but no power over others; they were firsts among equals.

A high degree of mobility was necessary for survival because many local territories did not have enough food and water to support a band year in and year out (Lee 1976). In response, the average Ju/'hoan developed between 15 and 16 partnerships with other Ju/'hoansi up to 200 km away with whom they exchanged gifts in *xaro* exchange to obtain access to alternate residences (Wiessner 1982, 1986). Each man and woman maintained his or her own distinct set of partners. In times of hardship families or extended families packed up and went their own ways to stay with partners for weeks or months in bands made up of close kin, distant kin, or non-kin (Hill et al. 2011). Norms of peaceful relations greatly reduced the social transaction costs involved in entering and fitting into other bands.

## Sanctioned Uses of Aggression

Ju/'hoansi eschewed violence in everyday life.<sup>2</sup> Children rarely received corporal punishment, and domestic violence was rare before alcohol was widely available in the 1970s. Ju/'hoansi did not sanction violence as a legitimate means to any ends except against murderous psychopaths (Lee 1979). Nonviolence might be considered a "sacred value" (Atran 2016); violence drew moral outrage from the community. Ju/'hoansi knew that peaceful relations were key to maintaining the freedom of movement in times of resource failure or social strife.

A number of cultural means supported the rejection of physical violence. Marriages were arranged for young girls (Marshall 1976; Shostak 1981; Wiessner 2009), often prepubescent, to avoid male competition and to secure in-laws who get along. Trance healing dances drew people together in a joint effort to promote community well-being and reduced tensions, particularly during large gatherings (Katz 1984; Marshall 1999). Engaging stories told by firelight soothed tensions in the evenings (Wiessner 2014). The most common

1. See Supplementary Information 1 in the CA+ online supplement for discussion of the discrepancy between the Lee and Marshall-Wiessner data sets.

2. I use the past tense for both the Ju/'hoansi and Enga because much has changed in recent years, though much remains the same.



Table 1. Ju/'hoansi homicides by decade from Marshall-Wiessner database (1920–2009)

Decade	Men	Women	Total	Population	Per 100,000 per year	Drunk (%) <sup>a</sup>	Revenge (%) <sup>b</sup>
1920–1939	34	9	43	1,750	123	0 (0)	9 (31)
1940–1959	25	11	36	1,750	103	0 (0)	12 (48)
1970–1989	7	5	12	1,750	34	10 (83)	2 (20)
1990–1999	12	6	18	2,000	100	16 (89)	1 (6)
2000–2009	3	2	5	2,000	25	4 (80)	0 (0)
Interethnic 1940–1969	13	2	15	1,750	29	Unknown	0 (0)

Note. Data from the 1960s when people were settling at Tsumkwe are not complete and so have been excluded.

<sup>a</sup> Percent of deaths when participants were drunk.

<sup>b</sup> Number of incidents with revenge.

response to serious conflict was dispersal; the *xaro* exchange system assured that conflicting parties had a place to go.

What do the quantitative data show? Figures on Ju/'hoansi aggression are somewhat puzzling. Avoidance of aggression and violence expressed by Ju/'hoansi shows up in data on everyday life. For example, in a period of 12 months at /Kae/kae, for a population of some 150 people with many visitors coming and going, I witnessed or heard of only seven severe cases of physical violence. Five of these were tussles between young men that may have been influenced by neighboring agropastoralists. One was between husband and wife and another between jealous wives. In all cases the parties were restrained, and no physical injury resulted. There were no cases of physical violence against children that I saw beyond mild slaps. Lee and Marshall found similar levels of peace in daily life (Lee 1979, chap. 13; Marshall 1976).

Though my work and earlier work carried out by the Marshall family (1976) indicate peaceful relations in daily life, homicide rates between 1920 and 1939 were relatively high: 123 homicides per 100,000 per year in comparison with 9.8 for the United States in 1991 (Pinker 2011:64), 39.7 for the Mbuti (Keeley 1996), and 100 for the Canadian Arctic Inuit (Pinker 2011:55). However, homicide rates for hunter-gatherers vary greatly (Kelly 2013), from 6.6 for the Hadza (Marlowe 2010:141) to 129 for the San Ildefonso Agta (Early and Headland 1998:103) to 500 for the Agta (Hill, Hurtado, and Walker 2007), depending on point in time, relations with neighbors, and position in nation-state. Rates were somewhat reduced between 1940 and 1959 when agropastoralists settled in the area (table 1). The Ju/'hoansi themselves claimed a high rate of homicides before agropastoralists and Europeans moved into their areas.

Of the 55 cases where relations between the killer and victim were known, 44% of the victims were close consanguineous or affinal kin (table 2). Others were more distant kin in camp or visitors who happened to be there at the time. Of 79 deaths in the 66 fights, six were bystanders, including two children. Reasons given for fights that resulted in homicides were largely interpersonal, particularly relations involving women (table 3).

Quantitative data leave us with the question of how such a generally peaceful society with norms of nonviolence can

have such high homicide rates. Here stories can add perspectives by describing lethal fights in detail, events that an ethnographer would be very unlikely to witness. The following story describes a fight over a marriage. Salient are the lack of any formal institutions to manage the situation once violence broke out, the ferocity of the anger that was taboo in daily life, and the horror of having lethal poisoned arrows that could be used to kill stealthily in times of conflict:

There was one man whose name sounds like my brother-in-law's name. They called him //’Ao the boastful one. And he was extremely crafty; crafty to no limit. He married a young woman [without parental agreement] named Tcoqa, a nice name, a teenager. He used to take her to collect morama beans and to prepare morama beans in the veldt but one day the woman refused. . . . She ran to another household instead [and left him]. Hee, heee heeeeee.

And the man //’Ao said, “Why is she laughing over there?” Heeela! And one night in the pitch dark she was sitting with a young man and they did not see him [//’Ao] when he came up quietly behind them and stood behind them, watching them, watching them as they sat together and looked at each other.

He turned around and went away and went away to his hut and just waited and waited. When a full moon rose, he made an arrow point and smeared it, an arrow, those arrows that are made of bone [tapered and unbarbed]. He smeared it with those things they gathered and uprooted [indirect reference to poison larvae]. “Yes, are you saying ‘ha, ha?’ You wait—I am coming today.” And then he re-

Table 2. Relations between killers and victims for 55 Ju/'hoansi homicides between 1920 and 1959

Relationship	Number	%
Close family	12	22
In-laws	12	22
Others in camp or camps in area	23	41
Other Bushman groups	2	4
Bystanders	6	11
<b>Total</b>	<b>55</b>	<b>100</b>

Table 3. Incidents triggering lethal Ju/'hoansi fights between 1920 and 1959

Incident	Number	%
Women, adultery, marriage	26	39
Psychopaths, hate, revenge	23	35
Resources	4	6
Unspecified	13	20
Total	66	100

turned, stood behind the woman and stabbed her here in this part [the chest].

And his in-laws said, "Wow you all, is //’Ao mad with his foreskin pulled back [insult]?" They wanted to catch him, to catch him but he got up and dropped behind them and turned saying, "Have you all seen //’Ao the boastful one?" He ran away and got to his quiver and spear that he had hidden ahead of time, because he had come unarmed, and went off and hid in the veldt. //’Ao had come here unarmed to do strange things [stab Tcoqa].

They chased him unsuccessfully but he hid in a thicket. Swou, swou, swou. "Yow, you all, where is //’Ao?" They ran right by him. Was he standing and watching them? "He should let us kill him today so that he can die and shit on himself and not be seen anymore." He was standing and watching them.

"Huuuuuuuu," she cried in the early morning. "Mother hold me tight. Huuuuuuuuu . . . I am dying today, huuuuuuu. //’Ao the boastful one has killed me, aaaah."

[The chase goes on, described in detail, but //’Ao was artful and evaded them.]

Early the next morning just before sunrise, he came back, stood there and provoked them saying, "Yes, what did I say yesterday? Are you now saying 'huue, huue' then?"

His brother-in-law said, "You will die with your foreskin pulled back. You all catch him, catch //’Ao the boastful one so he can shit!" They jumped right up and wanted to catch him. But he leapt behind them and said, "Perhaps you have seen //’Ao the boastful one, I am //’Ao the boastful one."

They chased him unsuccessfully. "//’Ao the boastful one you will go, die and ejaculate on yourself." But he outran them, leaving his belongings behind.

[Arrows were exchanged, the chase went on and on, described in detail, but the artful dodger //’Ao eventually got away and left the area.] (Narrated by N!ani Kxao, translated by Beesa Boo, 2011)

The story ends with "Nobody killed him, he died by himself." People know where he went, but the thought of pursuing him beyond the immediate moment is not even considered. The narrator goes on to describe //’Ao’s odd daughter as if to justify the fact that he was indeed a madman:

His daughter, //’Ao the boastful one’s daughter, is Di//ao a woman who has no sense. Just like her father, she is un-

believably strange. She whistles into men’s ears. She is very strong and can grab you and beat you.

Such stories show that an ideology of nonviolence without supporting cultural institutions is not sufficient to prevent violence in cases such as competition over women.

A second perspective related to the high homicide rate that comes out in stories is the inhibition to kill close kin who were mentally disturbed and dangerous. Some were killed by small group action, but only too late, after a number of atrocious acts. Mixed conflicting emotions of fear, anger, and wrenching kinship loyalties are expressed in the following excerpt:

There was one who was mad from the beginning. He was Tsamkxao who was senseless. He used to beat and kill people. After he killed another man, his uncle Kxao said, "I am going to shoot Tsamkxao, hit him with an arrow today." And when he [Tsamkxao] passed by, he shot at him, he shot at him and hit him in this bone here [hip].

Tsamkxao screamed, "Yeah, who has hit me, who has hit me?" He then took hold of the arrow that was still stuck in the bone and broke it off at the head. He ran up to his house and got his quiver.

His uncle said to the others, "He has already fetched his quiver so get your quivers for today we will kill him. You do not have to say 'but he is a member of our family,' else he will kill all of us today." They gathered and he shot at them but they dodged his arrows, and dodged his arrows, so he did not hit one of them. Then he played a trick on them for he was very clever. He let them shoot all their arrows and collected them. When their arrows were exhausted, there were two old men following each other. Tsamkxao said, "I am going to shoot with one arrow and hit one of these old and strange things." That’s what he said. Wasn’t he intending to hit =Oma?

He shot at the two old men; one was =Oma. The one in front dodged by lying flat but even though the other one (=Oma) dodged, the arrow hit him in the back. He called out, "Heeeeeee Tsamkxao has hit me."

"Tsamkxao has hit you? Are you crazy to let him hit you? We wanted Tsamkxao to die alone today but now a leader (=Oma) will die with him." They sprang up and chased him and chased him. . . .

Tsamkxao returned to camp wounded. Tsamkxao really cried, he cried indeed for he was miserable. His uncle who was supposed to feel sorry for him just spoke angrily. Tsamkxao said, "Uncle do not talk like that." And his granny, his old granny N!hunkxa said, "Why are you crying. Just sit down quietly and die for you are too crazy to live."

He refused and took antidotes for poison. [How he made antidotes from ground-up frogs, lizards, and ashes is described in detail.] "Poison cannot kill me. If you want to kill me, you have to spear me."

[Eventually they did spear him, an event also described in some detail.] (Narrated by /Ui N!a’an from N!omdi, translated by Beesa Boo, 2012)

Stories such as that of //’Ao and Tsamkxao contribute a great deal to understanding Ju/’hoansi violence. They reveal social selection pressures and portray the unpredictability of small battles with inaccurate, unfledged arrows and the unintended consequences of disorganized skirmishes that raise homicide rates.

*In- and Out-Group Formation*

Figures on intergroup homicides indicate a moderate rate of agropastoralist Ju/’hoansi murders in comparison with in-group murders: 29 per 100,000 per year between 1940 and 1969. There is only one case of a Bushman killing a Herero man when he caught him in flagrante with his wife and shot him in the butt. Given the fact that agropastoralists moved into Ju/’hoan land, exploited their labor, and were often said to beat Ju/’hoansi, one might expect the formation of in- and out-groups and a certain degree of coalitional conflict. Agropastoralists, though more powerful, did fear the possibility of Ju/’hoansi stealth attacks with poison arrows in an area where the government had little control. From stories and conversations, however, it is clear that Ju/’hoansi do not delineate in-groups that are immune to violence and out-groups that are targets of aggression. In the conversations noted and stories recorded, there was not a single mention of coalitional or sanctioned Ju/’hoansi violence against agropastoralists or Bushmen from other language groups. Stories often describe coresidence and cooperation with neighboring agropastoralists. Most conflict between agropastoralists and Ju/’hoansi was in reaction to Ju/’hoansi theft, or in a few instances, competition over Ju/’hoansi women, which was also the most common cause of internal strife.

*Revenge and Reconciliation*

Revenge is the number one cause of coalitional violence in simple societies (Gat 2006; Otterbein 1965; Van der Dennen 1990). The emotions of revenge—rooted in defense, deterrence, and the establishment of equality—are some of the most difficult human emotions to contain. Still, revenge was managed reasonably well by the Ju/’hoansi. There was no cultural value placed on taking revenge for murders or concern with such matters as appeasing the spirit of the dead. However, when violence did erupt and the scene was chaotic, it was accepted that people would retaliate on the spot, as in the //’Ao case (see also Lee 1979; table 4).

Revenge executed in the heat of the moment occurred in 21% of homicides. In most cases, a strong desire for revenge was expressed, but if it was not executed immediately, tempers cooled, people separated, and the incident was dropped. People convinced one another that blood would not erase blood but just render more tragedy. Revenge taken at a later date was generally discouraged unless the initial perpetrator was considered dangerous. There were, however, cases of delayed revenge carried out by the few men in the population

Table 4. Responses to homicide in 66 lethal Ju/’hoansi fights between 1920 and 1959

Response	Number	%
Immediate revenge	14	21
Delayed revenge	3	5
No known revenge	43	65
Unknown	6	9
Total	66	100

who were considered to be belligerent. Stories indicate that the few delayed revenge attacks were inefficiently executed, and despite rare serial killers and repeated attempts to kill them, there is no evidence of regular feuding.

The Ju/’hoansi had no formal proceedings for reconciliation or reparation payments; nonetheless, families involved in lethal conflicts were able to converge at central places after a period of separation. How was anger quelled so that people could live together again? Two strategies, gleaned from stories, dampened the bite of homicide and the desire for revenge. One was to portray the incident as an unfortunate twist of fate, such as the passions of young men or the fault of the beer. The other was to regard the aggressor as mentally unstable, dangerous, and to be forgotten:

After some time some of them went to G/am [where the deceased’s maternal relatives were].

“Did you kill him?” people asked.

“Yes, we killed him.”

“If you killed him, it is all right. He was killing all of you.”

“Yes, he was killing all of us; *he* was such a strange thing.” [How strange “he was” is repeated many times.]

And his mother was there and said “Even if he is dead it does not matter. He was not a normal human being. If you have killed him, we are not going to blame each other. We are not going to repay [pay back] each other for him, no way!”

“Have you not seen that he killed a big leader (=Oma) while he was dying. . . . We do not even have to say that the one who used to be alive is dead now, we do not even have to mention him.”

“Instead we are going to live on.” . . . There were gemsboks killed and weddings held. . . . They lived on and well.

Such ability to contain revenge was one of the most powerful Ju/’hoan means for reducing violence.

*Change and Agency*

Homicide rates declined slightly in the 1940s and 1950s when Herero settled in the community of G/am in southern Nyae Nyae and Tswana in Botswana and provided courts for mediation (table 1). In 1970–1989, when the Ju/’hoansi were settled at Tsumkwe by the South African government with

police presence, the combination of traditional ideology rejecting violence and formal state institutions to enforce the law greatly reduced the homicide rate to 34 per 100,000 despite the widespread availability of alcohol.

After independence in the 1990s, when most Ju/'hoansi had moved back onto their traditional lands, homicide rates soared for a decade. Ju/'hoansi had learned how to brew alcohol, and Ju/'hoan soldiers had participated in violence in the defense force. The Namibian police rarely intervened in Ju/'hoan affairs, and Ju/'hoansi were unwilling to report homicides; only four out of 18 homicides involved arrests in the 1990s. Most of those who had killed when drunk remained in their villages. Sixteen out of 18 homicides recorded occurred during drunken brawls; there was only one case of a revenge murder carried out in the spot. People were frightened by the wave of violence; however, little action was taken from within to curb the drinking and associated violence. Testimonies are revealing; most people attributed the violence to the "fault of the beer," and those present claimed to not know details for most cases. Such murders were regarded as "no fault," with no need for revenge.

By the end of the 1990s lessons had been learned,<sup>3</sup> and though there was little police intervention, Ju/'hoansi stopped brewing in villages for fear of drunken brawls. Those who wanted to drink went to Tsumkwe in clubs where non-Ju/'hoansi club owners were more active in breaking up fights. Ju/'hoansi explained the decision not to brew in villages in terms of passive agency: "We Ju/'hoansi do not know how to brew. The Blacks are crafty and eat up all our cash by selling alcohol. Ju/'hoansi do not have the sense to know how to brew and sell." Modern stories and personal explanations of change do much to clarify the nature of passive agency in a fiercely egalitarian society.

## The Enga

The Enga are horticulturalists who inhabit the central highlands of Papua New Guinea, cultivating sweet potato and other crops to feed large human and pig populations (Meggitt 1965; Waddell 1972; Wiessner and Tumu 1998). Today they number some 500,000. The Enga were organized into exogamous patrilocal clans of 350–1,000, which were the units for most political action, including war. Men competed passionately in politics, warfare, and building broad networks for the ceremonial distribution of wealth to gain prestige, wealth, and wives. Women devoted themselves to private activities such as family, gardening, and raising pigs (Kyakas and Wiessner 1992). Assembling and distributing wealth in *tee* exchange was the activity of highest social and political esteem (Feil 1984; Meggitt 1972; Wiessner and Tumu 1998).

3. In the end of the 1990s, the Namibian government introduced customary law courts for handling disputes but not serious crimes. Most cases taken to court by Ju/'hoansi involve marriage, the main cause of homicide in the past.

Enga social and political relations were organized along two axes of kinship. One was composed of agnatic kinsmen who competed for leadership within the group but supported each other as equals in agricultural activities, bride-wealth payments, defense, and raising compensation payments. Corporate groups were strengthened by men's houses, bachelors' cults, clan meetings, and cults for the ancestors. The other was made up of maternal and affinal kin outside the clan who supplied crucial wealth for exchanges, allies in warfare, and other forms of support. Loyalties often conflicted because labor, not land, was short. Raising pigs was labor intensive, and the number of pigs given in ceremonial exchange by the wealthy greatly exceeded the capacity of household production. Families related through marriage in surrounding clans were thus essential partners for providing pigs and other valuables for exchange on credit. Wars, usually with neighboring clans, disrupted critical affinal relationships and networks. Consequently, clans had an interest in keeping the peace by paying compensation for transgressions rather than fighting or by calling a truce after a few deaths and paying compensation.

## Sanctioning of Violence

Violence was considered to be a legitimate response, though not the ideal one, to reach a number of ends: the disciplining of children, expressing discontent in marriage, and responding to insult or injury at the level of the individual, subclan, and clan. Quantitative data bear out the regular use of violence in disputes. For example, in 1985 at the community of Kundis with some 350 residents during a time of peace over a period of 6 months, I recorded 86 cases of physical violence serious enough to make the victim seek care at the clinic for bites, bruises, broken teeth, minor machete wounds, and so forth. Approximately a third of these were disputes between men, another third were between men and women, and the remaining third were between women. The more serious of these were taken to customary courts, and compensation was paid.

It is difficult to get reliable figures on homicide rates for the Enga population before contact with Europeans.<sup>4</sup> Any infringement on property, garden land, lives, or wives could lead to war if balance could not be reestablished by mediation and material compensation (Wiessner 2010; Wiessner and Tumu 1998). Clan loyalty and defense was a "sacred value"; all men participated. To get an estimate of homicide rates, Larsen Kyalae and I collected a full genealogy of one clan over three generations, noting causes of death for 465 people between approximately 1920 and 1950, before the colonial administration was established in Enga (table 5). The clan was a particularly bellicose one during that time period.

The figures in table 5 are somewhat surprising. Despite widespread acceptance and use of violence in Enga society,

4. See Supplementary Information 2 in the CA+ supplement for a discussion of frequency of war and war deaths before colonization.

Table 5. Violent deaths in the Sambeoko clan from ca. 1920 to 1950

Cause	Men	Women	Total	Rate per 100,000
Deaths in war	25	0	25	179
Interclan homicides <sup>a</sup>	11	0	11	79
Intraclan homicides	4	2	6	29
Total	40	2	42	287

Note. Men = 281; Women = 184. There are more men than women because men are more likely to be remembered in genealogies as women marry out.

<sup>a</sup> Interclan homicides are either cases of payback murders or retribution for pig theft.

rates do not reach the high homicide rates for nonstate societies of 700–800 per 100,000 per year compiled by Pinker (2011:64). Had Enga warfare really been about taking the land and resources of others (Meggitt 1977), why are they not higher? Why was peace always made to end war?<sup>5</sup> Why was land taken after many wars later contested and often returned or left as no-man's-land? Here personal testimonies do much to clarify that war was not only about land but also about strategies of big men for reestablishing balance of power between clans in the interest of exchange. Some historical traditions reveal the schemes of big men who profited from short and strategic wars to foil the plans of competitors, win a reputation for negotiating peace, or build ties through the compensation payments that followed short wars (see also Sillitoe 1978).

Those who stood to lose the most in long, vicious wars, aside from those who were killed, were big men, because war broke down exchange ties. This may be the reason that war was not glorified but was seen as the unfortunate outcome of disputes that could not be solved by compensation:

The tongue was in most cases the thing that brought trouble to a clan. Wars started from the tongue. It was the tongue that said things that could provoke somebody who already had ill feelings, and those who did not want to fight had to go and fight, all because of the tongue. (Ambone Mati, Kopena, translated by Akii Tumu, 1991)

Adages warned against fighting:

1. You live long if you plan the death of a pig, but not if you plan the death of a person.
2. The blood of a man does not wash off easily.
3. If you take spoils of war or the land of others, you will invite trouble into the clan.

Historical traditions describing wars often end in warnings such as the war described here, fought before contact with Europeans:

5. See Supplementary Information 3 in the CA+ supplement for a discussion of Enga warfare and land.

So you see there is a price paid for getting into trouble like, for instance, killing another man. Therefore history has taught us this lesson: Never shed human blood within your territory. If you do, then history will repeat itself. Your village will be destroyed and the land will be taken away from you; land is the source of livelihood. (Kiua Apin, Kalia clan, Wakumale, translated by Nitze Pupu, 1989)

Rules were established to contain violence and destruction in war; for example, do not kill women and children, fight battles on one front, do not kill on the land of others, do not pursue the wounded or mutilate bodies, and do not kill leaders who had the wealth and skills to make peace. Such rules reduced the costs of engaging in collective action. Nonetheless, there is little doubt that when decisions were made to fight, political goals were on the agenda: control of trade and exchange, foiling the plans of rivals, acquiring a piece of land, or forging ties through reparation exchanges.

Through contained warfare, clans sought to reestablish balance after insult or injury to reopen paths for exchange. Consequently, relations between neighbors often involved alternating gifts and blows. War was not sanctioned for acquiring the land or the resources of others; however, seizing land did take place when violence became runaway and victors sought to punish losers (Meggitt 1977; Wiessner and Tumu 1998). It is through descriptions of wars, testimonies, adages, and historical traditions that it is possible to get a much better understanding of the goals of warfare at the individual and group levels and corresponding death rates.

#### *In- and Out-Group Formation*

Clans were the primary units for cooperation in Enga warfare, and when trouble broke out, clan meetings were held where every man expressed his opinion about whether to go to war or settle the matter by compensation. Big men orchestrated consensus and at least made it appear that all concerns were considered. Because people from neighboring clans intermarried, socialized, and celebrated together, on order to fight, empathy had to be disabled, and yesterday's friends had to be transformed into foes. How such changes in attitudes were brought about can best be understood from the inside. The following excerpt gives an example of the dehumanization process in a war that I followed carefully in 1987. After a tussle over land around a community church and aid post shared by both clans, the two clans separated, held meetings, and engaged in rallies to brew the fight:

Your girls are not like ours. Their skins were like crocodile skins, have pandanus thorns embedded in them, and their hair is as the red clay of Nomala. Our boys are afraid to touch the skins of your sisters or daughters. You yourself can pay bride wealth to your own girls [implying incest] and marry all of them.

You black-blooded people descended from a python [following their origin myth] could never become like other people. Even if you did try to wash, you would never look clean. Return to your mountain homes and look for the excreta of rats, pigs and marsupials to eat.

Songs sung to dehumanize the opponents centered on gender, food, and sex. Had more fundamental differences been incorporated, for example, sacred religious values (Atran and Gingis 2012), reconciliation would have been far more difficult.

When fighting broke out, the cadence and exuberance was like that of a sports match; sides lined up in an open area and exchanged volleys of long, tapered wooden arrows. When the first man was killed, sport turned to rage, and with subsequent deaths, combat moved beyond the battlefield with ambushes and night raids. Provocative songs continued to be sung after enemies were killed, encouraging the clan of the killers and enraging the clan of the victim.

A man from Tole was hunted and killed like a small bird along the Ambum River, and you are saying that was a man who was killed?

Amboko, you were eagerly coming up the road to Tole [to fight]; now you will hump around on one leg.

Pigs of Pau are growing fat and fine [for compensation], so dog-men just come and die.

Without such cultural means of rallying sides and arousing emotions, it is unlikely that fervor for wars between neighbors could have been mounted. Personal testimonies express the appeal of fighting under such circumstances:

Fighting is like eating pork—sweet. If you don't want to fight, never start because even after one war, fighting will get in your blood and you will not want to stop: . . . the excitement, the brotherhood, and the desire for revenge. (Anonymous warrior, Wabag, 2002)

### *Revenge*

The desire for revenge is a strong emotion that is easily manipulated by cultural means; it is an ideal sentiment to rally men when the goal of warfare is to establish balance between clans. Etic data collected on the triggering incidents for wars can give little more insight into revenge than that 15%–25% of wars began with the goal of revenge (Meggitt 1977:13; Wiessner 2010). Historical and modern testimonies vividly express the revenge imperative:

When a man was killed, the clan of the killers sang songs of bravery and victory. They would shout, "Auu" [hurray] to announce the death of an enemy. Then their land would be like a high mountain, and that is how it was down through the generations. The members of the deceased's clan would

become small. They would be nothing. But, when they had avenged the death of their clansman then they would be fine. Their hearts would be open. In other words, when one fights and takes revenge for the death of a fellow clansman, then one gets even and back on equal footing. (Tengene Teyao, Wakumale, Wabag, translated by Nitze Pupu, 1987)

I wanted to stop fighting and so got married, had kids and joined the church. But revenge was engraved in my heart like the Ten Commandments were engraved in stone. (Anonymous warrior, Wabag, 2004)

I used to leave home not even thinking about my wife and kids; I was driven by desire to destroy the enemy and avenge the deaths of my clan brothers. I was ready to sacrifice my life for my clan brothers. What did I get from this personally? Nothing at all except for "big name." Now that the fighting has stopped, I shudder to think what might have happened to my family had I been killed. . . . You ask if I ever feel guilty? No, after all they came to kill us. Maybe I would if I became a Christian. (Anonymous, Wabag, 2012, translated by Nitze Pupu)

### *Reconciliation*

Enga were always torn between loyalties to agnatic and affinal kin, the one who provided a close-knit corporate group and the other network ties. Wars had to be reined in so that exchange could flow along networks once balance was reestablished. Quantitative data indicated that most wars fought during the last four to five generations were eventually settled with compensation exchanges. Men engaged in the collective action of warfare knowing that hostilities would be terminated through formal institutions. Still, the fact that up to 25% of wars were initiated with the intent of revenge gives a sense of how often compensation failed to establish a long-term solution owing to emotions of anger generated during war. Testimonies from peacemakers contribute substantially to understanding the complexities of de-escalating the emotions of war:

At the time that men from the victim's clan went to see those from the killer's clan to negotiate war compensation, the killer's clan was prepared to meet them, having steamed sweet potatoes and cut sugarcane. When men from the victim's clan had arrived and were seated on the ceremonial grounds, men from the killer's clan spoke on behalf of their clan. The most important thing said on such an occasion by the killer's clan was this: you must tell the clan of the victim that it was unfortunate he was killed, but that was fate . . . and that you would not let the death of this person go uncompensated. After making such a speech, you should offer them steamed sweet potatoes and sugarcane.

The word of peace from the killer's clan was of utmost importance. However, if the clan of the victim was met in a different way, such behavior did not go unheeded. For

instance, the killer's clan might ridicule them by saying that they did not invite the victim to come and fight, and that the poor man brought on his own fate and deserved to die. Such words were very provocative. Even if they were not said in front of the victim's clan but in private and leaked out, the victim's clan would become furious. They should not say anything like it, for if the victim's clan heard of it, they would think of avenging the death of their man even if the liable clan was an ally. Many tribal wars were set off in that way.

When war compensation was carried out with sensitivity, people would let go, go on, and see how it went. Complex negotiation and diplomacy were required to undo the in- and out-group indoctrination and desire for revenge that had been during the war and to rehumanize via food sharing. Without subjective testimonies, it is difficult to understand the complex processes of peacemaking and the role of leaders.

When a person was killed, he was gone forever. You would miss him always. His bed would be empty and his fellow clansmen, upon seeing the empty bed, would be overwhelmed by emotion and feel like going out to avenge his death. . . . To prevent such feelings, one of the victim's relatives had to go and remove his bed from sight, get rid of his pipe and dispose of his net bag and anything else that would remind people of him. Quite often these things would be removed after war compensation was paid. You see, the victim would not be seen around his house and his wife and children would miss him. Only when his clan was paid war compensation would they slowly forget the death of the person killed in the war.

The big-man of a clan had to make sure that no dissatisfied person would think of taking revenge, for he did not want to see chaos come to his place and he did not want houses and gardens to be destroyed. For such reasons, the big-man had to give a pig, preferably one he had decided to keep for himself, to the person who was most likely to cause trouble for such purposes as paying bride wealth for his wife. (Kyakas Sapu, Wabag, translated by Nitze Pupu, 1991)

### *Modern Warfare and Agency*

In the 1950s, the Australian colonial administration was established in Enga; over the next decades they enforced a ban on warfare as best they could. After independence in 1975, fighting resurged (Gordon and Kipilan 1982). Around 1990, homemade and factory-made guns were adopted by tribal fighters to set off a spate of some 500 wars between 1991 and 2010. Youths who could wield modern weapons seized power from elders who had formerly mediated peace before hostilities got out of hand (Wiessner and Pupu 2012). By 2010 much of the population was tired of war. No longer willing to have young "Rambos" in the driver's seat, people turned to customary law courts to settle disputes and to the churches

for moral support for the values of peace. State intervention was minimal (Wiessner and Pupu 2012). The death rate in warfare was 81 per 100,000 when guns were first adopted, 91 in 2000 at the height of the fighting, and then 19 in 2011. Not all clans fought in this period; if they had, the death rate would have been much higher.

Testimonies from Enga youths and men regarding the rejection of fighting indicate major shifts in attitude. The following excerpts come from longer discussions of war experiences. Fifty interviews conducted in this dynamic society indicate active reflection on the part of each person about the implications of warfare for their lives and society. They add much to understanding the agency behind change in contrast to the more passive attitudes of Ju/'hoansi.

Even in situations such as if my father was chopped down, somebody raped my daughter, that is if I got married, I still will not fight. When somebody dies, life is gone for good; they will never come back. When shot down (with guns) they die on the spot and don't even say goodbye to their families. I will take the matter to the customary courts and the law will deal with them. (Anonymous, ca. 17 years old, 2008)

Most of the community now rejects fighting so they can pursue family and economic goals. I made the promise that I would not fight again and sold my single shotgun to another man. I sold my weapon because I do not like fighting and I wanted to make a commitment to never fight again. (Anonymous, ca. 30 years old, 2010)

I usually get money and pigs from fighting as a mercenary. Now people do not seem to want to fight but to nip trouble at the bud in the customary courts, so nobody comes to hire me. If somebody comes to hire me with my SLR weapon, I will go and fight. But I will not go around looking for wars unless they come to hire me. (Anonymous, ca. 35 years old, translated by Larsen Kyalae, 2010)

## Discussion

Aggression, individual or coalitional, is influenced by a number of factors: ecology, social and political landscape, acculturation, physical attributes, technology, history, and cultural institutions. Cultural institutions allow for aggression to be harnessed in many different ways to the benefit or detriment of society within the limits of social and ecological niches. In the Ju/'hoansi case, the repression of aggression allowed for peaceful daily living, high mobility, and access to alternate residences essential for survival. However, with no institutions to deal with aggression, the homicide rate was relatively high when violence erupted. Without organized coalitional aggression, military or otherwise, Ju/'hoansi struggle to defend land against encroaching neighbors from other ethnic groups and to wield influence in affairs of the state today (Biesele and Hitchcock 2011).

The Enga, in contrast, developed sophisticated institutions to organize coalitional aggression as well as ones to resolve conflict. The result was the rapid expansion of the population in space, the development of large ceremonial exchange systems before contact with Europeans, and a powerful role in the government today. Peace in daily life was sacrificed. Such different means of managing aggression made all the difference in the trajectory of human populations throughout history.

How do emic and etic data, data from the inside and outside, come into play in understanding such trajectories? Etic data can give us figures on frequency of individual and coalitional aggression, suggested underlying causes, and outcomes in terms of death rates and resources gained or lost. Emic data provide information on cultural context and meaning as well as more subtle power relations played out through ideologies. They can indicate how cognition and motivations are structured by cultural institutions and in turn shape emotions, behavior, and social selection pressures. For studies of change in a globalized world, they can help anthropologists grasp how people perceive the new and “indigenize” it into their own cultural niches or use it to alter them (Sahlins 1993). Finally, emic data (as well as some etic data) are essential to place quantitative figures assembled in the context of cultural institutions, history, and meaning, particularly today when many data sets are used for meta-analyses. Meta-analyses of data assembled from researchers holding very different theoretical orientations and working in different time periods may lead to cross-cultural comparisons with little scientific validity if the figures from each society included are not put into cultural and historical perspective. For example, such analyses fuel the ongoing debate of whether hunter-gatherer societies are peaceful or warlike by nature.

Most anthropologists who spend time in the field have excellent emic data regardless of theoretical orientation and will agree that casual observations from indigenous coworkers give the researcher the “aha” experience necessary to link quantitative data to the big picture of the culture. A challenge for anthropology will be to work out how to collect and apply data from the inside so that emic data can be collected as systematically as etic data to help interpret and contextualize data. Systematic use of emic data requires a preliminary understanding of how knowledge is generated, distributed, exchanged, and controlled. We know that Geertz’s (1973) proposition that humans are “suspended in webs of significance” has limited applicability; rather, people in any society differentially trap and are entrapped by knowledge. Culture is distributive in the sense that “it consists of variable and interactive populations of meaning, historically particular and internally diverse” (Rodseth 1998:56).

Barth (1990) has demonstrated the powerful role that transactions in knowledge played in differentially shaping the cultures of northern Bali in contrast to those of inner New Guinea. Poole (1982) wrote that the Bimin-Kuskusmin compared ritual knowledge with a nut that is layered like an onion; all people understand the outer most layers, but the inner

ones are only accessible to a few. As Keesing (1987:161) has argued, culture as a collective phenomenon requires a view of knowledge as distributed and controlled. Culture needs to be connected to real humans who create and define cultural means to meet certain ends.

Qualitative methods are becoming ever more diverse and sophisticated (Bernard 2011). Today, with digital means of recording, educated indigenous coworkers to translate, and electronic appendixes to present more lengthy data, it is much easier to integrate emic and etic data systematically in research. For topics such as aggression and violence, the stakes of gaining fuller understandings to tackle the problems of today are high. So why not work to close this gap in anthropology?

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# Consanguineous Marriage, Kinship Ecology, and Market Transition

by Mary K. Shenk, Mary C. Towner, Emily A. Voss, and Nurul Alam

This paper uses the framework of intensive and extensive kinship systems to organize and understand a large body of research on consanguineous marriage across cultures, particularly studies in demography and development that document decreasing consanguineous marriage with market integration. We argue that while agricultural subsistence is often associated with intensive kinship systems, including kin marriages, increasing engagement in a market economy prompts a shift to a more extensive kinship system and possibly a novel cultural niche. We test this model using quantitative and qualitative data from rural Matlab, Bangladesh, which is rapidly transitioning from an agricultural to a market-based economy, and find that our model is partly supported by our quantitative data and strongly supported by our qualitative data. Yet we also observe that rates of consanguineous marriage are not decreasing in Matlab, possibly as a result of a new trend toward love marriages among cousins that is replacing an earlier custom of arranged marriages among cousins focused on property and family considerations.

## Introduction

Human marriage represents a wedding between human biology and culture, filtered through local socioecology. Marriages are situated within evolved human reproductive biology, including concealed ovulation, pair bonding, and highly dependent infants (e.g., Borgerhoff Mulder 1992; Chapais 2008). Marriage, however, combines the biology of mating with cultural norms and customs concerning preferential marriage partners, incest taboos, economic exchanges, and alliances between families (e.g., Chapais 2008; Harrell 1997; Levi-Strauss 1949). Such customs appear to remove marriage far from the biological roots of reproduction. On closer inspection, however, marriage is cross-culturally patterned in ways that are predictable using evolutionary-ecological or structural-functionalist theories (e.g., Borgerhoff Mulder 1992; Chapais 2008; Goody 1976; Harrell 1997), both of which emphasize a connection

between subsistence and economic patterns, kinship systems, and marriage customs.

This paper uses the framework of intensive and extensive kinship systems (Bailey, Hill, and Walker 2014; Bugos 1985; Walker and Bailey 2014) to examine consanguineous marriage patterns in rural Bangladesh, where the traditionally agrarian region is increasingly engaging with the global market economy. We use this perspective to predict that factors related to agricultural subsistence or traditional intensive kinship systems will increase the likelihood of consanguineous marriage, whereas higher market engagement and associated aspects of family, kinship, and marriage systems will decrease the likelihood of consanguineous marriage. We test our predictions using quantitative and qualitative data collected in Bangladesh in 2010 and 2014 and explore the implications of our results for understanding patterns in consanguineous marriage cross-culturally and historically.

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## *Consanguineous Marriage*

Consanguineous marriage, or close kin marriage (Afzal, Ali, and Siyal 1994), is a common form of marriage globally, practiced by an estimated 10.4% of the current world population (Bittles and Black 2010b). In North America and Western Europe, consanguinity has declined in the last century, with only 0.6% of the population married to a first cousin in recent decades (Lebel 1983). In contrast, 20%–50% of observed marriages in North Africa, Central and West Asia, and large parts of South Asia are between second cousins or closer relatives (Bittles et al. 1991). In Bangladesh specifically, the practice is fairly common, with about 10% of people

marrying a first cousin and 8% marrying a more distant relative (Do, Iyer, and Joshi 2013).

Although the functions of consanguineous marriage have been of interest to anthropologists and sociologists since the nineteenth century (e.g., Ember and Ember 1983; Fortes 1969; Fox 1975; Levi-Strauss 1949; Morgan 1871; Murdock 1949; Rivers 1914; Westermarck 1891), recent studies primarily explore the downstream effects of consanguineous marriage and show that people in consanguineous marriages marry at earlier ages and have higher rates of fertility and child mortality and morbidity (Afzal, Ali, and Siyal 1994; Bittles and Black 2010*b*; Bittles et al. 1991; Hakim 1994; Helgason et al. 2008; Hussain and Bittles 1999; Islam 2012; Reddy 1987; Surender, Prabakaran, and Khan 1998; Wahab 1996). For example, a meta-analysis of data from 69 populations shows an excess infant and child mortality rate of 3.5% from 6 months to 12 years of age for offspring of first-cousin consanguineous marriages compared with unrelated spouses (Bittles and Black 2010*a*). Most research suggests that these moderate mortality penalties are likely outweighed by the social and economic advantages of consanguineous marriage in societies where it is common (Bailey, Hill, and Walker 2014; Bittles and Black 2010*b*; Walker and Bailey 2014), especially when consanguineous couples have higher fertility. Rather than expand on such consequences here, we return to the earlier anthropological question—why people marry consanguineously—focusing on the functions such marriages may serve in different types of societies and subsistence systems.

#### *Extensive and Intensive Kinship Systems*

Agriculturalists tend to have higher rates of consanguineous marriage than do hunter-gatherers, a pattern recently interpreted within the context of extensive and intensive kinship systems (Bailey, Hill, and Walker 2014; Walker and Bailey 2014). This work suggests that individuals and families making marriage decisions face a trade off between expanding their social networks (extensive kinship pattern) and reinforcing existing kin ties (intensive kinship pattern).

Extensive kinship networks characterize most foraging societies (Bailey, Hill, and Walker 2014; Walker and Bailey 2014) and may also characterize some horticulturalists and pastoralists. Extensive kinship networks are created through exogamy and widen the social network of the individual, creating not only more kin but also a more diverse set of social ties. Foragers may use these ties to reduce risk—gaining rights to forage in a larger number of territories or to join a larger number of bands or to develop exchange and sharing relationships with a larger number of people. In risky environments where the availability of plants and animals may shift from year to year, access to a diffuse and flexible kin network can be key to survival (e.g., Kramer and Greaves 2011; Lee 1984; Marlowe 2004; Yellen and Harpending 1972). Similarly, among some pastoralists, larger networks may help secure grazing rights in times of drought, keep livestock dispersed across the

landscape and buffered from risk, and extend the cooperative ties needed to defend herds (e.g., Radcliffe-Brown and Forde 1950). Diffuse kin networks may also aid in finding marriage partners for one's children in a small and dispersed population (e.g., Wiessner 2009). In extensive kin networks, consanguineous marriage is often rare and may be the subject of detailed systems of taboos (e.g., Lee 1984; Tonkinson 1978). Moreover, a consanguineous marriage might represent a missed opportunity to create new social ties and broaden one's kin network.

In contrast, intensive kinship systems (Bailey, Hill, and Walker 2014; Bugos 1985; Walker and Bailey 2014) rely on dense networks of kin who can cooperate to perform subsistence tasks, engage in the conquest or defense of property, and/or avoid the division of property in intensive agricultural societies. Consanguineous marriage helps create such networks by reinforcing existing kinship ties while avoiding creating new ties. Moreover, although the total number of kin decreases with consanguineous marriage, kin group relatedness increases. Higher group relatedness in intensive kinship systems may increase the motivation for cooperation for both biological and cultural reasons. Greater genetic similarity facilitates kin selection by creating overlapping motivations from an evolutionary perspective (Hamilton 1964), while cultural mechanisms (e.g., shared rites of passage, norms of filial piety) can serve to increase cohesiveness and reinforce loyalty to one's kin group. Importantly, consanguineous marriages allow kin groups to limit the subdivision of property and/or the sharing of such property with non-kin (e.g., Goody 1976; Harrell 1997; Obeyesekere 2008; Yalman 1967). This may be one reason that intensive kinship systems are primarily found among intensive agriculturalists and some pastoralists (Walker and Bailey 2014), where heritable wealth in animals or land are key to both survival and social status (Borgerhoff Mulder et al. 2010; Shenk et al. 2010).

Walker and Bailey (2014) examined this contrast between extensive and intensive kinship systems and found that hunter-gatherers had relatively few consanguineous marriages and low levels of inbreeding, while some agricultural and pastoralist groups had high rates of consanguineous marriage and high rates of group-level inbreeding. In contrast to cross-cultural work, we wish to better understand the mechanism underlying this pattern by seeking to understand the patterns of consanguineous marriage within a culture as it transitions from agriculture toward a market economy.

#### *Patterns of Consanguineous Marriage in the Developing World*

Much of the literature on recent patterns of consanguineous marriage is concentrated on demography and public health and provides excellent data on its patterns and correlates—especially as they relate to economic development and market integration. In reviewing this literature, Voss (2014) identifies three factors thought to shape rates of consanguineous marriage across cultures.

*Industrialization.* Several findings link the shift from an agrarian economy toward greater industrialization and urbanization to a decrease in the practice of consanguineous marriage (Calderon et al 1993; Chandrasekar, Jayraj, and Rao 1993; Peña et al. 2002), leading some to forecast an ongoing global decline in consanguineous marriage (Bittles and Black 2010*b*). Industrialization affects many aspects of social organization. In an agrarian economy, land is generally the most important form of wealth, and consanguineous marriage can be used to ensure that family property is retained or consolidated within the family (e.g., Goody 1976; Harrell 1997). A shift to industrialization and urbanization often means a decrease in land ownership. In many regions, the maintenance of property appears to be a major determinant of consanguineous marriages among landowners (Calderon et al. 1993; Hakim 1994; Strickland and Tuffrey 1997). Bittles and Black (2010*b*) predict that consanguineous unions will decline with increasing urbanization, and many studies have found higher rates of consanguineous marriages in rural areas compared with urban areas (Afzal, Ali, and Siyal 1994; Bittles et al. 1991; Calderon et al. 1993; Hussain and Bittles 1998, 2000; Lazo et al. 1978; Surender, Prabakaran, and Khan 1998; Wahab 1996).

Education and occupational change can also influence marriage patterns. Many studies show higher rates of consanguinity among men or women with low levels of education than among those with higher education levels (Barbour and Salameh 2009; Bittles et al. 1991; Bittles and Black 2010*b*; Hakim 1994; Hussain 1998; Khlat 1988; Surender et al. 1998). Some studies also find an association between agricultural work and higher levels of consanguinity (Chandrasekar, Jayraj, and Rao 1993; Hussain and Bittles 2000), while studies focused in urban areas have found associations between consanguinity and low occupational status of husbands (Khlat 1988) or low levels of employment by wives (Hussain et al. 1998; Islam 2012).

*Dowry.* Dowry is practiced in many societies in which consanguineous marriage is common. In some areas, particularly in South Asia (Bangladesh, India, Pakistan), consanguineously married women may pay a lower dowry or no dowry at all (Badaruddoza and Afzal 1995; Bittles 1994; Hussain 1999; Mobarak, Kuhn, and Peters 2013; Reddy 1988; Suryanarayana 1977), suggesting that rates of consanguineous marriage may be affected by the rise and fall of dowry payments. Caldwell, Reddy, and Caldwell (1983) suggest rising dowries could lead the families of grooms to seek nonconsanguineous unions while the families of brides may be more likely to seek out or encourage consanguineous matches. Alternatively, some families may choose to have consanguineous unions in order to avoid splitting their property through dowry (Reddy 1987).

*Cultural Tradition.* Despite outside changes to the external economic or social environment, strong sociocultural traditions may maintain the practice of consanguineous marriage

(Buttenheim and Nobles 2009). Persistence of consanguineous marriage is sometimes linked to religion (Khlat 1988), for example, among many Muslim populations where consanguineous marriage is a tradition dating from the time of the Prophet and mentioned in the Qur'an and Hadith (Bittles and Hamamy 2010; Gunaid, Hummad, and Tamim 2004; Hussain 1999; Reniers 2001). Hussain (1999) further argues that social reasons, most notably parental influence, are strong causes of consanguineous marriage in South Asia and the Middle East, where the majority of marriages are still arranged by parents (particularly if the parents themselves are consanguineously married; Barbour and Salameh 2009; Hussain and Bittles 1998). Another common belief is that a marriage between family members may ease the transition for the bride and ensure a more caring attitude from her in-laws (Hussain 1999), leading to greater marital stability (Hakim 1994; Islam 2012).

#### *Theoretical Model and Predictions*

We propose that the commonly observed decrease in consanguineous marriage as societies industrialize and urbanize—or at least move from a primary emphasis on agriculture toward increasing integration with a market economy—is in part related to the social shift from an intensive kinship to an extensive kinship system. Table 1 summarizes and contrasts the social characteristics of intensive kinship systems among agriculturalists with extensive kinship systems in market economies.

In intensive agricultural systems, a great deal of cooperation is needed within families and kin networks to handle the high demands of agricultural labor and the processing of agricultural products. It is also important to keep parcels of land intact and within families. Both unilineal kinship systems and consanguineous marriages serve these goals by concentrating kinship ties with respect to labor and land ownership. Marriages are generally arranged by parents, with a focus on endogamy within families or allied lineages, promoting reciprocal and overlapping ties. Extended families are common, and postmarital residence is generally patrilocal or matrilocal.

In contrast, as agricultural societies undergo market transition, the need for labor cooperation with kin is reduced because an increasing amount of labor takes place in the market. Likewise, as land becomes less important for earning a living, the importance of defending land or retaining land within families is reduced. Both consanguineous marriage and arranged marriage more generally become less common, and a preference for endogamy within kin is replaced by a preference for a more generalized form of endogamy focused on social class. As market integration continues, families require more mobility to respond to job opportunities, and children become less financially and socially reliant on parents. Consequently, families become increasingly nuclear, neolocal, and more widely dispersed. Unilineal kinship systems are often replaced by bilateral kinship and broader social networks that include non-kin. Such networks are useful for making connections in both urban areas and in the local communities

Table 1. Expected cultural differences between extensive and intensive human kinship systems and different subsistence systems

Cultural trait	Extensive kinship: hunter-gatherers	Intensive kinship: agriculturalists	Extensive kinship: market economies
Marriage:			
Kin marriages	Few	Many	Few
Marriage distance	Often far	Often close	Often far
Marriages	Exogamous	Endogamous	Exogamous (kin), endogamous (class)
Marriage alliances	Diffuse	Reciprocal	Diffuse
Regulation of reproduction	Weak	Strong	Weak
Affines	Unrelated, more	Related, fewer	Unrelated
Marriage arrangement	Often arranged	Usually arranged	Rarely arranged
Kinship and family:			
Kinship system	Bilateral	Unilineal	Bilateral
Kin network	Diverse	Dense	Dispersed
Group relatedness	Mostly low	High	Low
Group fissions	Familial	Lineal	Familial
Family structure	Nuclear/Band	Extended	Nuclear
Residence pattern	Multilocal	Often patrilocal or matrilocal	Neolocal
Group and resources:			
Group size	Small	Larger	Large to very large
Heritable wealth	Little to none	Important	Important
Social stratification	No	Yes	Yes
Level of inequality	Low	High	High
Resource defense	Low	High	High, done by state
Political organization	Nonstate	Nonstate, state	State

Source. Adapted and extended from Walker and Bailey (2014).

that could lead to better job opportunities or marriage prospects. Although distinct in many ways from the extensive kinship systems found in hunter-gatherers, kinship systems in market economies share several key features with them, including bilateral kinship, exogamous marriage, and dispersed kin networks favoring mobility and wide social connections (Harrell 1997). They also share generally low rates of consanguineous marriage.

We thus predict that factors related to agricultural subsistence or traditional intensive kinship systems (e.g., engagement in agriculture, land ownership, arranged marriage) will increase the likelihood of consanguineous marriage while the likelihood of having a consanguineous marriage will decrease with higher market engagement and with aspects of family, kinship, and marriage systems associated with market economies (e.g., engagement in labor market occupations, higher levels of education, labor migration, love marriage). More detailed expectations for the Bangladesh study population follow.

### Study Population

Rural Matlab, Bangladesh, is well known for long-term demographic and public health research conducted by the International Centre for Diarrheal Disease Research, Bangladesh (ICDDR,B). The primary economy of the Matlab area is farming of rice and other crops followed by fishing (Central Intelligence Agency 2012; Holman and O'Connor 2004). A

large proportion of villagers participate in agriculture, although many own no land themselves. Income is generated from a variety of sources including agriculture, fishing, day labor, handicraft production, small businesses, salaried work, and remittances from family members working in cities or abroad (ICDDR,B 2007). Residents are primarily Muslim (87%) with a minority population of Hindus (ICDDR,B 2007).

Extended patrilocal families live together in a *bari* containing several small houses, and marriage is usually arranged, though love marriage is becoming more common. A recent study reports that 18% of people in Matlab marry consanguineously, with 10% marrying first cousins (Do, Iyer, and Joshi 2013). Dowry is increasingly common in Matlab, being paid in 59.3% of marriages in 2009 (ICDDR,B 2011). Women practice a limited form of *purdah* and usually spend most of their time in the *bari* engaged in agricultural processing work, cooking, and childcare. Education levels vary considerably, especially by age; 30% of the population has no schooling, but 42% of 15–24 year olds has 7–9 years of schooling (ICDDR,B 2007). Education has become more widely available since the 1990s, and a small but growing number of men have obtained education-based salaried employment. Education has also become more socially acceptable for women, with a small fraction entering the labor market (Caldwell and Khuda 2000; Razzaque, Streatfield, and Evans 2007).

In 1974, the first year for which we have good records, traditional occupations including agriculture and fishing were practiced by 80.2% of households and were the primary

occupations of 59.5% of male household heads. In contrast, by 2005 only 55.8% of households engaged in agriculture or fishing, and in only 40.3% of cases were they the primary occupations of male household heads. Moreover, the percentage of families who own no agricultural land increased from 26.8% in 1982 to 43.5% in 2005 (ICDDR,B 2007) alongside a decrease in traditional commercial occupations such as mill worker, boatman, and small business operator and a rise in salaried work for the government or established businesses (ICDDR,B 2007). The shift in economic systems has several causes, including decreasing land ownership linked to rising population (Kabeer 2001) and increasing access to local, national, and international labor markets (Novak 1993).

One of the more striking aspects of these economic changes has been a surge in male labor migration to the capital city Dhaka and abroad. An estimated 5.4 million Bangladeshis are working abroad (Afsar 2009). In Matlab, residents have increasingly come to rely on cash income earned by men working as day laborers in Matlab or as migrant laborers outside of Matlab who send their earnings home as remittances. Out-migration by men in Matlab remained relatively steady until the late 1990s, when it more than doubled from 30.7 per thousand in 1998, to 78 per thousand in 2008 (ICDDR,B 2008). In 2005, 24% of households in Matlab received remittances (ICDDR,B 2007).

The simultaneous rise of wage labor and labor migration have produced both subtle and significant changes in local social relations. Most important are shifts in family structure and gender relations brought about by the increasing absence of men. These include a higher valuation of daughters, who stay in the village and are able to help their aging parents in the absence of sons (who are often labor migrants), and daughters-in-law, who often accompany their husbands to their new place of work or continue to live with their own parents until their husband returns to Bangladesh (Fraser 2014; Rao 2012). Other shifts include a rise in love marriage and a rise in neolocal residence (Rao 2012).

Because land in this region is divided equally among sons, with a half share going to daughters if the family can afford it, there is a tendency for land to fragment over time (Kabeer 2001). To counteract this trend, families often maintain a joint patrilineal estate with adolescent and adult sons working the land together with their father until his death or after. Under these circumstances, marrying consanguineously has several potential advantages. First, it keeps land consolidated because the claim of the groom and the claim of the bride are added together, and the bride's share (if any) stays in the family. Second, it increases the potential for cooperation and decreases the potential for conflict in the family because relatives have overlapping interests. This is true not just for the bride and groom but also for the parents of both, who are now doubly related to each other and thus more highly invested in their relationship, the young couple, and their grandchildren. Third, it capitalizes on existing relationships. Relatives already know each other and have a sense of each other's personalities

and how to work together—an important advantage on the marriage market in Bangladesh and also in enterprises involving cooperative labor.

With higher rates of both labor migration and wage labor, access to wealth has increased, but so has social stratification, with several consequences for kin networks. As agricultural labor becomes less important, the need for cooperation beyond the family has decreased. As mortality rates have fallen and parents are increasingly motivated to educate their children and attempt to establish them in jobs outside of agriculture, family size has fallen (Shenk et al. 2013), creating smaller kin networks. The absence of sons and sometimes daughters-in-law from the village has further reduced the size of kin networks and made kin a less reliable source of aid (Fraser 2014). On the other hand, increasing contacts with relatives and former neighbors now living in cities and abroad has brought not only wealth but new ideas and useful social connections into the villages that help foster the education, labor migration, and higher-status marriages of family members.

The tradition of patrilocal residence of the couple in the husband's family's *bari*, while still the norm, is giving way to a rise in neolocal residence in which a couple may rent a house in a different *bari* closer to the husband's place of work or live in a town or city outside of a *bari* entirely. Although parents are still motivated to arrange marriages for their children to ensure a high quality spouse, love marriages are increasingly common as children marry at older ages and are better educated and more economically independent than they were in previous generations. If the parents approve a child's choice of marriage partner and handle wedding arrangements in the usual way, this is called an "arranged love" marriage and carries no stigma. In contrast, "love marriages" made without parental approval often still carry some social stigma. Women are less likely to bring a dowry at marriage if the marriage is consanguineous (Do, Iyer, and Joshi 2013), and poorer households are more likely to engage in consanguineous unions because of their inability to pay dowry up front (Mobarak, Kuhn, and Peters 2013), while wealthier parents able to pay higher dowries are motivated to search for a husband outside of the kin group (Do, Iyer, and Joshi 2013; Mobarak, Kuhn, and Peters 2013).

## Methods

### *Data Set*

Quantitative data were gathered through an extensive questionnaire administered in 2010 to 944 women in Matlab, Bangladesh (Shenk et al. 2013). Women were sampled at random from women participating in ICDDR,B's Health and Demographic Surveillance System (HDSS). The HDSS is a full population survey that includes over 200,000 people. For our subsample, equal numbers of women were drawn from three 15-year age categories (20–34, 35–49, and 50–64), allowing for better representation of older women. The 2010 questionnaire collected quantitative information about the women

and their families on topics such as residence, education, occupation, labor migration, cultural transmission, and marriage for the woman along with her husband, parents, and children. Qualitative data were gathered in 2014 from an additional group of Matlab women who participated in semistructured interviews and focus groups on consanguineous marriage. The content of each session was transcribed into notes, annotated, and coded for key themes.

For our quantitative analysis, we first conducted an analysis of the marriages of the focal women interviewed in 2010 ( $N = 742$ )—the respondent sample. Then we examined the marriages of a larger sample of wives ( $N = 2,579$ ), including the focal women plus their mothers, mothers-in-law, and children—the three-generation sample. The respondent sample has a smaller sample size but many more variables with complete data than does the three-generation sample. We also examined summary statistics for consanguineous marriages between different types of cousins.

#### Variables

The main dependent variable for this study is binary: whether or not a woman had a consanguineous marriage. In the respondent sample, 868 of the 944 women were ever married and of known consanguinity status, of which 102, or 12%, of marriages were consanguineous. We focused our analyses on all women in our survey for whom data were complete on our variables of interest ( $N = 742$ ). Of these women, 80 had consanguineous marriages. The three-generation sample includes all women (respondents plus their mothers, mothers-in-law, and children) for whom marriage and demographic data were sufficient for analyses. There were a total of 3,816 potential women, of whom 2,579 had complete data. Most potential candidates were excluded from the sample because one or more variables were missing. We did not detect any systematic biases among women with missing data except a possible underrepresentation of the very oldest women in the three-generation sample.

For the respondent sample, we examined 28 variables, each chosen as a proxy for some aspect of (1) the subsistence strategy—whether agricultural or market oriented—being used by the focal woman or her family (e.g., the education levels and occupations of family members, how much cropland the family owns, the number of labor migrants in the family or *bari*), (2) the focal woman's residence patterns (e.g., whether the woman lives in her husband's *bari* or outside of a *bari*), (3) details of the woman's marriage or the marriages of close relatives (e.g., the woman's marriage costs, whether the marriage was arranged or a love marriage, whether the woman's parents or husband's parents had a consanguineous marriage), and (4) the woman's family demography. Woman's age and age at marriage were also included, primarily as control variables. Table 2 shows summary statistics for all variables in the respondent sample analyses.

Male occupation was broken into three categories: agricultural/fishing, artisan/day labor (without education), and

Table 2. Summary statistics for respondent sample

Variable	N	Mean	SD	Median	Range
Continuous variables:					
Woman's age (years)	742	42.0	12.13	42	19–67
Woman's age at marriage (years)	742	16.6	3.21	16	7–34
Woman's education (years)	742	4.0	3.80	4	0–16
Husband's education (years)	742	5.0	4.43	5	0–16
Number of labor migrants in family	742	3.1	1.98	3	0–13
Total number of siblings	742	4.7	1.97	5	0–11
Number of people in natal <i>bari</i>	742	16.0	9.85	14	2–70
Categorical variables:					
Consanguineous marriage:					
0 = no	662				
1 = yes	80				
Husband's parents consanguineous:					
0 = no	711				
1 = yes	31				
Woman's parents consanguineous:					
0 = no	697				
1 = yes	45				
Woman has no brothers:					
0 = no	697				
1 = yes	45				
Woman has no sisters:					
0 = no	652				
1 = yes	90				
Woman's father's occupation:					
1 = agriculture or fishing	378				
2 = day labor or similar	184				
3 = salaried or education-based	180				
Woman works:					
0 = no	683				
1 = yes	59				
Husband's father's education:					
0 = none	516				
1 = some	226				
Husband's mother works:					
0 = no	720				
1 = yes	22				
Cropland owned by woman's parents:					
0 = no	130				
1 = yes	612				
One or more labor migrants in marital <i>bari</i> :					
0 = no	115				
1 = yes	627				

education-based or salaried occupations. Marriage type included arranged marriage, arranged love marriage (where the couple fell in love and then the parents arranged the union), and love marriage (often involving parental disapproval or a runaway match). The woman's marriage cost variable was adjusted using Bangladesh consumer price index information by year to account for inflation and then logged to adjust for right skew. Natal family variables included the total number of siblings and also binary variables for whether a woman had no



brothers or no sisters, which could have special relevance for inheritance and marriage decisions.

Analyses on the three-generation sample used five of the variables described above, including the wife's year of birth, education, husband's occupation, whether the couple owned cropland, and what type of marriage they had (arranged, arranged love, or love). A sixth variable was added to represent the wife's generation—either the respondent's generation, a parental generation including mothers and mothers-in-law, or a child generation including the respondent's children. Table 3 shows summary statistics for all variables in the three-generation sample analysis.

### Analysis

To model whether a woman married consanguineously or not, we use logistic regression through generalized linear modeling with a binomial probability distribution and log-odds link function (Crawley 2005). All analyses were completed using R (R Development Core Team 2014) and the multimodel inference packages MuMIn (Barton 2014) and glmulti (Calcagno 2013). For the respondent sample, we identified 28 initial variables (described above) to evaluate as covariates in our model. To narrow down this large number in a systematic way, we first dropped from consideration variables that were highly correlated with other variables under consideration (e.g., husband's age, which correlated with respondent's age) or that

were missing many values (e.g., husband's father's income). Next, we identified and removed from consideration several other variables that had very low importance values (see table 4). In an information-theoretic framework, *importance* is a statistical measure estimated by the contribution the variable makes relative to other variables as determined through model comparison (described further below). Variables excluded because of very low importance values included husband's occupation, husband's father's occupation, whether the focal woman's mother worked, whether the woman had any sisters, whether the family lived in the husband's *bari*, and whether the woman's marriage was arranged or love. Our final analyses modeled whether the focal woman had a consanguineous marriage according to 17 covariates. We followed a very similar procedure for the three-generation sample, albeit with a much more limited set of variables, yielding our final list of six variables for analysis.

We use an information-theoretic approach (Burnham and Anderson 2002) to compare the evidence for alternative models and evaluate the importance of the independent variables in explaining consanguineous marriage across women. This approach centers on the likelihood of each model given the data rather than null hypothesis testing (see Towner and Luttbeg 2007 for a review; see also Richards, Whittingham, and Stephens 2011). Model comparison relies on Akaike information criterion (AIC) or variations thereof. For a given model,  $AIC = -2\log(L) + 2K$ , where  $L$  is the likelihood of the model given the data and  $K$  is the number of parameters in the model. All possible subsets of the full model with 17 covariates (respondent sample) or six covariates (three-generation sample) were constructed to calculate each model's AIC value.

Independent variables were assessed based on the number of top models in which they appear as well as by the weight of those models, with the weight being a measure of the likelihood of that model among those being compared. For each variable, importance values are calculated as the sum of the weights of the models in which that variable appears (see tables 4, 5). Although a single best model (the model with the lowest AIC) results from an exhaustive search, a number of models often have similar weights. We therefore used model averaging to construct a model that incorporated information from multiple top models (see tables 6, 7). We followed the recommendations of Richards (2008) in estimating the averaged model, using all models with a  $\Delta \leq 6$ , where  $\Delta$  is the difference between the model's AIC value and the lowest AIC value. We also filtered out all models that were more complex versions of a model with a lower AIC value.

## Results

### Quantitative Findings

Table 4 summarizes the multimodel inference of importance in the respondent sample using all 17 variables that survived initial rounds of exclusion. The strength of predictors is in-

Table 3. Summary statistics for Matlab three-generation sample

Variable	N	Mean	SD	Median	Range
Continuous variables:					
Wife's year of birth	2,579	1954	21.1	1955	1884–1996
Wife's education (years)	2,579	2.69	3.59	0	0–16
Categorical variables:					
Consanguineous marriage:					
0 = no	2,389				
1 = yes	190				
Generation:					
Parents	1,388				
Focal Women	840				
Children	351				
Land owned by couple:					
0 = no	307				
1 = yes	2,272				
Type of marriage:					
1 = arranged	2,507				
2 = arranged love	42				
3 = love	30				
Husband's occupation:					
1 = agriculture, fishing	1,080				
2 = day labor or similar	781				
3 = salaried or education-based	718				

Table 4. Multimodel inference: summary for full set of predictor variables in respondent sample

Variable	Sign <sup>a</sup>	N in top 100 (no filter)	Importance ( $\Delta_i \leq 6$ , filtered)
Woman has no brothers (dummy)	+	100	1.00
One or more labor migrants in marital <i>bari</i>	–	100	1.00
Woman's father's occupation (day labor, salaried)	–, +	100	.98
Husband's education	–	100	.81
Woman works	–	96	.85
Husband's parents consanguineous	+	87	.50
Husband's father's education (none/some)	+	82	.53
Number of labor migrants in family	+	47	.43
Husband's mother works	+	46	.28
Woman's years of education	–	29	.18
Woman's age at marriage	–	22	<.01
Cropland owned by woman's parents <sup>b</sup>		14	0
Total number of siblings <sup>b</sup>		10	0
Woman's age <sup>b</sup>		5	0
Number of people in natal <i>bari</i> <sup>b</sup>		4	0
Woman has no sisters <sup>b</sup>		4	0
Woman's parents consanguineous <sup>b</sup>		4	0

<sup>a</sup> Refers to the sign of the variable's model coefficient with positive values correlating with higher probability of a consanguineous marriage as the variable value increases and vice versa.

<sup>b</sup> Does not appear in the averaged model (table 6), so no meaningful coefficient sign.

icated by both the number of times each variable appears in the top 100 models as well as the calculated importance values for each variable. Strong predictors include whether the woman has brothers or not, whether there are labor migrants in the marital *bari*, the woman's father's occupation, the husband's education, and whether the woman herself works. The next six variables—whether the husband's father has any education, whether the husband's parents had a consanguineous marriage, the number of labor migrants in the woman's family, whether the husband's mother works, the woman's years of education, and the woman's age at marriage—have meaningful explanatory power in at least some models. The remaining six variables—the amount of cropland owned by the woman's parents, the woman's number of siblings, the woman's age, the number of people in the woman's natal *bari*, whether the woman has sisters, and whether the woman's parents have a consanguineous marriage—garner little to no support.

Similarly, table 5 summarizes the multimodel inference results for the three-generation sample. Generation and type of marriage (arranged, love arranged, love) emerge as very im-

portant predictors, appearing in all of the top 10 models and showing high importance, while the wife's education and year of birth, along with whether the family owns land, emerge as moderately good predictors, appearing in four to six of the top 10 models and showing a moderate level of importance. Husband's occupation only appears in two of the top 10 models, with very low importance, and is excluded from further analyses.

Table 6 shows the model average resulting from our model selection and multimodel inference approach for the respondent sample. Model parameters are estimated based on weights from the filtered models ( $N = 33$ ) that were within  $\Delta \leq 6$  of the model with the lowest AIC value. One of the strongest predictors of consanguineous marriage status is whether the woman has any brothers—if she does not, she is significantly more likely to have a consanguineous marriage. Of women with no brothers, 27.3% have kin marriages, whereas only 10.6% of women with brothers do. This pattern does not hold for sisters. In contrast, several factors reduce the chances of having a consanguineous marriage, including having one or more labor migrants among the families living in the marital *bari*. More educated husbands are also associated with a lower likelihood of consanguineous marriage. Finally, the woman's father's occupation as a day laborer or at another market-related (but not education-based) job reduces her chances of marrying kin. Other variables are important enough in some models to be represented in the model average, although their individual coefficients are not significant. For example, whether the woman herself works outside the home has a high importance value and a negative effect on the likelihood she will have a consanguineous marriage (table 4).

Model average results for the three-generation sample are presented in table 7. Women with more years of education are less likely to marry consanguineously. The generation variable, however, suggests that respondents are more likely to have a cousin marriage than were their parents or parents-in-law.

Table 5. Multimodel inference summary for three-generation sample

Variable	Sign <sup>a</sup>	N in top 10 (no filter)	Importance ( $\Delta_i \leq 6$ , filtered)
Generation (respondent, children)	+, +	10	1.00
Type marriage (arranged love, love)	+, +	10	.94
Wife's education	–	5	.49
Wife's year of birth	+	5	.49
Family owns cropland <sup>b</sup>		4	
Husband's occupation <sup>b</sup>		2	

<sup>a</sup> Sign on the variable's coefficient. Positive values mean a higher probability of a consanguineous marriage as the variable increases and vice versa.

<sup>b</sup> Does not appear in the averaged model (table 7), so there is no meaningful sign on the coefficient.

Table 6. Model average of consanguineous marriage predictor variables in respondent sample

Variable	Estimate <sup>a</sup>	Adjusted SE	z	P
Intercept	.196	.505	.389	.697
Woman has no brothers (dummy)	1.389	.385	3.613	.000
Husband's father's education (none/some)	.274	.330	.830	.407
Husband's parents consanguineous	.498	.607	.821	.412
One or more migrants in marital <i>bari</i>	-.976	.300	3.255	.001
Woman works (yes/no)	-.981	.723	1.357	.175
Woman's father's occupation: day labor	-.720	.368	1.955	.051
Woman's father's occupation: salaried	.364	.298	1.226	.220
Husband's years of education	-.079	.049	1.609	.108
Number of labor migrants in family	.042	.063	.665	.506
Husband's mother works (yes/no)	.288	.575	.501	.616
Woman's years of education	-.018	.041	.438	.661
Woman's age at marriage	-.001	.007	.075	.941

<sup>a</sup> Positive values correlating with higher probability of a consanguineous marriage as the variable value increases and vice versa.

Similarly, wife's year of birth has a positive effect on the likelihood of a consanguineous marriage. Taken together, these may represent a trend toward more cousin marriages over time, at least in the earlier parts of the sample. Whether this is being reversed among the respondent's children is hard to tell, especially because not all of the children are yet married, and the reasons for cousin marriages may be changing. The respondents' children do, however, have lower rates of consanguineous marriage than the members of the respondent's generation. Finally, having an arranged love marriage is a strong predictor of cousin marriage. Husband's occupation and cropland are both dropped from the model average.

Qualitative Findings

Here, we present the qualitative results from semistructured interviews and focus groups held with women to discuss consanguineous marriage. The majority of consanguineous marriages in our sample is between first cousins (93 out of 102, or 91%, of the respondent sample and 277 out of 303, or 91%, of the three-generations sample). More distant relationships are often lumped in the category of "distant kin" for the purposes of marriage. Marriages with affines also occur as a locally meaningful category, particularly in a configuration called the *boner debor*, or sister's husband's brother (usually a younger brother). Marriages among distant kin and in-laws were relatively rare in our sample and were infrequently discussed by the interviewed women. In contrast, women frequently dis-

cussed reasons for marrying—or not marrying—first cousins of different types, including patrilineal parallel cousins, matrilineal parallel cousins, and cross-cousins. A detailed comparison of the characteristics of couples with different types of cousin marriages can be found in table 8. Small sample sizes across different categories of cousin marriages limit the power of statistical comparisons, but some trends are apparent. For example, couples with cousin marriages are younger than those married to nonrelatives, and patrilineal and matrilineal parallel cousins are more likely to have arranged love marriages.

Of the consanguineous marriages in our respondent sample, 23% were within the *chachatobhaibon*—patrilineal parallel cousins—as were 22% of such marriages in the three-generation sample. In interviews, many women agreed that these marriages were problematic for two reasons: (1) because claims to property within the patrilineage could be contentious, and (2) because cousins growing up in the same *bari* might feel like siblings. However, in cases where a family had no son, marrying one's daughter to her patrilineal parallel cousin was seen as ideal. Such "inside grooms" (*ghor jamai*) could help secure her inheritance and make certain of a stable relationship with other members of the patriline.

Marriages within the *khalatobhaibon*—matrilineal parallel cousins—are seen as the most positive, least problematic type of cousin marriage. Of the consanguineous marriages in our respondent sample, 29% were between matrilineal parallel cousins, as were 33% of marriages in the three-generation sample. Relationships between sisters (the bride's mother and groom's mother) are usually more relaxed than between brothers, as they are typically married to husbands in different places, with neither common property to dispute nor the tensions of living together on a daily basis. Many women believed that such marriages had become more common in recent years because of the rise of love marriages. They argued that "nowadays *chele* and *meye* (boys and girls) meet each other through family visits" and "come to like each other," and then when it is time for marriage, they "prefer each other" and ask their parents to approve the match.

Many cousin marriages occur within the *mamatofupa-tobhaibon*—between cross-cousins. Cross-cousin marriages

Table 7. Model average for three-generation sample

Variable	Estimate <sup>a</sup>	Adjusted SE	z	P
Intercept	-13.918	14.345	.970	.332
Generation: respondents <sup>b</sup>	.647	.227	2.845	.004
Generation: children <sup>b</sup>	.167	.318	.523	.600
Arranged love marriage <sup>c</sup>	1.204	.379	3.172	.002
Love marriage <sup>c</sup>	.140	.624	.224	.823
Wife's education	-.043	.026	1.660	.097
Wife's year of birth	.012	.007	1.735	.082

<sup>a</sup> Positive values correlate with a higher probability of a consanguineous marriage as the variable value increases and vice versa.

<sup>b</sup> Reference category is the largest and oldest generation, the respondent's parents and parents-in-law.

<sup>c</sup> Reference category is the largest category, arranged marriage.

Table 8. Comparison of characteristics across types of cousin marriages

Variable	Not related		Patrilateral parallel cousins		Matrilateral parallel cousins		Cross-cousins		Total
	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N
Continuous:									
Wife's year of birth	2,769	1957 (22)	55	1962 (19)	74	1964 (20)	88	1960 (19)	2,986
Husband's year of birth	2,510	1946 (24)	43	1948 (21)	70	1955 (22)	86	1949 (21)	2,709
Wife's age at marriage	1,921	16.4 (3.5)	46	15.6 (3.6)	68	16.0 (3.3)	76	15.0 (3.7)	2,111
Husband's income (log)	2,093	10.5 (1.2)	39	10.4 (1.0)	60	10.7 (1.1)	84	10.4 (1.4)	2,276
Wife's education	3,278	3.2 (3.9)	62	3.4 (3.8)	87	3.4 (3.7)	104	2.9 (3.5)	3,531
Husband's education	3,164	4.3 (4.5)	58	4.4 (4.8)	90	5.2 (4.6)	98	4.2 (4.0)	3,410
Categorical variables:									
Generation:									
Parents	1,659	47%	25	37%	32	32%	47	43%	1,763
Focal women	765	22%	22	33%	31	31%	40	36%	858
Children	1,115	31%	20	30%	37	37%	23	21%	1,195
Husband's occupation:									
Agriculture	1,252	40%	18	31%	31	34%	38	38%	1,339
Day labor	988	31%	25	43%	27	30%	27	27%	1,067
Salaried	911	29%	15	26%	33	36%	35	35%	994
Own land:									
No	330	9%	8	12%	20	20%	16	15%	374
Yes	3,202	91%	59	88%	80	80%	94	85%	3,435
Type of marriage:									
Arranged marriage	3,378	96%	55	82%	86	86%	103	93%	3,622
Arranged love marriage (approved by parents)	83	2%	6	9%	10	10%	6	6%	105
Love marriage (not approved by parents)	73	2%	6	9%	4	4%	1	1%	84

made up 39% of consanguineous marriages in the respondent sample and 36% in the three-generation sample. In contrast to both types of parallel cousin marriages, no prevailing cultural explanation for cross-cousin marriages emerged, although reasons mentioned included both property and love as well as other motives that might apply to any type of cousin marriage. For example, sometimes parents propose a match based on the desirable personality of a prospective boy or girl. Or a family might find a future spouse for their child by taking an orphan girl or boy in as a spouse, both to give them a place in society and because orphans were expected to be hardworking and loyal. Although a rarity in this region, a working woman might prefer her son to marry a relative because the girl would be more loyal to the family and thus take better care of the household in the mother-in-law's absence. In addition, consanguineous marriage was sometimes seen as ideal in wealthy or well-educated families if the family had a hard time finding a suitable match; marrying a family member ensured socioeconomic similarity and a good family reputation, key concerns of high-status families. Finally, any type of cousin marriage might be sought because the parents of the bride and/or groom wanted to "strengthen the relationship" between the two families. This was especially important if the relationship was particularly positive or cooperative but without a kin link between the families for two generations. People argued that such relationships needed to be periodically refreshed or rekindled through new kin ties, extending a bond that might otherwise break down over time.

Despite these many motivations for consanguineous marriage, most women we interviewed (including many women who themselves were married to a cousin) said that they did not like consanguineous marriage and would not want their children to marry a relative. The number one reason given was that they wanted to "make new relatives," and that arranging or allowing a consanguineous marriage for their child would not allow them to do so. New relatives formed through the bond of marriage were seen as having several advantages over existing relatives. Women said that with new relatives, it was easier to state one's grievances or make demands without "breaking" the family relationship, whereas in consanguineous marriage, sometimes they would have to "keep quiet" (*chup kori*) when they would prefer to speak out about a problem. Many women also claimed that there were no suitable spouses for their children among their relatives, and that if they wanted to "get a good boy/girl," they would need to look "outside the relatives."

New relatives were also seen as useful in increasing a family's social status and providing valuable connections for gaining school admissions, jobs, help in sending a son abroad, or other forms of aid typically sought through social networks. Finally, new relatives made one's family less dependent on kin (particularly patrilineal kin) who might otherwise place unreasonable demands on a family after marriage. In particular, women argued that relatively egalitarian kin relationships often transformed after marriage into the types of hierarchical relationships common between the families of grooms who

are ritually superior and often make demands on the families of brides. In this circumstance, a consanguineous marriage would not only fail to create new relatives but, worse, for the family of the bride it could transform kin relationships from a dynamic of cooperation to a dynamic of demand.

## Discussion

Our quantitative results are somewhat consistent and our qualitative results are highly consistent with our hypothesis that there will be a shift toward extensive kinship with market transition. We also find more nuanced patterns that warrant further discussion.

Whether the woman had any brothers predicts a higher likelihood of consanguineous marriage in table 6, consistent with an explanation that kin marriage functions to keep property in families or strengthen cooperative relationships. It is also consistent with qualitative results, as interviewees suggested that women without brothers would be married to cousins to both preserve their property in the family and strengthen relationships with patrilineal family members who would socially support daughters who had no brothers to fill this role. In addition, the goals of arranging consanguineous marriages to “strengthen the relationship” between families and to find a hardworking or loyal spouse for a child are consistent with an interpretation that consanguineous marriages are pursued by families as part of an intensive kinship strategy.

Variables predicting a lower likelihood of consanguineous marriage in tables 4, 5, 6, and 7, along with reasons given by women in qualitative interviews and focus groups for not having or not preferring consanguineous marriage, are consistent with the idea that people with higher levels of engagement in the market economy are more likely to have non-kin marriages and are specifically seeking to create more extensive kin networks. More educated people, those engaging in market-oriented occupations, or those with labor migrants in the family or *bari* generally have lower likelihoods of consanguineous marriage. Most convincing, however—and in fact one of our strongest and most consistent findings overall—is that the number one reason given against consanguineous marriage, asserted independently by more than two-thirds of our interviewees and focus group participants, was the desire to “make new relatives.” For some this goal had the aim of creating relations of a higher social status than their existing relatives, while others focused on finding people they got along with better or people with connections to the city. Some simply cited the importance of having new kin ties of any type. The extensive kinship framework gives a clear interpretation of the “new relatives” response, one that integrates this pattern with the quantitative results and other qualitative responses.

Some of our results are not entirely consistent with our predictions and require further exploration. For example, while consanguineous marriages are associated with intensive

kinship patterns, love marriages are far more common in extensive kinship systems (e.g., Bittles and Black 2010b; Harrell 1997). Thus, the rise of consanguineous love marriages in rural Bangladesh presents a puzzle for this theoretical framework. A deeper look at this pattern, however, suggests that love marriages may commonly occur among cousins for two reasons. First, social segregation of the sexes means that young people are much more likely to meet—and thus have the chance to form romantic attachments to—their cousins, who are among the few young people of the opposite sex with whom it is appropriate for them to socialize. While patrilineal parallel cousins or others who have grown up in the same *bari* are often not considered good marriage partners because they are “more like siblings” (a sensibility consistent with Westermarck 1891), in contrast, cross-cousins and matrilineal parallel cousins usually grow up apart from each other and only meet occasionally when their families visit each other—enough to get to know each other but not enough to feel like siblings. It is among these types of cousins, and particularly among matrilineal parallel cousins, that love matches are most likely to occur. Moreover, parents may also be more likely to approve of love matches with cousins because they know the family well and/or do not want to “break the relationship” if they were to resist a match the other family approves. That such marriages are contracted with cousins may thus often be incidental to the fact that they are love marriages, and one could interpret them as part of a shift toward extensive kinship; it is more often older, more educated, or financially independent young people who choose their own spouse rather than allowing parents to do so, yet their choice of spouses is currently constrained by traditional patterns of social interaction in Bangladeshi villages. One interviewee explicitly supported this interpretation by suggesting that love marriages in urban areas are less likely to occur among cousins because urban daughters go to school longer, and urban families “mingle with more people.”

A second trend that merits further discussion is that some indicators of greater market integration are associated with higher rates of consanguineous marriage. While none of these was a strong predictor in our final analysis (table 6), they were nonetheless retained in the model average, suggesting that they contribute to the model. Notable among them is a woman’s father’s salaried occupation (see tables 4, 6), which was a positive predictor in many alternative models in the analyses. It is possible that the positive sign on this variable is an artifact of being in a model that controls for many other aspects of family socioeconomic status, but qualitative interviews suggest a reason why such effects—if they are meaningful—might make sense ethnographically. Interview participants told us that in some circumstances, especially in rural areas, higher-status families might have a limited pool of eligible high-status spouses to draw from. While one alternative would be to marry their children into a wealthy or educated family from an urban area, another is to marry their child to a cousin who has a similar social status. A similar type

of limited choice based on social circumscription also characterizes very low-status families who traditionally engaged in socially marginal activities such as singing, dancing, and acting—interviewees reported their rates of consanguineous marriage to be very high because other families did not want to intermarry with them.

Finally, in the respondent sample, the woman's age is such a weak predictor of consanguineous marriage that it appears in none of the top 33 models (table 4) and thus is not included in the averaged model (table 6). Yet wife's year of birth is retained in the final model for the three-generation sample (table 5), which spans a much longer range of time and is positively associated with kin marriage, meaning that younger women are more likely to marry consanguineously (table 7). Contrary to what we would predict based on the transition from an agrarian to a market economy, this suggests that consanguineous marriages may actually be increasing over time in Matlab. This is bolstered by the finding that women in the respondent's parents' generation were less likely to marry kin and the fact that family size was falling during this period (Shenk et al. 2013), meaning that cousins are probably less plentiful than before. There is one likely reason for this pattern—the shift from ubiquitous arranged marriage toward an increasing fraction of love marriages, which are often contracted with cousins for the social structural reasons discussed above. The rise of love marriages among cousins might obscure reductions in rates of consanguineous marriages arranged by families for reasons of property or labor. In fact, *t*-tests comparing the year of birth of wives ( $t = 2.86, P = .005$ ) and husbands ( $t = 3.31, P = .001$ ) between people with non-kin marriages and those who had married their matrilineal parallel cousins find that such cousin marriages occurred among significantly younger people; a similar trend also occurs for women marrying their patrilineal parallel cousins ( $t = 2.04, P = .05$ ). It can also clearly be seen in table 8 that patrilineal and matrilineal parallel cousin marriages have the highest rates of arranged love and love marriages of all marriage types. The finding that the respondent's children are less likely to marry kin, however, may suggest that this trend will reverse over time as young people spend longer years in school and work and thus meet a broader range of prospective marriage partners.

This research has several important limitations. Not much can be said about degrees of biological relatedness with this data because most consanguineous marriages in our sample are first-cousin marriages, and we do not have enough other kin marriages to make a reasonable comparison. This is not unusual, however, as first-cousin marriages make up a very large fraction of consanguineous marriages globally (Bittles and Black 2010b) and are often as or more common than other marriage relationships. We are also not in a position to examine religious variation in consanguineous marriage in Bangladesh because virtually our entire sample is Muslim, and there are not enough Hindus in the sample to produce statistically valid results. Nonetheless, consanguineous marriage is generally not practiced among Hindus in North

India where rules of kin exogamy dominate, though cross-cousin marriage was traditionally normative in South India (Trautmann 1981). Hindus in Bangladesh tend to follow the North Indian kinship patterns. Perhaps the most significant problem with our quantitative analysis, however, is sample size. Although we have a large enough sample to investigate differences between people who marry consanguineously and those who do not, the sample of consanguineous marriages is smaller, making it difficult to pick up more subtle effects (e.g., differences among different types of cousin marriage).

#### *Kinship Systems as Cultural Niches*

This paper was written as part of the Wenner-Gren symposium "Integrating Anthropology: Niche Construction, Cultural Institutions, and History." Thus, we explore whether it could be useful to consider extensive and intensive kinship systems as separate cultural niches that generate different payoffs to consanguineous marriage.

Niche construction occurs when an organism modifies its environment in such a way that it changes the selective pressures on that organism, meaning that natural selection is not just responding to changes in the environment but also to the way that the organism has changed the environment (Kendal, Tehrani, and Odling-Smee 2011; Odling-Smee, Laland, and Feldman 2003). While natural selection acting on environmental change is an exogenous form of causation, niche construction can be considered a mechanism of endogenous causation (Kendal, Tehrani, and Odling-Smee 2011). Different subsistence patterns, for example, likely change selective pressures on humans (e.g., see Gerbault et al. 2011 for the evolution of lactase persistence). Whether different kinship systems change selective pressures in meaningful ways is harder to answer, but they certainly change the payoffs to particular behavioral strategies and thus have the potential to affect genetic evolution when these strategies affect survival or reproduction.

The model we propose in this paper suggests that changes in the economic and subsistence system cause changes in the local family and kinship ecology, which in turn change the payoffs to marriage decisions, which can alter reproductive outcomes and relatedness at the level of the local social group (e.g., patriline, joint family). The technologies, skills, and cultural practices associated with a subsistence mode and the related marriage, family, and inheritance practices can also be considered a cultural niche. One could argue that intensive and extensive kinship systems are thus trait complexes that may have coevolved with certain subsistence systems (Bailey, Hill, and Walker 2014; Walker and Bailey 2014). Taking one example, intensive agriculture may create an ecology where lineage systems, restrictive inheritance rules, and arranged marriage evolve as functional cultural adaptations to land limitation and social stratification based on differential land ownership. Under such circumstances, strategies such as consanguineous marriage have the potential to reduce the number of claimants on property and/or increase ties among a

small, well-defined group of cooperators (such as a village, patriline, or joint family), making kin marriage beneficial compared with non-kin marriage in terms of wealth or social cohesion. Thus, intensive agriculture may create a niche where consanguineous marriage pays off to the point where people are willing to tolerate its moderate genetic risks. Market economies, on the other hand, create a niche where consanguineous marriage no longer pays off in terms of wealth or social cohesion—people gain more from marrying out than marrying in and thus should be less willing to tolerate its genetic risks. Given this logic, appropriate social norms either promoting or mitigating against consanguineous marriage would be likely to arise in each niche over time, further increasing the benefits of adhering to socially normative behavior to further enjoy the benefits of social cohesion or avoid the negative effects of social punishment.

### Conclusions

The data presented here suggest that consanguineous marriage decisions are often strategic. For example, a daughter with no brothers might marry a cousin to retain rights to family property, or a family might choose to marry an educated daughter to an unrelated spouse in order to “make new relatives.” However, marriage decisions are also constrained by social structural elements, such as when young men and women fall in love with their cousins because they are limited in whom they are able to meet socially. The perspective of intensive and extensive kinship systems helps us organize many of these findings into a coherent pattern and should be relevant to other studies of consanguineous marriage as well as kinship and family systems more generally. Finally, we think it is plausible to view intensive and extensive kinship systems as cultural niches. This perspective formally connects the individually focused study of behavioral strategies with the larger cultural structures in which they are embedded, structures that provide the possibilities, limitations, and payoffs for such behavior.

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# Reconceptualizing the Human Social Niche

## How It Came to Exist and How It Is Changing

by Craig T. Palmer, Kathryn Coe, and Lyle B. Steadman

In this paper we present a reconceptualization of the social dimension of the human niche and the evolutionary process that brought it into existence. We agree with many other evolutionary approaches that a key aspect of the human niche is a social environment consisting primarily of cooperating and altruistic individuals, not a Hobbesian social environment of “war of all against all.” However, in contrast to the conception of this social environment as consisting of individuals who, in Boyd and Richerson’s words, “cooperate with large groups of unrelated individuals,” we propose that it is more accurately described as consisting of cooperating individuals who currently are often nonkin but who, until relatively recently in human existence, were primarily, and in many cases almost exclusively, kin. In contrast to the conception of this social environment coming into existence by way of a process of selection within and between groups, we propose that it is the result of selection operating on traditions originated by ancestors and transmitted to their descendants. We use our fieldwork in three areas of the world (New Guinea, Ecuador, and Canada) to illustrate this process and how current social environments can be roughly placed on a continuum from traditional to nontraditional.

For more than 2,000 years our best thinkers have attempted to unravel the “riddle,” as E. O. Wilson puts it (2013), posed by our own behavior, namely, that although conflict appears difficult for humans to avoid (McCullough and Tabak 2010), cooperation and altruism characterize much of the human social environment (see Nowak 2006).<sup>1</sup> We view this social environment characterized by cooperation and altruism as the result of social niche construction. By “niche construction” we refer to the process in which organisms transform aspects of their environment and in the process change “the selection pressures to which they and other organisms are exposed” (Laland, Odling-Smee, and Feldman 2001:22; see also Rendell et al. 2010). We use the phrase “human social niche” to refer to the behavior of the other humans in the environment of an individual and with whom that individual is likely to interact during his or her lifetime. We find this very basic and general conception of social niche to be more appropriate for explanations of the evolution of human cooperation than the far more specific use of “social

niche,” or “social niches,” to refer to “a series of overlapping, hierarchical role-structures” within more recent and complex societies (Lipatov, Brown, and Feldman 2011:901; see also Brown and Feldman 2009). We use the phrase “human social niche” instead of “human social environment” to emphasize that through social niche construction, organisms influence not only their own social environment but also the social environment to which “their descendants are exposed” (Day, Laland, and Odling-Smee 2003:80; see also Fuentes, Wyczalkowski, and MacKinnon 2010) and thus influence the selective pressures operating on those descendants. The use of the word “descendants” is important because it includes not just children and grandchildren but a potentially unlimited number of subsequent generations of descendants. To help solve the riddle of the relatively cooperative and altruistic social environment to which many generations of humans have been exposed, we present a new conception of both the characteristics of the human social niche and the evolutionary process that brought it into existence.

### Reconceptualizing the Human Social Niche

We agree with other theorists that the social niche of our ancestors was characterized by a large amount of cooperation and altruism. However, in contrast to the conception of

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1. We will use the word “cooperation” to refer to individuals influencing each other’s behavior in ways that benefit the fitness of both individuals and the word “altruism” to refer to acts that are costly to the actor’s fitness and beneficial to the receiver’s fitness (see West, El Moudden, and Gardner 2011).

the human social niche as consisting of individuals who “cooperate with large groups of *unrelated* individuals” (Boyd and Richerson 1982:325, emphasis added), we propose that it is more accurately described as consisting of cooperating and altruistic individuals who now include many nonkin but until relatively recently in human existence were primarily, and in many cases almost exclusively, kin.<sup>2</sup> By kin, we refer to individuals identified by others as being related by birth or from common ancestors.<sup>3</sup>

We also agree with other approaches that the human social niche can be described as both biological and cultural, but we differ from many of those approaches by emphasizing the distinction between traditional cultural behavior (i.e., traditions) and nontraditional cultural behavior. By “traditions” we refer to behaviors descendants copy from their ancestors. Traditional behaviors are a subset of cultural behaviors, which we define as behaviors copied from any individual.<sup>4</sup> These definitions allow us to describe people’s behavior as relatively traditional when a

2. We propose that the presence of “nonkin” in the residential communities of contemporary foragers found by Hill et al. (2011) is the result of individuals identified as very distant kin being classified as “nonkin” and various aspects of contemporary environments (described below) that made actual nonkin far more likely to be present than they would have been in the past. Significant sustained cooperation with nonkin may have occurred in some places several thousand years ago but in other places as recently as the current generation (see Diamond 1997:273, 2012).

3. “Fictive” or “metaphorical” kin are terms used to refer to individuals that are claimed to be actual kin in some circumstances but are also acknowledged not to be actually related by birth (i.e., not actually kin) in others. When individuals are identified as kin based on shared descent, kinship terms may be used metaphorically to refer to genealogically distant kin but by using a kin term that literally refers to a genealogically closer kin person (e.g., calling certain cousins siblings).

4. Culture may include information inside brains (Hill, Barton, and Hurtado 2009), but it can only influence others and be copied if it is exhibited as behavior. As behavior, both traditional and nontraditional cultural behaviors are biological in the sense of being an aspect of a living organism. However, behaviors are not purely genetic or purely environmental because all aspects of all living things are the result of genes interacting with many environmental factors (Freeman 1983:294). More specifically, we propose that people call a behavior cultural when one of the necessary elements in the developmental environment of the individual performing the behavior was another individual performing the behavior and serving as a model to be imitated. We also propose that a behavior is called traditional to indicate that the other person in the developmental environment serving as a model of the behavior is a parent, grandparent, or more distant ancestor. Parts of traditions may originate among nonkin or be significantly modified during transmission. Behaviors may even be invented and then falsely asserted to have been transmitted from earlier generations of ancestors (Hobsbawm and Ranger 1983). While acknowledging these possibilities, it is important to recognize the evidence of actual traditional transmission of behaviors (Mathews and Perreault 2015) and to realize that there would be no point in falsely claiming that a behavior is traditional if the actual multigenerational transmission of behaviors was not seen as being important. What is needed is a theory that can account for not only the breaking, manipulating, rejecting, and inventing of traditions but also for the existence of traditions (Palmer 2010, 2013).

relatively large amount of their cultural behavior is traditional (i.e., copied from ancestors) and relatively nontraditional when a relatively large amount of their cultural behavior is nontraditional (i.e., copied from individuals other than ancestors).<sup>5</sup> We further propose that social environments in which much of the behavior is traditional probably correspond to the ancestral human social niche designed by selection more closely than do social environments where most behavior is not traditional. This is consistent with the observation by Cronk (1999) that the human niche, what he refers to as “the world we were made for,” includes the replication of behaviors with relatively little change and the preponderance of kin in the social environment: “we were made for a world that has mostly disappeared . . . a world in which all activities were enmeshed in webs of kinship . . . a world in which things rarely changed much over the course of a lifetime” (119).

This focus on kinship and traditions is in contrast to descriptions of social relationships relying on the concept of “groups.” Indeed, much of the novelty of our proposal comes from the absence of the term “group,” which we avoid for three reasons. First, “group” often refers to a reified abstraction (Murdoch 1971). Humans obviously come into close proximity with each other and interact in various ways, but when described as groups, these interactions between individuals are often endowed with properties they do not possess, such as being an animate entity that can do things such as survive, reproduce, and evolve (as opposed to merely “change”).

The second reason we avoid the term is that groups are often presented as preexisting givens that can be used as variables in evolutionary equations to explain the evolution of cooperation. For example, Traulsen and Nowak (2006:10952) start their explanation with the assumptions that “a population is subdivided into groups,” and “if a group reaches a certain size, it can split into two.”<sup>6</sup> This assumed preexistence of groups with certain characteristics is also found in the many different models of cultural group selection, including those emphasizing conformity and prestige-based biases (see Boyd and Richerson 2010; Henrich 2004; Soltis, Boyd, and Richerson 1995).<sup>7</sup> Preexisting groups are also used as variables in approaches that use the Price equation to conceptualize kin selection, reciprocal altruism, and group selection as “simply

5. We do not consider the term “traditional” to be either derogatory or complimentary.

6. Boyd, Richerson and Henrich (2011) make a similar assumption: “The population is structured into a large number of groups. Local population regulation maintains groups at a fixed, finite size and during each generation groups exchange migrants with all other groups” (433). Similarly, Hill, Burton, and Hurtado (2009) refer to theoretical modeling showing that “copying is most favored in groups that already have many copiers who have already produced adaptive culture” (190).

7. As Richerson and Boyd (2010:3788) point out, “group selection has many faces.” For a discussion of the many different meanings of both group selection and cultural group selection, see West, El Mouden, and Gardner (2011).

three systems of gene-tracking and fitness accounting from three different perspectives” (Bijma and Wade 2008; Hamilton 1975; Henrich 2004:10; Hill, Barton, and Hurtado 2009; Price 1972; Wade et al. 2010; Wilson 2015). In contrast, we propose that the interactions of multiple humans in close proximity should be conceived of not as givens but as what needs to be explained. We agree with Boyd, Richerson, and Henrich (2011) that “we owe our success to our uniquely developed ability to learn from others” (10918). However, we disagree that the construction of our human social niche, what they refer to as our “cultural adaptation,” is best seen as “a population process” (Boyd, Richerson, and Henrich 2011:10921). Instead, we try to specify from whom they were learning and who they were copying—kin.

The third reason we avoid the word “group” is that it is often used to refer to any category of humans, including categories where many members may never interact or be gathered together in close proximity (e.g., tribes, clans, phratries, sibs, peoples, cultures, ethnic groups, nations; Palmer, Fredrickson, and Tilley 1997; see also Godfrey-Smith 2006).

These three reasons for avoiding the word “group” are important because of the role the term “group” plays in both descriptions of the human social niche as consisting of cooperation within and between groups and in the hypothesized construction of this niche by a process of selection within and between groups. Fortunately, not only can the characteristics of the human social niche be accurately described without the use of the term “group” but also the process by which it was constructed can be described.

## Reconceptualizing How the Human Social Niche Came to Exist

Our explanation of the construction of the human social niche attempts to answer the question, how did our ancestors manage to construct a social environment in which their descendants would live that was populated by many, primarily cooperative, and even altruistic individuals instead of by hostile competitors?<sup>8</sup> Our answer is that they started traditions that influenced their offspring to both cooperate with and exhibit altruism toward their siblings and influenced those offspring to replicate that behavior in order to influence their own offspring to cooperate with and exhibit altruism toward all of the ancestor’s grandchildren (i.e., their siblings and their first cousins), and so on and so forth throughout subsequent generations (Palmer and Palmer 2015). Specifically, we propose that the human social niche is the result of selection operating on traditions originated by ancestors and transmitted, along with their genes, to their descendants and influencing those descendants to coop-

erate with, and be altruistic toward, codescendants also identified as such by traditional names and “ethnic markers.”<sup>9</sup>

Our explanation of how selection could have favored the transmission of these traditions starts with an explanation of altruism first put forth in the mid-1970s. The parental manipulation explanation of altruism (Alexander 1974; Dawkins 1982; West-Eberhard 1975) is based on the concept of parent-offspring conflict. As originally stated by Trivers (1974), the existence of parent-offspring conflict means that “parents are expected to attempt to mold an offspring, against its better interests” and in favor of the interests of the parent (249). This attempted molding, or manipulation, is the result of the simple biological fact that a parent is equally related to all of his or her offspring, but the offspring is completely related to itself ( $r = 1$ ) and only half related to a full sibling ( $r = 0.5$ ). Therefore, evolutionary theory predicts that an “offspring should value its personal fitness twice as much as it values any full sib’s fitness” (Kurland and Gaulin 2005:452), but parents should try to influence offspring to value a full sibling as much as it values itself (Wright 1994:166) because both siblings are equally valuable to the parent in terms of genetic relatedness because both are equally related to the parent.

The parental manipulation explanation is likely to be involved in the construction of the human social niche because “humans are parental manipulators par excellence” (Alexander 1974:367), and a human parent can suppress selfish behavior even in their adult offspring and even after the death of the parent (Alexander 1974:368; Trivers 1974:262). Voland and Voland (1995) come close to recognizing the consequences of parental manipulation when they refer to the possibility of offspring being “raised to ‘voluntarily’ stake at least part of their reproductive fitness for the maintenance and welfare of their families and thus to the long term advantage of their *lineage*” (407, emphasis added). The use of the word “lineage” is crucial because it refers to a chain of ancestors and descendants and therefore implies a time span much longer than one individual’s life span. The failure to follow up on this insight is unfortunate, because recognizing that this manipulation can be extended past a single generation leads to a profound new prediction about the behavior of distant generations of descendants.

If individuals who influenced all of their offspring to “treat each other as if you valued them as much as yourself” (i.e.,  $r = 1.0$ ) have been favored by natural selection over individuals who did not influence their offspring to behave this way toward their siblings, then individuals who influenced all of their grandchildren to “treat each other as if you valued

8. These ancestors were perhaps living in the type of simple social organization that limited the identification of kin to only two or three generations, as described by Chapais (2008).

9. The concept of traditions being subject to natural selection is consistent with Darwin’s ability, before the discovery of genes, to realize the power of natural selection by observing phenotypic traits transmitted from parent to offspring. These traditions, or “ethnic markers,” are “one of the most striking and unusual features of the human species” (Boyd and Richerson 2006:104, 1982). However, this is not because they form ethnic “groups” but because they identify codescendants.

them as much as yourself” (i.e.,  $r = 1.0$ ) would have been favored over individuals who did not influence their grandchildren to behave this way toward their siblings and first cousins. Further, individuals who influenced all of their great-grandchildren to “treat each other as if you valued them as much as yourself” (i.e.,  $r = 1.0$ ) would have been favored over individuals who did not influence their great-grandchildren to behave this way toward their siblings, first cousins, second cousins, and so on and so forth. This leads to the conclusion that selection would have favored individuals who were most successful at influencing the social behavior among the most distant generation of their descendants (Coe et al. 2010; Steadman and Palmer 2008).

The next question is what process could enable individual humans to have such influence on the behavior of their descendants born many generations after their own death? We propose that the answer is as simple as it has been unappreciated: by transmitting traditional behaviors that influenced each generation to be willing to behave in those ways and then to go on to replicate that influence on the next generation.

This multigenerational approach is fully compatible with the view that natural selection can be better measured over a large number of generations than in terms of the number of surviving children or grandchildren produced (Alexander 1974:346, 374; Dawkins 1982:184). It is also consistent with the evidence of cultural traditions often enduring many generations (Coe 2003; Mathews and Perreault 2015; Palmer 2010; Palmer and Steadman 1997) as well as the fact that “large lineages or clans . . . grow up over time as the descendants of the original ancestor/ancestress” accumulate (Fox 1967:122). It is also consistent with the observation that “kinship predicates the axiom of amity, the prescriptive altruism exhibited in the ethic of generosity,” and that this “axiom” of “kinship amity” is apparently a cultural universal (Fortes 1949:231–232). Finally, it is also consistent with examples where explicit emphasis is placed on replicating the traditional code of ethics to the next generation (e.g., the Jewish prayer known as the *V’ahavta*; see Sosis 2008:214). We emphasize, however, that this process, which can lead to the axiom of kinship amity applying to tens of thousands of individuals because they are identified as kin (Keesing 1975), only occurs when traditions identifying kin are transmitted over many generations. This is important because it is difficult to see how large numbers of individuals can come to identify each other as kin without the transmission of traditions over many generations regardless of the selection taking place between and within groups.<sup>10</sup>

10. One of the few alternative ways such a social environment could be constructed is the fictitious one described by Kurt Vonnegut (1976) in his tongue-in-cheek novel *Slapstick; or, Lonesome No More!* As Cronk (1999:129) explains, Vonnegut’s character Dr. Swain runs for president on the promise to use “the computers of the federal government to recreate kinship networks like those of our ancestors . . . [including] 190,000 cousins, all obligated to help fellow clan members.” Although explicitly a fantasy, it highlights the challenge that evolutionary theories

Not only has the importance of traditions been largely unrecognized, so too has the difficulty and uncertainty of transmitting traditions. Evolutionary explanations of culture tend to see only cultural change as an active process involving such activities as “the hard work of invention” (Schiffer 2005:485), the operation of various cultural transmission biases (e.g., Henrich 2004), and random copying errors (e.g., Eerkens and Lipo 2005; Richerson and Boyd 2010). Overlooked is the fact that the preservation of traditional behaviors is also an active process that requires hard work (Coe and Palmer 2013; Palmer 2010).<sup>11</sup>

To illustrate the process just described and how it has resulted in current social environments forming a continuum from traditional to nontraditional, we use examples from three distinct areas where we have performed extensive fieldwork (New Guinea, Ecuador, and Canada).

### The Hewa

The Hewa are a people living in the western highland of Papua New Guinea who, Steadman (1971) writes, had small gardens and were excellent hunters. They were one of the last people in Papua New Guinea to come into contact with outsiders; in fact, they had very recently been discovered by an Australian Patrol officer. Several thousand individuals were called “Hewa,” and most of them lived in the large area bisected by the Lagaip River and its tributaries. Beginning in 1966, Steadman initiated his 2-year study of approximately 500 Hewa living on the western side of this area. While they wore similar traditional attire and shared many other traditions, they had no name for themselves. “Hewa” was the name given to them by nonkin living in the surrounding areas.

The habitat was characterized by dense rain forest, sharp mountain ridges, and swift rivers. Consequently, “the Hewa” were not only geographically isolated in the sense of having relatively little contact with outsiders—nonkin—but each family lived in relative isolation from other families. As Steadman’s knowledge of these people, their language, and their culture increased, he realized “the Hewa” were not a social group. While their language belonged to the Sepik Hill family, the way they spoke gradually changed as one crossed the area to the point that people living on one side of “the Hewa” would have a hard time communicating with those on the other side. Further, there was no overarching hierarchy; the largest hierarchies were tempo-

focused on selection between and within groups, and ignoring traditions, face in accounting for one of the most basic aspects of the human social environment.

11. Because of the social behavior resulting from the traditional social influence of parents and not the sharing of genes, changes in social influence could lead to cooperation with, and altruism toward, individuals not identified as kin. This is what allowed for the human social environment to be relatively recently modified from one populated almost exclusively by individuals identified as kin to one consisting of individuals who “cooperate with large groups of unrelated individuals.”

rary ones headed by Big Men who had some influence over six or seven households.

Steadman also came to realize that the relationships among these people were based on descent from common ancestors. Cooperation and altruism occurred only between individuals identified as kin; whenever Steadman asked why an instance of altruism or cooperation occurred, the reason given was always kinship, which as Steadman also quickly learned was not a group phenomenon.

Like most people in the world, the Hewa used two naming systems to identify their kin: kin terms to identify close kin and ancestral names (such as clan or “family” names) to identify more distant kin. In regard to those kin identified by kin terms, every individual was at the center of his or her own unique set of kinsmen (i.e., his or her kindred). Also, the Hewa, like many other people, extended kin terms metaphorically to all their identified kin, close and far. Certain cousins, for example, were referred to as “siblings.” This metaphorical extension, however, never violated a crucial kinship rule, that genealogically closer kin were favored over more distant kin.<sup>12</sup>

In regard to ancestral names (i.e., clan names), all individuals bearing one’s own clan name were always considered kin because the name identified them as codescendants—the only way to obtain a clan name was by descent from someone with that clan name. The individuals identified as kin by clan names included all those bearing the clan names of any of one’s four grandparents and the clan names of some great-grandparents and their offspring. And, of course, the children of any kinsmen were your kinsmen, as were the grandchildren, and so forth. Thus, by using clan names these people could identify many distant relatives. It is important to note that the residences of individuals with the same clan name were scattered in a wide variety of residential areas. Clans—comprising those individuals sharing the same ancestral name—were exogamous; one could not marry an individual bearing one’s own clan name. Thus, every household contained individuals of different clans.

The enduring cooperation and altruism between many individuals in the social niche constructed by the ancestors of these people did not arise as merely the result of shared genes. It was encouraged through traditional behaviors, many of which could be described as forms of ancestor worship, encouraging descendants to accept the influence of their ancestors, including the ancestors’ encouragement of cooperation with and altruism toward kin. One such tradition was the hanging of skulls of dead ancestors inside their houses, where they would be treated with great respect. People would also punish those who behaved in ways that violated the traditional taboos passed down to them from their ancestors, and

12. The existence of killing among the Hewa demonstrates how traditions do not eliminate conflict among kin. However, just as a Hewa would favor his closer kin in hunting and in exchanging food, a Hewa would also favor closer kin in a fight.

often the punishment involved making offerings to dead ancestors to make up for failing to accept their influence.

Many of the traditional forms of social cooperation and altruism were transmitted by observation, as were the many other traditional behaviors involved in such tasks as subsistence activities and house making. Proper social behavior was also often transmitted from one generation to the next during the evenings when people would praise the behaviors of some individuals and criticize those of others, often justifying these judgments by referencing traditional stories.

Although the Hewa had remained relatively isolated, and relatively traditional, when Steadman returned 15 years later, he found certain instances of increased contact between the people referred to as Hewa and nonkin. Kinship was still the basis of all cooperation, but it now became important in new ways, including trade. For example, Steadman found out that Tama, son of a man who had been an informant, had, at the encouragement of the Australian government, agreed to work on a distant tea plantation for 2 years, where he learned to speak pidgin English. Tama’s patrilineal clan name came from a distant male ancestor who, many generations ago, had crossed the mountains into the Hewa area from an area known as Kapiago (or Duna) and left male descendants, including Tama. The people called Kapiago had very different traditions from those called Hewa, including a completely different language. After Tama landed at Kapiago Airstrip and before he began the long trek back to his home, he decided to visit his alleged distant clansmen among the people referred to as Kapiago. After introducing himself, using his newly acquired pidgin English, he explained to them that even though he lived among people most outsiders called “Hewa,” he was a descendant of their clan ancestor. They welcomed him and he stayed with them for several weeks, returning with gifts for their kin.

Another example concerned Wato, another Hewa man also returned from working at a tea plantation where he learned pidgin English. Wato decided to cross the wide Strickland River to trade with people called the Oksapmin. He assumed that because he could speak the lingua franca of New Guinea that he could get along with anybody who could speak that language. However, although he could communicate with some Oksapmin in pidgin English, he could not show any kinship linkages with them. They killed him. These examples illustrate the importance of kinship, even distant kinship, and the extreme danger of attempting to cooperate with anyone but kin.

## The Chachi

The people referred to as “the Chachi” (formerly called the “Cayapa”) live in Ecuador’s lowland coastal rainforest. Data on these people were collected over a 90-year period, beginning in 1907, by Barrett (1925), then continued by Altschuler (1964), who was there in the early 1960s, and then Coe (1995), who conducted her primary fieldwork in 1989–1990.

In 1989, seven thousand individuals referred to as the Chachi lived, as their ancestors had since prehistoric times, in isolated

longhouses located along the banks of tributaries located in an isolated section of northwestern Ecuador's Santiago Drainage,<sup>13</sup> an area characterized by intermittent contact with the outside and accessible only by dugout canoe.<sup>14</sup> Out of the several hundred categories of codescendants identified by descent from common ancestors that resided in the coastal rainforest of Ecuador in prehistoric times, the Chachi are one of only two whose descendants survive today. While maintaining many traditions, their behavior, in 1989–1990, was less traditional than the behavior of the people studied by Steadman because they were starting to experience the disappearance of many traditions because of contact with outsiders.<sup>15</sup> The Chachi's claim that they share a common ancestor is supported by genetic evidence indicating that they actually do come from a small founding population with only occasional entry of genes from other individuals who came in as wives.<sup>16</sup>

Chachi, who have always claimed that their system of behavioral codes was ancient, when asked where their system of behavioral codes had come from inevitably replied, "That is the way the ancestors did things and that is the way they want us to do them" (Coe 1995). While they linked current practices to

their ancestors, Praet (2005:133), who currently studies them, argues that the Chachi have no ancestors, claiming that they, "like many Amazonian and Andean groups explicitly refuse to remember anything about the dead. The dead are relentlessly annihilated and systematically erased from living members." On the same page, however, he writes that the Chachi claim they live in "ancestral" territory, a claim, based on their traditional stories, that they used successfully in 1992 when they sought formal recognition of their land rights. Praet also contradicts his claim when he writes that the "living are not always neatly set apart from the dead," when he describes funerals as sacred rituals that involve playing games with the deceased, now an ancestor, and leaving food for them by their graves, and when he calls the ceremonial center where all kinship and traditional events are held "the village of the dead" (Praet 2005:136).

Although most Chachi lived in the Santiago Basin, "membership," or acceptance as a Chachi, was determined by birth. As Altschuler (1967:32) explained, membership "is limited to born Cayapa." Chachi, as Coe described, were identified by birth to a Chachi mother (a woman who had a Chachi mother). Fathers were identified through their close and prior relationship with the mother. If the father was not identified as Chachi, a rare event, the child would be considered to be Chachi, but illegitimate. On rare occasions (rare, given strong rules of endogamy), a Chachi was identified by birth to a non-Chachi female who had a close, intimate relationship with a Chachi male.<sup>17</sup> All Chachi were considered to be kin based on descent from clan ancestors identified by patrilineal names; they saw outsiders—those with different ancestors—as not being true people. Although they were encouraged to behave in cooperative ways with all Chachi, they favored genealogically closer kin (e.g., those sharing two parents, one parent, grandparents) over more distant ones. Distant kin were identified as those sharing a ceremonial site (and a patrilineally inherited last name) as they shared a distant Chachi ancestor. A Chachi male or female was identifiable through a set of traditions described in detail by both Barrett and Coe and that included not only the ability to speak a unique language (Chapaalachi) but various forms of art (e.g., body decoration, paintings on dugout canoes, designs in weaving) that the Chachi claimed they had inherited from their ancestors.<sup>18</sup> Participation

13. The small number of Chachi who live in Muisne separated from the others because they wanted to change the behavioral codes so they could marry polygynously.

14. Access to the area has been difficult; however, some gold has been found in the rivers, and the area has been rich in endemic plant life, including tagua (important at one time for making buttons), balsa (important during World War II), and bananas (important after blight destroyed the crop in other areas). While efforts to harvest these resources were initiated, none of the efforts were sustained. An African Ecuadorian population was also brought in at one time to pan for gold, a venture that soon failed. The extent to which these outside influences and missionaries changed certain specific practices (e.g., monogamy) is unclear (see Praet 2009:2, 10).

15. This contact was accompanied by the loss of land to lumber concessions and the introduction of diseases. The Chachi, as described by Barrett (1925), had good health. He wrote that the area in which they lived was "the most salubrious territory of the entire western coast of South America" (Barrett 1925:25). He observed no serious contagious diseases; typhoid was entirely unknown, dysentery was little known, and cases of malaria were mild. The most frequent causes of death were drowning, falling from trees, and being bitten by snakes. By 1989–1990, this situation had changed considerably; dysentery was widespread, and infant and maternal mortality were reported to be high. Additional causes of morbidity and mortality included malaria, anemia, malnutrition, chronic diarrheas, intestinal parasites, malabsorption, leishmaniasis, scabies, yellow fever, tuberculosis, bronchitis, and pneumonia. The first case of onchocerciasis was discovered in the area in 1980. According to data provided at that time by Ron Guderian, MD, 71.8% of the Chachi living on the Rio San Miguel tested positive for the disease in the late 1980s.

16. Genetic studies of HLA-B variants and mtDNA (C10 haplotype) support that the Chachi actually do share a common ancestor, that the genetic diversity of the founding population was limited, and that the Chachi have maintained relative isolation for a long period of time in situ (Garber et al. 1991; Rickards et al. 1999).

17. The children born to non-Chachi mothers but who had Chachi fathers were treated as social outcasts. When Coe asked the Chachi why endogamy was so important to them, they explained, "If our children do not marry Chachi we will be gone as a people in one generation."

18. These resembled those found in the Andes, where the Chachi claimed their distant ancestors had once lived and with whom even their more recent ancestors had maintained kinship ties. These art motifs also closely resembled those made by the Tsachila and Awa, people who lived in other areas of the rainforests in northern Ecuador and southern Colombia but who claimed descent from the same distant ancestors. It seems clear that the art of the Chachi, Tsachila, and Awa was inherited from a distant ancestor they all shared.

in Chachi ceremonies required cooperation and, through the stories and activities that were part of the ceremonies, promoted or encouraged cooperation with other Chachi. These stories related how the ancestors wanted their descendants to continue practicing the same ceremonies and described how they wanted their descendants to behave—in other words, stories were used to teach appropriate social behavior.

Neither Barrett (1925) nor Altschuler (1964) described how these cultural traits were transmitted across generations, although transmission obviously was occurring. Chachi children, based on data collection using both continuous and scan sampling, were instructed beginning early in life about the moral system and the duties they would need to perform later as parents and spouses. Through copying and guided practice, Chachi children learned complex technologies (e.g., girls learned weaving, boys learned how to make a dugout canoe). In the process, they also learned the history of their people and how to properly interact with kin.

Relationships within the family, Barrett (1925:42) writes, were held sacred, and family ties were binding; “one of the most characteristic features of the daily life of the Cayapa is the devotion of the members of the family toward one another.” Further, Altschuler (1964:57) explains that “it is expected that siblings will form an especially intense bond.” Chachi children, Altschuler (1967) writes, were taught to respect their parents, grandparents, other Chachi elders, and their ancestors. He describes how children treated their grandparents with respect, referring to them as mother and father. The children also were to attend and respectfully participate in the ceremonies, including those honoring the deceased.

In sum, kinship was the organizing principle among these people, with kinship defined broadly as based on birth and shared descent and as identified by kin terms and ancestral names and other traditions. The myths and stories used in ceremonies were traditional and often were accounts of how Chachi ancestors had behaved and wanted their descendants to behave. These stories formed the core of the system of behavioral codes that, as a result of being passed down for many generations, had constructed the Chachi version of the human social niche.

### Newfoundlanders

The behavior of the people in Canada referred to as “Newfoundlanders” is much less traditional than that found in the two earlier examples.<sup>19</sup> That is, less of the behavior of these people has been copied from ancestors, and much of

the behavior that has been copied from ancestors has not been passed down for as many generations as in the earlier examples. Further, the name of this category of people refers not to a common ancestor but to the geographic area to which most of the ancestors of the current population migrated from Europe, especially England and Ireland, over the last few centuries (Mannion 1977).<sup>20</sup> However, although the term “Newfoundlander” started as a name referring to a resident of a certain geographic area, it subsequently came to identify the descendants of those individuals. In a process that has occurred at many times and in many places in the last several thousand years, the name of a location started to be transmitted, along with many accompanying behaviors, from parents to offspring (i.e., it became traditional). As this happened, the traditions accompanying the name “Newfoundlander” started the same process seen in the other two examples. More recently, as in the previous examples, the influence of these traditions started to lessen.

The following description of Newfoundland traditions starts with Firestone’s (1967) description of life along the west coast of the northern peninsula of Newfoundland known as “the Straits” during 1962 and 1963. Although traditional compared with many areas of North America at this time, Firestone describes the deterioration of traditions passed down from earlier generations.

Firestone emphasizes that the people he studied did not form a social group but instead an environment where there was “a series of limitations to the social world” (Firestone 1967:33). At the core of this social world was a form of kinship cooperation and altruism traditionally encouraged by ancestors: “when brothers grow up they are expected to fish with each other and their father” (Firestone 1967:47). Thus, in the next generation “The essential nexus of co-operation is still brothers . . . [who] carry on together after their father has died, . . . [and with their sons] make up the nexuses of future crews” (Firestone 1967:66). Firestone also emphasizes that this pattern results from the traditional moral code stating that “Brothers and their father remaining together and ‘all hauling together’ is the ideal” (Firestone 1967:51). In an example of how the transmission of traditions to new generations can expand the number of cooperating codescendants, Firestone writes, “where cousins cooperate within a single crew, we have a family extending over four generations and including the founder, his sons, grandsons, and their immature off-spring” (Firestone 1967:51).

Firestone (1967) also describes how “if men split up before their boys are grown ‘people talk about it’” (52). Despite criticism of those who fail to follow traditional patterns, the

19. “Newfoundland” is used here to refer to the island part of the province of Newfoundland and Labrador. Because of the negative connotations sometimes associated with the word “Newfie,” the term “Newfoundlander” will be used except where “Newfie” appears as part of a quotation.

20. Some of the genes, traditions, and traditional material culture of the area (e.g., a traditional Inuit sled known as a *qamotiq*) have come from indigenous populations in the area (e.g., Inuit, Innu, Mik’maq). The primary indigenous population on Newfoundland was known as the Beothuk, the last of whom died in the early nineteenth century.

influence of traditions was weakening, leading to a decrease in the extent of cooperation among codescendants: “Instances where first cousins do fish together [were] . . . more prevalent in the past” (Firestone 1967:51). More recently, “After the father dies the oldest brother becomes the leader. . . . When the brothers’ children grow up there will in most cases be a split and each brother will fish with his sons” (Firestone 1967:47).

Palmer’s fieldwork began 25 years later and continued through the following generation among both descendants still living in Newfoundland and those who had migrated to Alberta to work in the oil industry.<sup>21</sup> Palmer found evidence that many traditions in the Straits were fading.<sup>22</sup> This includes even the patrilocality that had produced the “essential nexus of co-operation” between male codescendants.<sup>23</sup>

The recent migration of many Newfoundlanders to Alberta not only reveals the inaccuracy of referring to this category as a group, it also reveals the extent to which the identity of “Newfoundlander” is now based on ancestry more than geographic location. Further, even the social behavior involved in this migration is still significantly influenced by traditions encouraging cooperation with and altruism toward kin. Kin provide crucial help with every aspect of the migration, including transportation, housing, employment, and childcare (Palmer, Groom, and Brandon 2012). While some of this interaction (e.g., residential clustering) might be described as a group (Wilson 2002), a closer examination of the interaction between Newfoundlanders in Alberta quickly reveals the inaccuracy of such a description. For example, the number of cooperating Newfoundlanders identified by descent names as cousins in Alberta can be extremely large (over 200 in one case described by Palmer, Groom, and Brandon 2012), despite all of these cousins never being gathered together.

The ability of descent names to allow individuals to identify even distant codescendants as kin the first time they

meet is illustrated by this story told by a Newfoundlander living in Alberta: “I stopped in the office, talked to this other lady that’s there. . . . Turns out, her family are . . . [same family name as my maiden name]. So we’re related five or so generations back.” The ability to use descent names to identify individuals as kin even when they have a different descent name was illustrated at a party in Fort McMurray where a handful of Newfoundlanders who had never previously met were able to identify each other as kin through the tracing of birth links through female relatives back to individuals with the same descent name.

Visual displays signaling that one is a Newfoundlander (i.e., ethnic markers) play an important role in Newfoundland-to-Alberta migration because such displays can significantly alter the social environment. The transmission of the Newfoundland identity to children born in Alberta from Newfoundland parents is indicated by T-shirts saying “Made in Alberta, with parts from Newfoundland” (Palmer, Groom, and Brandon 2012). Such displays of Newfoundland identity often lead to cooperation and altruism (Hiller 2009). For example, a Newfoundland flag hanging off an apartment balcony in Fort McMurray is sometimes taken as an invitation to other Newfoundlanders that they could come in and have a place to stay (Palmer, Groom, and Brandon 2012). Newfoundland identity and social behavior are transmitted largely through the telling of stories about kinship cooperation back home in Newfoundland.

## Discussion

Hewa, Chachi, and Newfoundlanders all exist in an environment populated with many individuals who are generally cooperative and altruistic. In all of these examples, this social environment has been at least partially constructed by traditions identifying individuals as kin and influencing cooperative and altruistic behavior toward individuals because they are identified as kin. These three examples also illustrate how social environments have been changing. This change has been taking place at vastly different rates in different places, but in general, as the influence of traditions diminish, the social environment becomes populated less by altruistic and cooperative kin and more by nonkin. On the continuum between the highly traditional social environments of our ancestors thousands of years ago and the nontraditional ones of today, the Hewa, and to a somewhat lesser extent the Chachi, fall close to the traditional end of the spectrum, while Newfoundlanders fall near the nontraditional end.

In this paper we raise three important points. First, the construction of the human social niche can be described without using the concept of “a group,” much less a model based on selection within and between groups. Second, models based on selection within and between groups are unable to account for the large categories of codescendants identified by traditions (e.g., clan names) and the cooperation and altruism exhibited toward codescendants. Third,

21. Palmer’s initial fieldwork from 1990 to 1992 was followed by eight subsequent periods of fieldwork between 1994 and 2011 in Newfoundland and four periods of fieldwork during the same time period in communities in Alberta where many Newfoundlanders had moved following the collapse of the cod fishery in the early 1990s (Palmer and Sinclair 1997; Palmer, Groom, and Brandon 2012). Most of this migration was related to employment opportunities associated with the oil industry. Although this migration may hasten the end of many traditions, it also revealed the extent to which the Newfoundland identity was based on descent, not current residence, and led to cooperation and altruism with those sharing that descent.

22. Palmer and Sinclair (2000:42) found wide variation in the percentages of male and female high school students who had participated in a wide range of traditional activities, ranging from 97.9% females and 93.4% males who had participated in picking berries to 1.4% females and 4.6% males who had participated in making sealskin boots.

23. Not only was the traditional male-only inheritance of land becoming actively debated (Palmer 1995), women were becoming more likely than men to expect to inherit part of their parent’s land (Palmer and Sinclair 2000:39).



the three examples of the human niche in this paper are far from unique in the ethnographic record.<sup>24</sup>

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24. A number of anthropologists claim that cross-culturally, moral codes originate with ancestors who “from time immemorial” were the “primitive custodians of the unwritten, uncodified, unclassified rules of conduct” (Rattray 1929:1). They were “neither more nor less than the rules of behaviour ordained by the ancestors and practiced by them” (Culwick and Culwick 1935: 203), and they “contain in themselves the authority of the ancestral ghosts” (Sumner 1907:232). Or, as the Lugbara of Africa state concisely, “the rules of social behaviour are the ‘words of our ancestors’” (Middleton 1960:27). Further, who is or is not subject to those traditional behavioral codes, as Edel and Edel (1959:16) explain, is typically determined by kinship: “Kin are those who count in its reckoning and take part in its proceedings.” Membership, Briffault (1931:57) writes, was based on kinship; for members there are rules of “kindness, love, help, and peace applicable to members of our own clan, tribe, or community, the other of robbery, hatred, enmity, and murder to all the rest of the world.” This “tie of blood to forefathers” led to the claim that membership was determined by kinship and descent, not geography (King 1972:37). Similarly, Confucius (Rainey 2010:36, 38) points out, marriage and filial piety are keys to understanding extended kin groups. This “ancestral law” or “proper way” (Keen 2004:244) emphasizes the “rules and conventions about how people in certain relations ought to behave towards one another.” It involves the transmission of an “ethic of generosity” (Hiatt 1982:23) alongside other traditional forms making an obligation of self-restraint: “The obligations of kinship govern a person’s behaviour from his earliest years to his death, and affect life in all its aspects; in conversation, visiting and camping; at the crises of life, namely, childbirth, initiation, marriage, sickness and death; and in quarrels and fights” (Elkin 1964:118). Among the Ndembu, the moral person is one “who bears no grudges, who is without jealousy, envy, pride, anger, covetousness, lust, greed, etc., and who honours his kinship obligations . . . [and] respects and remembers his ancestors” (Turner 1975:48–49). Turner (1975) also notes that this “ethical code” is universal and would be recognized as valid by all human groups. Fortes (1949) described the axiom of amity as behavior influenced by moral rules specifying generosity, trust, and altruism and which cluster around the sphere of kinship defined not only as relationships within the family but those created more broadly through lineage relationships. As Tylor (1898:250) notes, nothing displeased the ancestors more than “changing the old customs they were used to” and a “lack of respect for the aged.” Traditions are seen as wisdom coming from the past (Holkup et al. 2007). Rules honoring the elders, ancestors, and traditions, Diamond writes (1951), are found in all traditional societies. Ancestor worship may be a human universal (Steadman, Palmer, and Tilley 1996), and according to Tylor (1898), “the worship of the dead encourages good morals.”

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# The Devoted Actor

## Unconditional Commitment and Intractable Conflict across Cultures

by Scott Atran

Uncompromising wars, revolution, rights movements, and today's global terrorism are in part driven by "devoted actors" who adhere to sacred, transcendent values that generate actions dissociated from rationally expected risks and rewards. Studies in real-world conflicts show ways that devoted actors, who are unconditionally committed to sacred causes and whose personal identities are fused within a unique collective identity, willingly make costly sacrifices. This enables low-power groups to endure and often prevail against materially stronger foes. Explaining how devoted actors come to sacrifice for cause and comrades not only is a scientific goal but a practical imperative to address intergroup disputes that can spiral out of control in a rapidly interconnecting world of collapsing and conflicting cultural traditions. From the recent massive media-driven global political awakening, horizontal peer-to-peer transcultural niches, geographically disconnected, are emerging to replace vertical generation-to-generation territorial traditions. Devoted actors of the global jihadi archipelago militate within such a novel transcultural niche, which is socially tight, ideationally narrow, and globe spanning. Nevertheless, its evolutionary maintenance depends on costly commitments to transcendental values, rituals and sacrifices, and parochial altruism, which may have deep roots even in the earliest and most traditional human societies. Fieldwork results from the Kurdish battlefield with the Islamic State are highlighted.

### Introduction

#### *The Devoted Actor*

"The devoted actor" is a theoretical framework developed by a group of scholars and policy makers at Artis International (<http://artisresearch.com/>)—a nonprofit group that uses social science research to help resolve seemingly intractable political and cultural conflicts—to better understand the social and psychological mechanisms underlying people's willingness to make costly sacrifices for a group and a cause (Atran 2010; Atran, Axelrod, and Davis 2007; Atran, Sheikh, and Gómez 2014; Sheikh et al. 2014). Our research indicates that when people act as "devoted actors" they are deontic (i.e., duty-based) agents who mobilize for collective action to protect cherished values in ways that are dissociated from likely risks or rewards. Devoted actors represent a dimension of thought and behavior distinct from instrumental rationality in resisting material compromises over such values (Atran 2015; Atran and Axelrod 2008; Berns and Atran 2012; Dehghani et al. 2010; Ginges et al. 2011). The devoted actor hypothesis is defined as follows:

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People will become willing to protect morally important or sacred values through costly sacrifice and extreme actions, even being willing to kill and die, particularly when such values are embedded in or fused with group identity, becoming intrinsic to "Who I am" and "Who We are." (Atran and Ginges 2015)

Progress in the fields of moral psychology and philosophy has mostly focused on universal Golden Rule principles of fairness and reciprocity emotionally supported by empathy and consolation (Baumard, André, and Sperber 2013; Van Slyke 2014). This is in contrast to what Darwin referred to as the primary virtue of "morality . . . patriotism, fidelity, obedience, courage, and sympathy" with which winning groups are better endowed in history's spiraling competition for survival and dominance (Darwin 1871:163; cf. Greene 2009). Nevertheless, a smaller body of research (Baron and Spranca 1997; Fiske and Tetlock 2002; Tetlock 2003) suggests that people resist attempts to compromise sacred values no matter the cost to themselves or others. In the last decade or so, experimental work that goes beyond the morality of fairness and harm suggests that religious and transcendental beliefs consolidate "community" (Rozin et al. 1999), lead to "binding" (Graham et al. 2011), provide "unity motivation" (Ray and Fiske 2011), and mobilize parochial altruists, such as suicide bombers, to give their lives for the group (Ginges, Hansen, and Norenzayan 2009; cf. Atran 2003).

The devoted actor framework integrates two hitherto independent research programs in cognitive theory, sacred values

and “identity fusion,” while drawing on key insights from sociological (Durkheim 2012 [1912]; Weber 1963) and anthropological (Turner 1969; Rappaport 1971, 1999) analyses of religion and community. Sacred values are nonnegotiable preferences whose defense compels actions beyond evident reason, that is, regardless of calculable costs and consequences (Ginges et al. 2007). Identity fusion occurs when personal and group identities collapse into a unique identity to generate a collective sense of invincibility and special destiny (Swann et al. 2012). These two programs account for different aspects of intractable intergroup conflicts; however, here and in a companion article (Sheikh, Gómez, and Atran 2016), we argue that sacred values and identity fusion interact to produce willingness to make costly sacrifices for a primary reference groups even unto death, that is, sacrificing the totality of self-interests.

There is an evolutionary rationale to willingness to make costly sacrifices for the group, even fighting to the death and against all odds. Especially when a perceived outside threat to one’s primary reference group is very high and survival prospects are very low, then only if sufficiently many members of a group are endowed with such a willingness to extreme sacrifice can the group hope to parry stronger but less devoted enemies who are less committed to disregarding the costs of action. Sacred values mobilized for collective action by devoted actors enable outsize commitment in low-power groups to resist and often prevail against materially more powerful foes who depend on standard material incentives, such as armies and police that rely on pay and promotion (Atran and Ginges 2012). From an evolutionary perspective, collective actions, such as hunting and fighting, are vulnerable to defectors and thus difficult to initiate, but if some highly motivated individuals are willing to initiate activity, this may reduce the costs for others to join in, and such an “advancement in the standard of morality and an increase in the number of well-endowed men . . . always ready to give aid to each other and to sacrifice themselves for the common good, would be victorious over other tribes” (Darwin 1871:163).

Recent changes in the composition of the global jihadi<sup>1</sup> movement from fairly well-educated and well-off founders

1. The term “jihadi” is commonly used to refer to self-declared *mujahedin* (holy warriors) of the global movement for the worldwide defense, spread, and conquest of the world by Islam ruled in accordance with a strict, literalist version of Islamic law, ethics, and administration, or sharia, that requires absolute obedience and denies that interpretation is possible (Qutb 1964). Any nominal Muslim who denies this truth or works against it is subject to excommunication (*takfir*) and may be killed as an apostate (*murtad*). Thus, “jihadis” are also commonly referred to as “takfiris.” In the jihadi-takfiri canon, the contrast between “greater jihad” as an inner struggle to submit to God and the “lesser jihad” of physical holy war is spurious. Upon the Prophet Mohammed’s death, his companions (*al-salaf al-salahin*), especially the early Caliphs Omar and Othman, considered jihad only as offensive war to expand the frontiers of the House of Islam (*Dar al-Islam*) against infidels (*kuffar* and *taghut*; Naji 2004) and their House of War (*Dar al-Harb*). The idea of “greater jihad” as inner struggle appears to be a Sufi introduction from the Ab-

to increasingly marginalized youth in transitional stages of life continue to follow this evolutionary rationale (Atran and Sheikh 2015) but within a new kind of transcultural niche that leapfrogs the limits and responsibilities engendered by previous generations within territories of origin. Here, peer communities of imagined kin—bands of “brothers and sisters” drawn willy-nilly from across more than 100 countries and many more ethnic groups—commit in ritual oaths and performance of sublime acts of terror to a new world order (Atran 2014). The jihadi Caliphate,<sup>2</sup> whose “dreaming ecology” includes the global media landscape and whose cosmic law, or sharia, encompasses “the Everywhen”; it provides “an explanation of nature, establishes a social code, creates a basis for prestige and political status . . . acts as a religious philosophy and forms the psychological basis for life” (Cane 2002, quoted in Bird 2016). It is a transcultural framework whose implementation in action creates a new form of transcultural niche encompassing “human behavior, perception and embodiment, cultural institutions and history, social experience and symbolic life” (Fuentes 2016). Its evolutionary maintenance, while largely nongenerational and somewhat extraterritorial, nonetheless appears to rely on the sorts of costly commitments to transcendental ideals and values, rituals and sacrifices, and parochial altruism that also likely have deep roots even in the earliest and most traditional societies (Coe 2016).

#### *Aspects of Sacred Values*

Humans often make their greatest exertions and sacrifices, including killing or dying for ill or good, not just to preserve their own lives or kin and kith but for an idea—the abstract conception they form of themselves, of “who I am” and “who

basid period (Ansary 2009). Jihadis reject Sufism as sinful (*haram*) and subject to *takfir*.

2. Abu Bakr al-Baghdadi outlined the strategy of the Islamic State as a global jihadi archipelago in his “Volcanoes of Jihad” speech on November 13, 2014: “Glad tidings, O Muslims, for we give you good news by announcing the expansion of the Islamic State to new lands, to the lands of [Saudi Arabia] and Yemen, to Egypt, Libya and Algeria. We announce the acceptance of *bayah* [allegiance] . . . the announcement of new *wilayat* [provinces] for the Islamic State, and the appointment of [leaders] for them.” With the naming of governors outside of Syria-Iraq, Baghdadi was telling the world that the Caliphate was going global. These now stretch from Abu Sayyaf and Jemaah Islamiyah splinters in the Philippines and Indonesia to the Islamic Movement of Uzbekistan and al-Maqdis in the *wilaya* of Sinai, Egypt, to Jun al-Khalifa in Algeria and Boko Haram in Nigeria and Cameroon. In Libya, three *wilayat* were declared: Tripoli, Fazzan, and Barqay (which contains Darna, where whole neighborhoods of young men had earlier joined the jihads in Iraq). In this, the Islamic State is preempting al-Qaeda’s claim to be the vanguard of global jihad, inspiring associated jihadi insurgencies in geographically distant and separated regions to fight for the Caliphate under one supreme leader with an eye toward eventual unification of all territories and, ultimately, the world.

we are.” This is the “the privilege of absurdity; to which no living creature is subject, but man only” of which Hobbes (1901 [1651]:29) wrote in *Leviathan*. At least since the rise of chiefdoms and state-level societies, religion has been the locus of this privilege and power of absurdity (Norenzayan 2013; Atran, forthcoming). For Hobbes, as for countless other religious and nonreligious thinkers, from Augustine to Kierkegaard (1941 [1844]) and Galileo to A. J. Ayer (2001 [1936]), the “incomprehensible” nature of core religious beliefs, such as a sentient but bodiless deity, renders them immune to empirical or logical verification or falsification (Atran 2002).

Religious consensus over values does not primarily involve fact checking or reasoned argument but ensues from ritual communion and emotional bonding (Atran and Norenzayan 2004; Turner 1969) whose symbolic signposts channel and coordinate cognitions and emotions toward preparedness for action (Downey 2016). Costly commitment to idiosyncratic and apparently absurd beliefs and associated values, cued by sartorial and corporeal markers (e.g., veils, beards, and especially more indelible marks, such as the *zabiba* on the forehead of pious Muslims generated by repeated friction with the prayer mat), can deepen trust by identifying cooperators (Moya and Boyd 2016) while galvanizing group solidarity for common defense (Atran and Henrich 2010; Norenzayan and Shariff 2008). Although all religions have a “marked idiosyncrasy” and bias in their moral message (Geertz 1973:87), the more belligerent a group’s environment, the more proprietary and costly the commitment and display regarding the group’s sacred values, rituals, and identifying markers, which groove and deepen the cultural niche. This channels and increases in-group reliance but also disbelief, distrust, and potential conflict toward other groups (Sosis, Kress, and Boster 2007; Wilson, 2002). By contrast, fully reasoned social contracts that regulate individual interests to share costs and benefits of cooperation can be less distancing between groups but also more liable to collapse: awareness that more advantageous distributions of risks and rewards may be available in the future makes defection more likely (Atran and Axelrod 2008). Even ostensibly secular nations and transnational movements usually contain important quasi-religious rituals and beliefs (Anderson 1983).

Thus, while the term “sacred values” intuitively denotes religious belief, in what follows, sacred values refer to any preferences regarding objects, beliefs, or practices that people treat as both incompatible or nonfungible with profane issues or economic goods, as when land or law becomes holy or hallowed and as inseparable from people’s conception of “self” and of “who we are.” This includes the “secularized sacred,” as, for example, in political notions of “human rights” (Smith et al. 2013) or in the transcendent ideological “-isms” that have dominated political life ever since the Enlightenment’s secularization of the universal religious mission to redeem and save “humanity” through political revolution (liberalism, socialism, anarchism, communism, fascism, etc.; Gray 2007).

Our previous research indicates that when people act in defense of sacred values, they act in ways that cannot be reliably

predicted by assessing material risks and rewards. This feature holds even when taking into consideration modifications and constraints on instrumental rationality, such as cognitive limitations on gathering and processing information (Simon 1997), desire to avoid cognitive dissonance (Festinger 1962) or conform to group thinking (Asch 1987), lack of cultural awareness (Schelling 1960), intrinsic indivisibility of resources (Fearon 1995), or other psychological biases and ecological constraints (Kahneman 2011). Of course, concern with instrumental and deontic (i.e., rules and obligations) matters interact in the real world to motivate the actions of individuals and groups, and any explanatory or descriptively adequate account must be able to model and predict this interaction (for recent proposals on “devoted realism” in geopolitics, see Atran, Ginges, and Iliev 2014; Turchin 2014).

Nevertheless, acts by devoted actors are not chiefly motivated by instrumental concerns, or at least those of which people are usually aware. Instead, they are motivated by sacred values that drive actions independent from or all out of proportion to outlays and outcomes. Devotion to some core values may represent universal responses to long-term evolutionary strategies that go beyond short-term individual calculations of self-interest but that advance individual interests in the aggregate and long run (Atran and Medin 2008); in nonliterate societies these may be encoded as preferences of spirits and deities (Purzycki 2016). This may include devotion to children, to community, or even to a sense of fairness (Atran and Axelrod 2008; cf. Eliade 1959).

Other such values are clearly specific to particular societies and historical contingencies, such as the sacred status of cows in Hindu culture or of the Sabbath or Jerusalem in Judaism, Christianity, and Islam. Sometimes, as with India’s sacred cows (Harris 1966) or sacred forests (Upadhaya et al. 2003), what is seen as inherently sacred in the present may have a more materialistic origin, representing the accumulated material wisdom of generations who resisted individual urges to gain an immediate advantage of meat or firewood for the long-term benefits of renewable sources of energy and sustenance. Yet despite the long-standing material advantages associated with these values, unconditional devotion to sacred values in a rapidly changing world can also be materially disadvantageous: for example, when a hitherto closed commons suddenly becomes an open commons, then continued cultural commitment to values for protection of the commons may be highly maladaptive by facilitating extinction of native conservationists in areas now open to exploitation by foreign extractors (Atran et al. 2002; Atran, Medin, and Ross 2004).

Of course, the evolutionary rationale in devotion to children can be understood in terms of genetic kin selection: individuals are ephemeral, but promoting welfare of children and other kin ensure propagation of many of the individual’s genes. Moreover, imagined kinship applied to larger sociopolitical groups (brotherhoods, motherlands, etc.) exploits the cognitive and emotional concomitants of this evolutionary rationale in myriad ways that may be adaptive or not (much

like the food and sex industries exploit our evolutionary proclivities in favor of nourishment and reproduction; Atran 2010). From a historical vantage, evolutionary-based tendencies of kin selection and parochial altruism are often co-opted in state-level societies and transstate movements with dominant religions—and (ever since the French Revolution) also with salvational transcendental secular ideologies—in the creation of devoted actors.

Our empirical studies in multiple cultures and distressed zones across the world indicate that sincere attachment to sacred values entails (1) commitment to a rule-bound logic of moral appropriateness to do what is morally right no matter the likely risks or rewards rather than following a utilitarian calculus of costs and consequences (Atran 2003; Bennis, Medin, and Bartles 2010; Ginges and Atran 2011); (2) immunity to material trade-offs coupled with a “backfire effect” where offers of incentives or disincentives to give up sacred values heighten refusal to compromise or negotiate (Dehghani et al. 2010; Ginges et al. 2007); (3) resistance to social influence and exit strategies (Atran and Henrich 2010; Sheikh, Ginges, and Atran 2013), which leads to unyielding social solidarity and binds genetic strangers to voluntarily sacrifice for one another; (4) insensitivity to spatial and temporal discounting, where considerations of distant places and people and even far past and future events associated with sacred values significantly outweigh concerns with here and now (Atran 2010; Sheikh et al. 2013); and (5) brain-imaging patterns consistent with processing obligatory rules rather than weighing costs and benefits and with processing perceived violations of such rules as emotionally agitating and resistant to social influence (Berns et al. 2012; Pincus et al. 2014).

#### *Devoted Actors Are Deontic Actors*

Philosophers of moral virtue suggest that moral values may be deontological (Kant 2005 [1785]) or utilitarian (Mill 1871). Deontic processing is defined by an emphasis on rights and wrongs (Weber 1958 [1864]), whereas utilitarian processing is characterized by costs and benefits (von Neumann and Morgenstern 1944). Models of rational behavior predict many of society’s patterns, such as favored strategies for maximizing profit or likelihood for criminal behavior in terms of opportunity costs (Becker 1962) and important aspects of conflict management (Allison and Zelikow 1999). But the prospects of crippling economic burdens and huge numbers of deaths do not necessarily sway people from positions on whether going to war or opting for revolution is the right or wrong choice.

For example, in one series of studies, we confronted people in the United States and Nigeria with hypothetical hostage situations and asked them whether they would approve of a solution—which was either diplomatic or violent—for freeing the prisoners (Ginges and Atran 2011). When told that their action would result in all hostages being saved, both groups endorsed the plan presented to them. When asked how many hostages they required to be saved to ensure their support

(from 1 to 100), those evaluating the military option said only one hostage needed to be rescued, showing a remarkable insensitivity to scope. In contrast, those evaluating the diplomatic option required a majority of hostages to be rescued.

Most theories and models related to violent intergroup conflict assume that civilians and leaders make a rational calculation (Fearon 1995; von Clausewitz, 1956 [1832]). If the total cost of the war is less than the cost of the alternatives, they will support war. But in another set of studies (Ginges and Atran 2011), we found that when people are confronted with violent situations, they consistently ignore quantifiable costs and benefits, relying instead on sacred values. We asked a representative sample of 650 Israeli settlers in the West Bank about the dismantlement of their settlements as part of a peace agreement with Palestinians. Some subjects were asked about their willingness to engage in nonviolent protests, whereas others were asked about violence. Besides willingness to violently resist eviction, subjects rated how effective they thought the action would be and how morally right the decision was. When it came to nonviolent options such as picketing and blocking streets, rational behavior models predicted settlers’ decisions. In deciding whether to engage in violence, the settlers reacted differently. Rather than how effective they thought violence would be in saving their homes, the settlers’ willingness to engage in violent protest depended only on how morally correct they considered that option to be.

Our research with political leaders and general populations shows that sacred values—not political games or economics—underscore seemingly intractable conflicts such as those between the Israelis and the Palestinians or between Iran and the Western allies that defy the rational give-and-take of businesslike negotiation (Atran et al. 2007; Dehghani et al. 2010; Ginges et al. 2007, 2011). Consider the Israeli-Palestinian conflict, where rational cost-benefit analysis says the Palestinians ought to agree to forgo sovereignty over Jerusalem or the claim of refugees to return to homes in Israel in exchange for an autonomous state encompassing their other pre-1967 lands because they would gain more sovereignty and more land than they would renounce. They should support such an agreement even more if the United States and Europe sweetened the deal by giving every Palestinian family substantial, long-term economic assistance. Instead, research with psychologists Jeremy Ginges and Douglas Medin and political scientist Khalil Shikaki reveals that the financial sweetener makes Palestinians more opposed to the deal and more likely to support violence to oppose it, including suicide bombings. Israeli settlers also have rejected a two-state solution that requires Israel to give up Judea and Samaria or “recognize the legitimacy of the right of Palestinian refugees to return” (in an agreement not actually requiring Israel to absorb the refugees). But Israelis, too, were even more opposed if the deal included additional long-term financial aid or a guarantee of living in peace and prosperity (Ginges et al. 2007).

To be sure, these studies involve mostly “emic” elicitations of willingness to act (Weissner 2016) expressed by people

from “the inside” (Bloch 2016). Nevertheless, “etic” or “out-side” observations and measures of actual behavior that are not based on information elicited from informants tend to confirm the relevance of inside observations and measures of mental models (Atran et al. 2002) to the prediction and interpretation of outside findings. For example, another series of studies—with psychologists Morteza Dehghani, Rumén Iliev, and Sonya Sachdeva—indicates that a relatively small but politically significant portion of the Iranian population believes that acquiring nuclear energy (but not necessarily nuclear weapons) has become a sacred value in the sense that proposed economic incentives and disincentives backfire by leading to increased and more emotionally entrenched support (Dehghani et al. 2010). Here, it appears that sacred values can emerge for issues with relatively little historical background and significance when they become bound up with conflicts over collective identity—the sense of “who we are.” For a minority of Iranians (11%–13% in these experiments), the issue had become a sacred subject through association with religious rhetoric and ritual (e.g., Iranian women marching and chanting in favor of “nuclear rights” while waving the Quran). This group, which tends to be religious, rural, and close to the previous presidential regime (Ahmadinejad), believes a nuclear program is bound up with national identity and Islam itself, so that offering material rewards or punishments to abandon the program only increases anger and support for it. Until the current round of nuclear negotiations with Iran (spring–summer 2015), the ratcheting up of sanctions had been accompanied by increases in construction of nuclear facilities, the level of nuclear enrichment, uranium output, and the total stockpile of low-enriched uranium, and this, in spite of the pressure on the country exerted by economic sanctions, with plans for 10 “new” enrichment sites touted shortly after the last round of sanctions.

Sacred values do not make people opposed to any sort of compromise. Instead, they appear to invoke specific taboos protecting these values against material trade-offs. Offering people materially irrelevant symbolic gestures can work where material incentives do not. For example, Palestinian devoted actors were more willing to consider recognizing the right of Israel to exist if the Israelis offered an official apology for Palestinian suffering in the 1948 war. Similarly, Israeli settlers were less disapproving of compromising sacred land for peace if Hamas and the other major Palestinian groups symbolically recognized Israel (Atran and Ginges 2009; Ginges et al. 2007).

Our survey results were mirrored by interviews with political leaders conducted with political scientists Robert Axelrod and Richard Davis (2007). For example, Mousa Abu Marzook, the deputy chairman of Hamas, said no when we proposed a trade-off for peace without granting a right of return. He became angry when we added in the idea of substantial American aid for rebuilding: “No, we do not sell ourselves for any amount.” But when we mentioned a potential Israeli apology for 1948, he said: “Yes, an apology is impor-

tant, as a beginning. It’s not enough because our houses and land were taken away from us and something has to be done about that.” His response suggested that progress on sacred values might open the way for negotiations on material issues rather than the reverse. We obtained a similar reaction from Israeli leader Benjamin Netanyahu. We asked him whether he would seriously consider accepting a two-state solution following the 1967 borders if all major Palestinian factions, including Hamas, were to recognize the right of the Jewish people to an independent state in the region. He answered, “OK, but the Palestinians would have to show that they sincerely mean it, change their anti-Semitic textbooks.” Making these sorts of wholly intangible symbolic but possibly sincere gestures, like recognition of a right to exist or a sincere apology,<sup>3</sup> simply does not compute in any utilitarian calculus. And yet the science suggests that these gestures may be the best way to cut through the world’s symbolic knot.

More systematic understanding of what kinds of symbolic gestures involving sacred values are likely to be effective in conflict prevention and resolution, including signatures of emotional sincerity, could provide novel possibilities for breakthroughs to avoid or lessen conflict. In a meeting of senior Iranians, Saudis, Israelis, Americans, and British arranged by members of our team and Lord John Alderdice (Convenor, UK House of Lords) at the University of Oxford on the nuclear issue in early September 2013, we informally monitored expressions of devotion to values, including emotional attachment, and suggested opening negotiations via a symbolic gesture evoking sacred values rather than political positions. In response we received a message that Iran’s President Rouhani would publicly acknowledge the Holocaust in New York (which US and Israeli officials told us would be a positive development for negotiations).

Sociopolitical groups often have “sacred rules” for which their people would fight and risk serious loss/death rather than compromise. In another study with a representative sample of more than 700 adults (no gender differences) in the West Bank and Gaza, we asked,

What if a person wanted to carry out a bombing (which some . . . call suicide attacks) against the enemies of Palestine, but his father becomes ill, and his family begs the chosen martyr to take care of his father; would it be acceptable to delay the attack indefinitely?

3. Apologies perceived as hedged and insincere risk backfiring, as when Japan’s government apologized to China for war crimes committed in World War II yet continues to honor war criminals at Yasukuni Shrine, or when Japan offered compensation and apology for its abuse of Korean “comfort women” but still denies the “Japanese people” were at fault. By contrast, consider British prime minister David Cameron’s apology for killings on “Bloody Sunday” in Northern Ireland, which led the Republic of Ireland to invite the Queen of England for a first official visit: “There is no doubt, there is nothing equivocal, there are no ambiguities. What happened on Bloody Sunday was both unjustified and unjustifiable. It was wrong” (BBC News 2010).



What if a person wanted to carry out a bombing (which some . . . call suicide attacks) against the enemies of Palestine, but his family begs him to delay martyrdom indefinitely because there was a significantly high chance the chosen martyr's family would be killed in retaliation; would it be acceptable to delay the attack indefinitely?

Palestinians tended to reason about political violence in a noninstrumental manner by showing more disapproval over a delay of a martyrdom attack to rescue an entire family than over a delay of a martyrdom attack to take care of an ill father. These findings indicate that when people are reasoning between duty to war or to family, they are not making instrumental decisions but decisions based on perceptions of moral obligations that can change as a result of instrumentally irrelevant alterations in context (Ginges and Atran 2009).

If people perceive that a sacred rule was violated, they may feel morally obliged to retaliate against the wrongdoers even if the retaliation does more harm than good. But such moral commitment to sacred values ultimately can be the key to the success or failure of insurgent or revolutionary movements with far fewer material means than the armies or police arrayed against them. Ever since the nineteenth-century anarchists, science education in engineering and medical studies has been a frequent criterion of leadership for these movements because such studies demonstrate hands-on capability and potential for personal and costly sacrifice through long-term commitment to a course of study that requires delayed gratification. Al-Qaeda, like other revolutionary groups, was initially formed and led by fairly well-off and well-educated individuals, the majority of whom studied engineering and medicine (Bergen and Lind 2007; Gambetta and Hertog 2007).

#### *The Importance of Identity Fusion and Group Dynamics*

Our fieldwork with captured and would-be suicide terrorists and political and militant leaders and supporters in violent conflict situations suggests that some behaviors that punctuate the history of human intergroup conflict do indeed go beyond instrumental concerns. Historical examples include the self-sacrifice of Spartans at Thermopylae, the Jewish Zealots in revolt against Rome, defenders of the Alamo, the Waffen SS "volunteer death squads" during the Soviet siege of Budapest, some cohorts of Japanese Kamikaze, and the jihadi pilot bombers of 9/11 (Atran 2010; Ginges et al. 2011). Such events exemplify that humans fight and kill in the name of abstract, often ineffable values such as God, national destiny, or salvation (Atran and Ginges 2012). Ever since World War II, on average, revolutionary movements have emerged victorious with as little as 10 times less firepower and manpower than the state forces arrayed against them (Arreguín-Toft 2001).

Although sacred values may operate as necessary moral imperatives to action, they are not sufficient. Group morality does not operate simply from ideological canon or decontext-

ualized principles that drive decisions and actions, but it is almost always embedded and distributed in social groups, most effectively in intimate networks of "imagined kin" (Atran 2010, 2011). Knowledge of the moral imperatives that drive people to great exertions toward one political goal or another as well as the group dynamics that bind individuals to sacrifice for one another in the name of those values both appear indispensable to extreme actions where prospects of defeat and death are very high, as with terrorism and revolution.

Thus, our working hypothesis is that extreme parochially altruistic action occurs and devoted acts are created when self-identity becomes fused with a unique collective identity and when identity itself is fused with sacred values that provide all group members a similar sense of significance (Kruglanski et al. 2013). Important values may influence extreme behavior particularly to the extent that they become embedded or fused with identity and internalized. When internalized, important moral values lessen societal costs of policing morality through self-monitoring and blind members to exit strategies (Atran and Henrich 2010).

There is more to group dynamics than just collections of people, their behavior, and ideas. There is also the web of relationships that make the group more than the sum of its individual members (Dunbar, Knight, and Powers 1999; White and Johansen 2006). It is this networking among members that distributes thoughts and tasks that no one part may completely control or even understand (Atran et al. 2002; Sperber 1985). Case studies of suicide terrorism and related forms of violent extremism suggest that "people almost never kill and die [just] for the Cause, but for each other: for their group, whose cause makes their imagined family of genetic strangers—their brotherhood, fatherland, motherland, homeland" (Atran 2010: 33).

In this vein, the theory of "identity fusion" (Swann et al. 2012) holds that when people's collective identities become fused with their personal self-concept, they subsequently display increased willingness to engage in extreme progroup behavior when the group is threatened. As such, fusion can help us better understand part of the complexity of group dynamics that leads to action when privileged values are threatened (for examples of fusion measures, see Sheikh, Gómez, and Atran 2016). Fusion theory differs from various social identity theories in emphasizing group cohesion through social networking and emotional bonding of people and values rather than through processes of categorization and association, thus empowering individuals and their groups with sentiments of exceptional destiny and invulnerability. In recent cross-cultural experiments, Swann et al. (2014) find that when fused people perceive that group members share core physical attributes and values, they are more likely to project familial ties common in smaller groups onto the extended group. This enhances willingness to fight and die for a larger group that is strongly identified with those values, such as a religious "brotherhood."

We have preliminary evidence collected in Lebanon (Sheikh et al. 2014) regarding the way priorities among sacred values translate the relationship between fusion with a group and parochial forms of self-sacrifice for that group. We surveyed a convenience sample of Sunni, Shia, and Christian Maronites, measuring fusion with their religious group, their attitudes toward sacrifices for the group (e.g., risking safety of the family to fight for the group or risking one's job to fight for the group), and scores on a version of the moral foundations questionnaire that we adapted for use in previous research in Lebanon and Morocco and informed by moral foundations theory (Graham et al. 2011). We found that the effect of fusion with religious group on willingness to engage in parochial sacrifice for that group was moderated by different moral concerns: fused participants who valued parochial values (e.g., purity, respect for authority and tradition) more so than universal values (e.g., concern for welfare of others, fairness) showed greater willingness to make parochial sacrifices, but fused participants who valued universal values over parochial values showed less willingness to make parochial sacrifices. We anticipate that in times of threat, morals of loyalty to the group and deference to authority gain over other basic morals such as care and fairness.

Considerations of commitment to comrades and cause bear directly on some of the world's most pressing concerns. Indeed, in recent remarks, President Obama (Payne 2014) endorsed the judgment of his US National Intelligence director: "We underestimated the Viet Cong . . . we underestimated ISIL [the Islamic State] and overestimated the fighting capability of the Iraqi army. . . . It boils down to predicting the will to fight, which is an imponderable" (Ignatius 2014). Yet if the methods and results suggested by our research ultimately prove reliable, then predicting who is willing to fight and who is not and why could be ponderable indeed and important to the evaluation and execution of political strategy.

In this regard, Whitehouse et al. (2014) provide evidence that fusion with a family-like group of comrades in arms, which can be felt as even stronger than genetic family ties, may have underpinned the willingness of recent revolutionary combatants in Libya to fight on even in the face of death and defeat. But apart from this single study of fighters in the field, fusion studies have concerned mostly student populations in hypothetical scenarios rather than populations in actual conflict zones and have neglected the role of sacred values in generating devoted actions. Accordingly, in our companion article (Sheikh, Gómez, and Atran 2016), we present empirical studies with Moroccans and Spaniards to assess the relationship between sacred values, identity fusion, and costly sacrifices, including willingness to fight and die. In these companion studies, people expressed "parochial altruism" the most when they were fused with a kin-like group of like-minded friends and felt that a cherished value they considered sacred was under threat (see Graham and Haidt 2013). Specifically, we interviewed and tested Moroccans in two neighborhoods where we had earlier carried out anthropological fieldwork (Atran

2010) and that had previously been associated with terrorist actions and were currently associated with high volunteer rates for the Islamic State.

Subjects expressed willingness to make costly sacrifices for the implementation of strict sharia when they were fused with a kin-like group of friends and considered sharia law as sacred. They were also most supportive of militant jihad. Complementing this experimental study in the field, an online study showed that Spaniards who were fused with a kin-like group of friends and considered democracy as sacred were most willing to make costly sacrifices for democracy after being reminded of acts of jihadi terrorism (although overall level of willingness to sacrifice among Spaniards was significantly lower than among Moroccans supportive of militant jihad). They were also more likely to consider their own group more formidable and jihadis as weak, which may facilitate costly actions against the "enemy." These results corroborate previous findings among Americans and Palestinians that devoted actors are most likely to commit themselves to extreme actions of parochial altruism if they perceive themselves to be under existential threat from outside groups (Sheikh et al. 2012).

In the sweep of cultural evolution, movements that develop psychological mechanisms to promote devoted actors are more likely to succeed because they exploit evolved psychology (e.g., kin selection) in evolutionarily novel ways. The interaction of identity fusion and sacred values seems to be one such case, where the psychology of kin selection combines with bonding rituals (e.g., sacred oaths, *bayat*, to the brotherhood, *ikhwaniyah*, of jihad and its leaders) to inextricably cement individuals to the group via a shared spiritual and moral mission.<sup>4</sup>

## The Global Jihadi Archipelago

### *A New Type of Transcultural Niche*

Jihadis span the population's normal distribution: there are a few psychopaths and sociopaths and some brilliant thinkers and strategists (Atran 2006; Sageman 2004). Unlike the founding members of al-Qaeda, today's jihadi wannabes are mostly self-seeking young adults in transitional stages in their lives—immigrants, students, people between jobs or mates

4. Although individuals and collectivities sincerely deny the material benefits of sacred values, because (from a psychological and evolutionary perspective) recognizing these benefits would render them susceptible to trade-offs and buyouts, in fact individuals and collectivities often gain materially in important ways from promoting sacred values, such as particular interpretations of Islam, or Kurdeity, or liberal democracy. Thus, young men in a society whose political legitimacy is traced through strict patrilineal descent might benefit by strengthening the honor code to control of women's sexuality; Kurds having suffered under rule by other ethnic groups and who have benefited from greater autonomy in Kurdish Iraq may enjoy material benefits by protecting Kurdish autonomy; people in liberal democracies, particularly young women, may see many direct threats to personal and material well-being from jihadi terrorism and threatened imposition of sharia law; and so forth.

or having left their native homes and looking for new families of friends and fellow travelers (Atran et al. 2014). For the most part they have no traditional religious education and are “born again” in their late teens or 20s into a radical religious vocation through the appeal of a meaningful cause, camaraderie, adventure, and glory to which young people are especially prone (Atran 2010; Sageman 2008). The path to radicalization can take years, months, or just days, depending on personal vulnerabilities and the influence of others. About three of every four people who join the jihad do so with friends, about one in five through their families, and the relatively small remainder join by themselves or through some form of direct discipleship or recruitment (Atran 2011; Bond 2014; Kathe 2014). Occasionally there is a connection with a relative or an acquaintance who has some overseas association with someone who can get them a bit of training and motivation to pack a bag of explosives or pull a trigger, but the Internet and social media can be sufficient for radicalization and even operational preparation.

Soccer, paintball, camping, hiking, rafting, body building, martial arts training, and other forms of physically stimulating and intimate group action create a small cultural niche: a bunch of buddies who become a “band of brothers” in a glorious cause (Atran 2010). It usually suffices that one or a few of these action buddies come to believe in the cause, truly and uncompromisingly, and for the rest to follow even unto death. This is in contrast to exaggerated notions of “command and control” organizations sending recruiters to “brainwash” unwitting minds into joining well-structured organizations. Standard counterterrorism notions of “cells” and “recruitment”—and to some degree even “leadership”—often reflect more the psychology and organization of people analyzing terrorist groups than terrorist groups themselves. Of course, some inspirational leaders such as the late Osama Bin Laden or more recently Abu Bakr al-Baghdadi, “Prince of Believers” (*Amir al-Muminin*) and self-declared Caliph of the Islamic State, demand formal oaths (*bayat*) of loyalty and agreement with their strategic vision and have ultimate control over operational decisions; however, enlistment into the group is often elective, especially for foreign volunteers, and tactical decision making is generally decentralized.

For the first time in history, a massive, media-driven political awakening has been occurring, spurred by the advent of the Internet, social media, and cable television: on the one hand, this may motivate universal respect for human rights; on the other hand, it may enable, say, Muslims from Sulawesi to sacrifice themselves for Palestine, Afghanistan, Chechnya, Iraq, or Syria. When perceived global injustice resonates with frustrated personal aspirations, moral outrage gives universal meaning and provides the push to radicalization and violent action. But the popular notion of a “clash of civilizations” between Islam and the West (Huntington 1996) is woefully misleading. Violent extremism represents not the resurgence of traditional cultures but their collapse as young people unmoored from millennial traditions flail about in search of a

social identity that gives personal significance and glory. This is the dark side of globalization.

Especially for young men, mortal combat with a “band of brothers” in the service of a great cause is both the ultimate adventure and a road to esteem in the hearts of their peers. For many disaffected souls today, jihad is a heroic cause—a promise that anyone from anywhere can make a mark against history’s most powerful country and its perceived allies. But because would-be jihadists best thrive and act in small groups and among family, friends, and fellow travelers—not in large movements or armies—their threat can only match their ambitions if fueled beyond actual strength. Publicity hyped by political and media frenzy is the oxygen that fires modern terrorism (Atran 2013), filling a transcultural niche whose ecology ranges over a media landscape (where competition for resources is a struggle for control of information) and a geographical archipelago that spans the globe.

#### *Going Forward*

Thus far, discussion of our studies has focused mainly on expressed willingness to make costly sacrifices for fused groups and sacred causes. Although the enduring and seemingly intractable nature of the conflicts from which we have drawn our subject populations suggest a strong relationship between expressed and actual willingness to make costly sacrifices, here we have no direct measures to confirm the relationship (although we do have outcome measures that involve lesser material sacrifices). In what follows, however, the subjects are militants and frontline combatants whose expressed willingness to make costly sacrifices, including fighting and dying, is directly confirmed through participant observation of their actions.

In this regard, in March 2015, we completed the first round of study in Kirkuk, Iraq, with captured fighters from the Islamic State and with Kurds in the frontline areas between Mosul and Erbil. Together with Artis colleagues Lydia Wilson, Hoshang Waziri, and Hammad Shiekh, we found that the Kurds demonstrate a will to fight that matches the Islamic State’s. When we asked the Islamic State prisoners, “What is Islam?” they answered, “My life.” Yet it was clear that they knew little about the Quran, or Islamic history, other than what they had heard from al-Qaeda and Islamic State propaganda. For them, the cause of religion is fused with the vision of a caliphate—a joining of political and religious rule—that kills or subjugates any nonbeliever. By contrast, the Kurds’ commitment to Islam is surpassed by their commitment to national identity; theirs is a more open-minded version of Islam. They have defended Yazidis and Christians as well as Arab Sunnis, who make up the bulk of the more than 1 million displaced persons in Iraqi Kurdistan. But perhaps what most reveals commitment by the Kurds is how they hold the line with so little material assistance (Atran and Stone 2015).

We interviewed and tested (on fusion, sacred values, costly sacrifices) 28 Kurdish combatants and 10 noncombatants

(e.g., suppliers, medics, etc.) in battle areas 1 to 3 km from forces of the Islamic State (Atran and Stone 2015), including respondents randomly chosen among special forces (Zerevani) from the front at Mosul Dam, Peshmerga fighters from the Kurdistan regional government at (the now depopulated village of) Rwala on the Mahmour front, and Kurdish soldiers from a joint Kurd-Arab Sunni unit of the Iraqi Army at the Qeremerdi forward outpost. Using our standard experimental procedures (Sheikh, Gómez, and Atran 2016), we found that 36 respondents are fused with “Kurds,” 35 with “family,” 23 with “close, family-like group” of comrades, and 14 with “Islam.” But in rankings of relative importance of identity fusion, 21 respondents reported that fusion with “Kurds” trump all other forms of identity fusion, three privileged Islam, only one respondent considered fusion with “family” as foremost, and no respondent held that “close, family-like group” is primary. There were also more than twice as many expressions of devotion to “Kurdistan” ( $N = 23$ ) as sacred values than to democratic values of “electoral democracy” and “free speech” ( $N = 10$ ) as sacred values for which respondents are willing to fight and die.<sup>5</sup> Finally, all but one person who held “Kurdistan” as an sacred value was fully fused with “Kurds,” indicating that defense of “Kurdeity” (as the Kurds themselves term their commitment to fellow Kurds as well as to defense of “our Kurdistan homeland”) is the most important obligation in life, deserving of costly sacrifice unto death, if necessary (i.e., 22 respondents, several of whom had been previously wounded, would be willing to die and sacrifice their families in defense of Kurdeity versus three who would be willing to sacrifice Kurdeity and family for Islam and one who was willing to sacrifice Kurdeity and Islam for family).

Indeed, we frequently have encountered devoted actors who clearly demonstrate emotional ties to family and concerns for self yet show their willingness to sacrifice these important interests. For example, one Kurdish fighter told us that during an Islamic State offensive that took his village, he had a (tragic) choice: to go into the village before Islamic State forces

5. Reviewers noted that in rallies for war and trance performances in small-scale societies, identity fusion may not only be a result of kin selection but also a capacity developed in bonding rituals to communicate with the spirit world or ancestors. Bonding rituals may be somewhat more “imagistic” than “doctrinal” in larger, complex societies (Whitehouse 2004), but their role in identity fusion appears to be somewhat similar. The role of sacred values in small-scale societies in promoting costly sacrifices also appears to be somewhat different. In small-scale societies, warriors often make extreme sacrifices in heat of battle; however, utilitarian constraints on ability to continue fighting are often more immediate than with large-scale societies that can acquire supplies, weapons, technical support, and so forth to make war endure. For people in more complex modern societies, being supplied from outside may allow for more deontic processing involving sacred values, although even long-term conservation practices in small-scale societies often seem to depend on a moral commitment to spiritual values that involves sacrifice of apparent self-interest and disregard of immediate needs, desires, and preferences (Atran and Medin 2008; Atran, forthcoming).

had established control and take his family out or to help stabilize the front to prevent the Islamic State from advancing. The choice, he said, haunts his every waking hour. In this short exchange he demonstrated the pain of trading off his familial obligations for the sake of fighting for Kurdeity (and we have found similar sentiments expressed, and acted on, in our interviews with fighters from the Islamic State and al-Qaeda’s Jabhat an-Nusra, but not in interviews with the Iraqi army).

These preliminary findings with frontline participants in the struggle for survival against the Islamic State suggests that, at least in this case (and quite possibly others), larger groups that are sacralized (in terms of territory, cultural history, language, etc.) can be the primary locus of identity fusion and of the interaction between identity fusion and sacred values in producing costly sacrifices, including fighting and dying. If this is so, then the primary relationship between identity fusion and willingness to fight need not be always at the level of a close, family-like group. In other words, the strongest and most powerful forms of sacrifice for group and cause need not always require a process of “upscaling” from a localized family-like cohort of comrades to an extended ideological community but may inhere in a larger, sacralized community to begin with, especially in “tight societies” that have strong social norms and strict channels of socialization (Gelfand et al. 2011). Such larger and tight societies include the geographically bounded but stateless cultural sphere of Kurdistan as well as the global jihadi archipelago where information from across the world and cyberspace narrows mightily to fit the dreaming ecology of the Caliphate—a transcultural niche, which the actors of Kurdistan are fighting unto death to defeat and the devoted actors of the Islamic State are fighting unto death to make real.<sup>6</sup>

## Epilogue

For the future of democracy and human rights, the core existential issue may be, Why do values of liberal and open democracy increasingly appear to be losing ground to those of narrow ethnonationalisms and radical Islam in a tacit alliance that is tearing apart the European middle class (the mainstay of European democracy) in ways similar to the undermining of republican values by fascists and communists in the 1920s and 1930s? Consider the following.

“Mr. Hitler,” wrote George Orwell (1968 [1940]) in his review of *Mein Kampf*, “has grasped the falsity of the hedonistic attitude to life. Nearly all western thought . . . certainly

6. Because our informants were mostly frontline combatants who fight and risk their lives almost daily (or rather, nightly, as most attacks by Islamic State fighters on the forward outposts where we worked occur at night), we added willingness to torture and carry out suicide attacks to increase the variance in responses relating to costly sacrifices. All but two Kurdish fighters excluded torture and suicide attack as morally permissible, even in mortal defense of Kurdistan.

all ‘progressive’ thought, has assumed tacitly that human beings desire nothing beyond ease, security and avoidance of pain.” In such a view of life there is no room for greatness and glory, which as Darwin noted motivates heroes and martyrs to motivate others to survive and even triumph against great material odds. “Hitler knows . . . that human beings don’t only want comfort, safety, short working-hours, hygiene, birth-control and, in general, common sense; they also, at least intermittently, want struggle and self-sacrifice” (Orwell 1968 [1940]).

Soldier for soldier, in World War II the Germany army outfought all others by any measure. German armies were destroyed only by the massive production and firepower superiority of the United States and by the massive manpower sacrifice of more than 20 million Russians. Perhaps it will come to that in the struggle against the Islamic State, but for now the means arrayed against this dynamic revolutionary movement seem feeble. A political entity preaching and practicing wildly different ideas from other nations and mass movements and that held no appreciable territory only two years ago now boasts the largest extraterritorial volunteer fighting force since World War II, with enlistees from some 100 nations. The Islamic State controls hundreds of thousands of square kilometers and millions of people and has successfully defended a 3,000-km military front against a multinational coalition of armies in ways reminiscent of the French Revolution.<sup>7</sup>

To dismiss the Islamic State as just another form of “terrorism” or “violent extremism,” to insist that its brutality is simply “immoral,” “nihilistic,” or “apocalyptic” and therefore inevitably self-destructive, or to refuse to call it by the name it calls itself in the vain hope that doing so will somehow undermine it, is counterproductive and deluding. From an evolutionary and historical vantage, no developments are really deviant or extreme unless they quickly die, for those developments that continue to survive are the very stuff of historical change and evolution. From this perspective—and in the light of interviewing and running psychological experiments with Islamic State and al-Qaeda (Nusra) fighters on the ground and with volunteers from Europe and North Africa as well as those who oppose and fight them—the rise of the Islamic State is arguably the most influential and politically novel countercultural force in the world today.

So a big question seems to be, short of a massive military onslaught against the Islamic State, whose downstream consequences are likely to be as uncontrollable as they may be undesirable, what can be done? Of all those opposed to the Islamic State, only the devoted actors of Kurdeity succeed on their own turf in resisting the devoted actors of the Islamic state. But because this is a fight for the future and for young

people who will be that future, what can be done to mobilize yearning youth to a countervailing cause? What dreams may come from current government policies that offer little beyond promises of comfort and security (Atran 2015)? People who are willing to sacrifice everything, including their lives—the totality of their self-interests—will not be lured away just by material incentives or disincentives.<sup>8</sup> The science suggests that sacred values are best opposed with other sacred values that inspire devotion, or by sundering the fused social networks that embed those values.

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8. In the history of modern insurgencies, there are also important parallels between the collapse and reaction to the Arab Spring and the pan-European popular uprisings of 1848 and their aftermath, the rise of al-Qaeda in the late twentieth century and that of anarchism in the late nineteenth century, and the present weakening of al-Qaeda relative to the Islamic State and the co-opting and near annihilation of the anarchists by the Bolsheviks who knew better how to manage their political ambition through military and territorial management and, perhaps most critically, a positive, proactive, coherent, and compelling moral and spiritual vision (a sentiment even expressed by some from al-Qaeda’s Jabhat an-Nusra fighting the Islamic State in Syria who Nafees Hamid, Richard Davis, and I interviewed in August 2015, although most still believe that Nusra’s version of a *salaf jihad* (offensive jihad) “tolerant” of others will win the day).

7. For example, an as-yet-unpublished World Bank Report made available to this author shows that there is no reliable relationship between job production and lessening of violence.

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# Empirical Evidence for the Devoted Actor Model

by Hammad Sheikh, Ángel Gómez, and Scott Atran

CA+ Online-Only Material: Supplement A

This report presents two studies in very different contexts that provide convergent empirical evidence for the “devoted actor” hypothesis: people will become willing to protect nonnegotiable sacred values through costly sacrifice and extreme actions when such values are associated with groups whose individual members fuse into a unique collective identity. We interviewed and tested (on sacred values, identity fusion, and costly sacrifice) 260 Moroccans from two cities and neighborhoods previously associated with militant jihad, and we conducted a follow-up online experiment with 644 Spaniards fairly representative of the country at large (adding an intergroup formidability outcome measure). Moroccans expressed willingness to make costly sacrifices for implementation of strict sharia and were most supportive of militant jihad when they were fused with a kin-like group of friends and considered sharia law as sacred. Similarly, Spaniards who were fused with a kin-like group of friends and considered democracy as sacred were most willing to make costly sacrifices for democracy after being reminded of jihadi terrorism, and they were also more likely to consider their own group more formidable and jihadis as weak.

This report presents convergent empirical evidence for the “devoted actor” hypothesis (Atran 2016; Atran, Axelrod, and Davis 2007; Atran and Ginges 2015) from the two very different contexts of a field study in radicalized neighborhoods in Morocco and a computer-based study in Spain. The focus is on the link between morally important or “sacred” values (Atran and Ginges 2012), “identity fusion” of self with a close group of like-minded people (Swann et al. 2012), and the willingness to make costly sacrifices and engage in extreme actions in defense of the sacred values when they are perceived to be under threat (Sheikh, Ginges, and Atran 2013). This research is part of a broader project to understand what compels costly sacrifice and extreme behaviors in intergroup conflicts.

To examine the relationship between threats to sacred values and the willingness to defend those values by extreme actions, we interviewed 260 Moroccans (July 2014). Morocco has seen a surge in fundamentalist radicalization in the aftermath of the

Arab Spring. With the perception of a “War on Islam” being waged by Western powers and their allies and of Muslim values under threat, more than 2,000 people have joined—and thousands more stopped by authorities for having attempted to join—the ranks of foreign fighters in Syria, in particular, the Islamic State. Previously, we conducted anthropological fieldwork in two neighborhoods previously associated with militant jihad: Jemaa Mezuak in Tetuan (home to five of seven principal plotters in the 2004 Madrid train bombings and a number of suicide bombers who died in Iraq) and Sidi Moumen in Casablanca (source of terrorist bombing campaigns in 2003, 2005, and 2007; Atran 2010). Here, we focused on experimentally measuring the willingness to make costly sacrifices and engage in extreme actions for the “implementation of sharia law” and the endorsement of militant jihad as a function of the degree people perceived sharia law to be sacred and their personal self to be “fused” with a group of kin-like friends (outside of their family) they considered brothers and sisters.

In a follow-up study, examining the proposed process free from methodological restrictions in the field, we surveyed 644 Spaniards online. Considering recent calls by the Islamic State to reclaim Muslim lands (including Andalusia in Spain), we focused on measuring the willingness to defend democracy as a function of the degree people considered democracy sacred and were fused with a kin-like group of friends and the perceived threat by Muslim fundamentalists to the Spanish democracy.

## Field Study: Morocco

In Morocco, we approached participants in public spaces in the two neighborhoods. We interviewed 260 people (50% fe-

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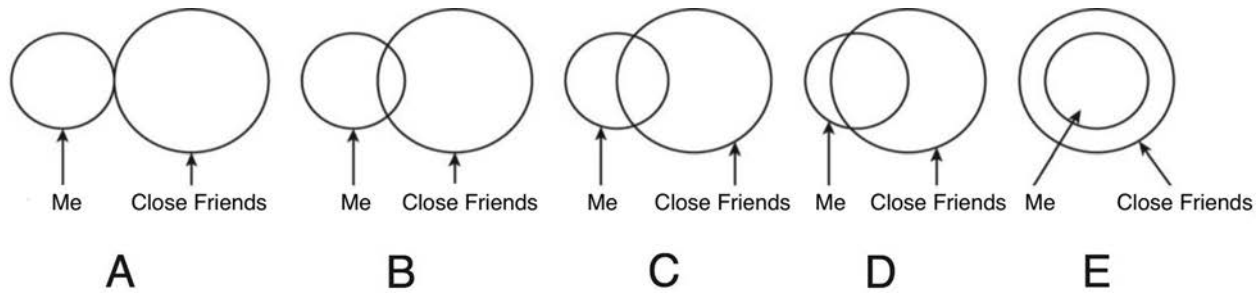


Figure 1. Identity fusion measure.

male), and we specifically approached two age groups: younger people ( $M_{\text{age}} = 22$  years, ranging from 18 to 25 years) who were more likely to have participated in the recent protests during the Arab Spring (making real sacrifices) and older people ( $M_{\text{age}} = 42$  years, ranging from 35 to 50 years) who were not likely to be involved in the protests. The educational level varied widely, ranging from functionally illiterate (18%) to at least some university education (10%).

First, we assessed sacredness of sharia by asking, “What is your opinion about delaying full imposition of sharia in the country?” Participants who picked “This is not acceptable no matter how great the benefits” from a given set of responses were considered to be holding sharia law as a sacred value. We then assessed participants’ willingness to make costly sacrifices for sharia by asking them about their agreement with five statements: “If necessary, I would be willing to *lose my job or source of income/go to jail/use violence/let my children suffer physical punishment/die* to defend the full imposition of sharia.” These were measured on a seven-point Likert scale ranging from “strongly disagree” to “strongly agree” (Cronbach’s  $\alpha = 0.94$ ). A measure of support of militant jihad was also administered to the participants. It consisted of five statements (e.g., “All countries that are not ruled by Muslims and do not observe sharia should be considered *Dar al-Harb* [abode of war]” and “Suicide bombers will be rewarded by God”), again using a seven-point Likert scale to assess agreement (Cronbach’s  $\alpha = 0.90$ ).

Identity fusion with a kin-like group of friends was assessed using a pictorial identity fusion measure (Swann et al. 2009). Participants were presented with a set of figures depicting two gradually overlapping circles, one representing them and the other representing kin-like friends: “Now think of your friends [outside your family] who are so close to you that you consider them brothers and sisters . . . Please pick the pair of circles that best represents your relationship with this group” (fig. 1). Participants who picked the completely overlapping circles (E) were categorized as fused with the group.

In line with previous associations of Jemaa Mezouak and Sidi Moumen with militant jihad, the proportion of participants considering sharia a sacred value in these neighborhoods was

considerably higher than citywide in Casablanca and Tetuan (see fig. 2).<sup>1</sup>

We found that 43% of participants were fused with a kin-like group of friends. Fusion and sacred values were not correlated with each other. We did not find any difference across age groups, but in Sidi Moumen more women than men considered sharia a sacred value (66% vs. 40%), and more men than women were fused with a kin-like group of friends (51% vs. 9%). There were no other gender differences (see table A1 for a breakdown of fusion and sacred values by gender and age group; tables A1, A2 are available in CA+ online supplement A).

To test our hypotheses, we conducted ANOVAs with willingness to make costly sacrifice (or support for militant jihad) as a dependent variable and fusion with a kin-like group of friends and sharia as a sacred value as independent variables. On average, participants in Jemaa Mezouak (Tetuan) were more radicalized than in Sidi Moumen (Casablanca) and exhibited ceiling effects on both dependent measures; in other words, the statements we used were not radical enough, and these participants overwhelmingly agreed with them. Accordingly, we report results separately for the two neighborhoods.

In Sidi Moumen, there was an interaction effect between sharia as a sacred value and fusion ( $F_{1,126} = 5.80, P = .02$ ) on willingness to sacrifice for sharia: while fused participants were more willing to make costly sacrifices than nonfused ones, this was especially pronounced for participants who considered sharia a sacred value (fig. 3).

Only those who considered sharia a sacred value and were fused with a kin-like group of friends exhibited an average value above the midpoint—that is, were more willing than not to make costly sacrifices for sharia. To illustrate the effect among the participants who were fused, those who considered sharia a sacred value were on average more willing to use violence ( $M_{\text{diff}} = 1.79, SE = 0.61, P < .01$ ) and more willing to die ( $M_{\text{diff}} = 1.49, SE = 0.66, P = .03$ ) than those

1. Citywide data on the sacred value of sharia was available from an unrelated study in collaboration with the University of Maryland (see CA+ online supplement A for details).

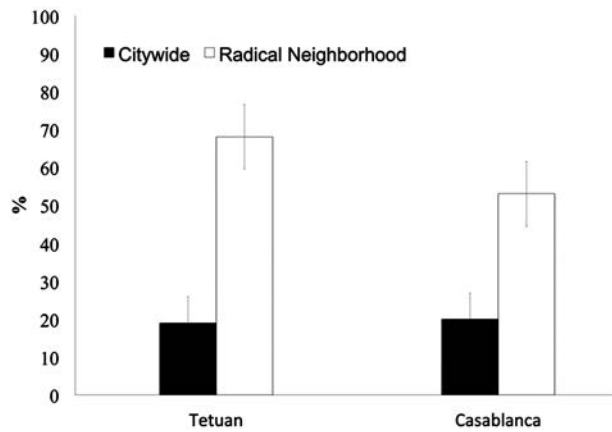


Figure 2. Proportion of people expressing a sacred value of sharia in Morocco.

who did not, again pushing them above the midpoint of the scale. We found a similar interaction effect for support of militant jihad ( $F_{1,126} = 4.017, P < .01$ ): participants who considered sharia a sacred value and were fused with a kin-like group of friends were on average the only group who were above the midpoint of the scale (i.e., supported militant jihad).

In Jemaa Mezuak, we observed an overall higher level of radicalization, leading to a ceiling effect on the costly sacrifice for sharia and militant jihad measures ( $M = 5.64, SD = 1.73$  and  $M = 5.47, SD = 1.76$ , respectively), making statistical analyses difficult: participants who considered sharia as sacred agreed strongly with costly sacrifices and militant jihad on average. Nevertheless, those who were also fused had on average the highest values on both measures ( $M = 6.43, SD = 0.73$  and  $M = 6.24, SD = 0.82$ ) reaching the top of the scale.<sup>2</sup>

In the context of heightened political tensions in Morocco, these results are in line with the devoted actor model: participants who were fused with a kin-like group of friends and considered sharia a sacred value were more willing to make costly sacrifices (including violence and dying) for sharia and were also more likely to support militant jihad, compared to other participants. Encouraged by these results, we proceeded with an experimental study under controlled conditions to examine this process in more detail, using computer-based measures with continuous scales to increase fidelity.

### Experimental Study: Spain

To complement our field study, we conducted a longer and controlled study using computer-based measures with continuous scales to increase fidelity (see below). We also added an additional outcome measure of intergroup formidability. In the relatively peaceful context of Spain, there are no sa-

lient tensions or threats comparable to the current political situation in Morocco. Therefore, we reminded our participants of sharia law to induce threat and assessed the willingness to make costly sacrifices to defend liberal democracy. We expected that a reminder of sharia law would induce threat in our participants, considering the fact that one of the major interests of the Islamic State is the reconstitution of a Muslim Spain by reclaiming Andalusia. We also added a control group where no threat was induced to examine the link between sacred values and identity fusion on costly sacrifices under circumstances that do not call for a defense of democracy. Previous data collected in the lab support the proposition that under calm circumstances identity fusion and sacred values may have independent effects on intergroup orientations (Atran and Ginges 2015).

In our study in Spain,  $N = 644$  people voluntarily participated online (63% female, average age of 35 years, range = 18–77 years, 14% undergraduates from the Universidad Nacional de Educación a Distancia and 86% from the general population). In contrast to the field study in Morocco, we could use a computer-based questionnaire that allowed us to counterbalance the order of the measures of sacred values and identity fusion.

To assess the level of fusion with a kin-like group of friends, we used the dynamic identity fusion index (DIFI; Jiménez et al. 2015). This novel measure shows convergent validity with the verbal and pictorial measures of fusion and higher predictive validity for sacrifices for the group than the pictorial measure (Jiménez et al. 2015). The DIFI presents two circles of different sizes and colors on the computer screen. In our study, the small circle represented the “self” and was initially positioned in the left quadrant of the screen. The big circle represented “a small group of friends (outside of your family) you consider brothers and sisters” and was fixed in the right margin of the screen. The small circle could be moved by either clicking and dragging with the mouse or pressing control buttons situated at the top of the screen. When the

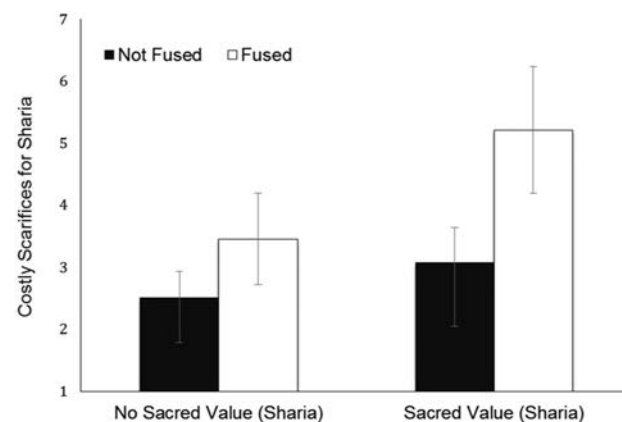


Figure 3. Willingness to make costly sacrifices (including using violence and willingness to die) for sharia (with 95% confidence intervals).

2. All effects reported in this paper did not differ across gender or age groups.

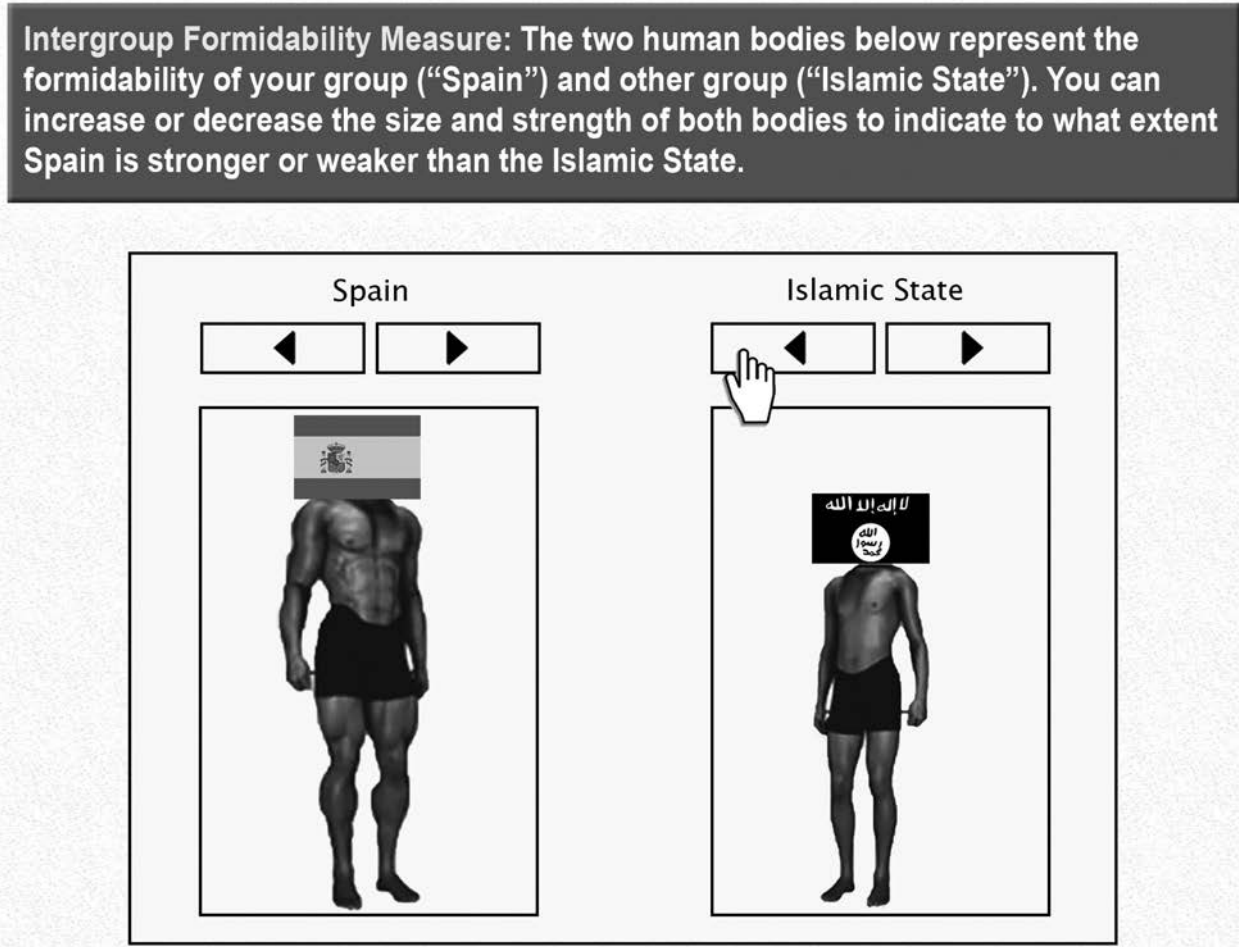


Figure 4. Intergroup formidability measure. A color version of this figure is available online.

two circles overlapped, the blending of colors enhanced the visual analogy of identity fusion. Participants were considered fused with the group when the two circles completely overlapped.<sup>3</sup>

We assessed sacredness of democracy by asking how much money the participants would be willing to accept for saying publicly that they would give up democracy. Participants who picked “Never, for any amount of money” from the set of given response options (ranging from “Eur 1” to “Eur 1 million”) were considered holding democracy as a sacred value. Subsequently, participants were randomly assigned to either the control or the threat condition. Participants in the control condition were asked to write about how they learned about the study and how they felt at the moment. Participants in the threat condition were asked to write about what they thought of the interpretation of sharia by followers of the Islamic State and al-Qaeda.

After the manipulation, participants responded to the same measure of willingness for costly sacrifices used in the field

study (this time in defense of democracy; Cronbach’s  $\alpha = 0.84$ ). Subsequently, intergroup formidability was rated by a dynamic version adapted from the perceived muscularity measure described by Fessler, Holbrook, and Snyder (2012). It showed two male bodies on the computer screen, facing each

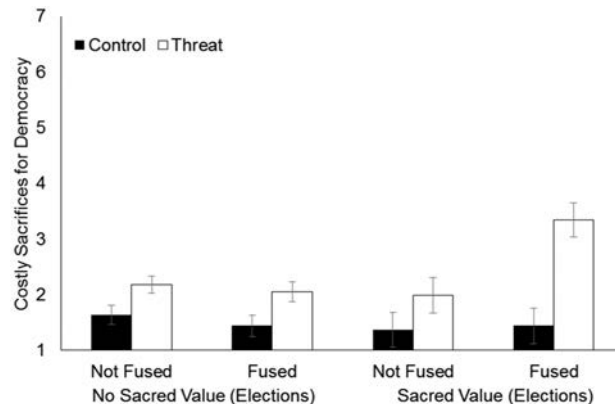


Figure 5. Willingness to make costly sacrifices for democracy (with 95% confidence intervals).

3. The results reported here did not differ when the DIFI was treated as a continuous measure and analyzed using regression analyses.

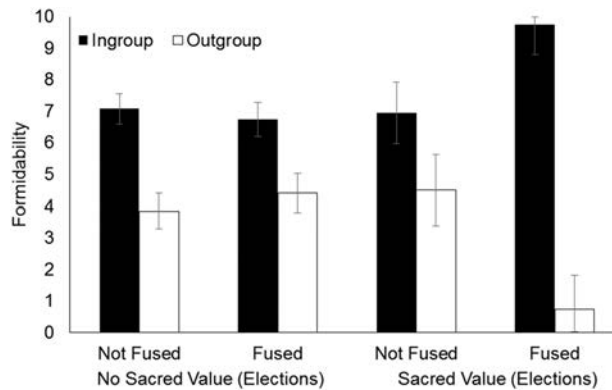


Figure 6. Formidability under threat (with 95% confidence intervals).

other (fig. 4). The left body represented the ingroup (Spaniards), and the right body represented the outgroup (jihadis). The respondents could change the formidability of both ingroup and outgroup bodies independently by clicking the control buttons at the top of the screen, on an 11-point scale ranging from 0 (weak and slender body) to 10 (strong and muscular body). Both male bodies were initially positioned in the middle of this scale, representing a moderately strong body.

We found that 46% of participants were fused with a kin-like group of friends and 23% of participants considered democracy sacred. Again, both measures were uncorrelated. We first conducted an ANOVA with costly sacrifices for democracy as a dependent variable and condition, fusion, and sacred values as independent variables. There was a reliable three-way interaction effect ( $F_{1,636} = 11.00, P < .01$ ). As figure 5 shows, this study replicated the results of the field study in Morocco. Under threat, participants who were fused with a kin-like group of friends and considered democracy a sacred value exhibited on average the highest level of costly sacrifices for democracy (compared to the other conditions; all  $P < .01$ ). In the control condition, there was no effect of identify fusion or sacred value of democracy on the willingness to make costly sacrifices, which may be owed to an overall low willingness to make any sacrifices for democracy (reaching the bottom of our scale). This low support for democracy by Spaniards is in line with earlier work that found only 10.5% of Spaniards fused with political parties (Buhrmester et al. 2012). This is not surprising, as frequent corruption scandals involving all four political parties have left most Spaniards disillusioned with the promise of democracy.

We then conducted a mixed-effect ANOVA with intergroup formidability as a dependent variable; condition, fusion, and sacred values as between factors; and group (ingroup vs. outgroup bodies) as a within factor. There was a reliable four-way interaction ( $F_{1,636} = 12.02, P < .01$ ). As can be seen in figure 6, participants in the threat condition who were fused with a kin-like group of friends and who considered democracy as sacred perceived the ingroup as stronger and the out-

group as weaker than participants in all the other conditions (all  $P < .01$ ). However, as shown in figure 7, participants in the control condition exhibited no difference based on fusion with a kin-like group of friends or the sacredness of democracy, although they consistently considered the ingroup as stronger than the outgroup.

In addition to replicating the results of the field study in Morocco, this controlled experimental study also shows that whereas even under nonthreatening conditions fused people are more willing to make costly sacrifices, it is under threat when fusion and sacredness combine into powerful motivators for sacrifice. This study also suggests that the perception of formidability may foster willingness to make sacrifices for a cause. Fused individuals tend to perceive their group as invincible and opposing groups as weak, which leads them to move against the other groups when they feel under threat.

## Conclusion

In our two studies with Moroccans and Spaniards, we found support for the devoted actor hypothesis: men and women alike (see also Hyde 2005) expressed “parochial altruism” the most when they were fused with a kin-like group of like-minded friends and felt a cherished value they considered sacred to be under threat. Specifically, Moroccans expressed willingness to make costly sacrifices for the implementation of sharia when they were fused with a kin-like group of friends and considered sharia law as sacred; they were also most supportive of militant jihad. Parallel to this, Spaniards who were fused with a kin-like group of friends and considered democracy as sacred were most willing to make costly sacrifices for democracy after being reminded of jihadi terrorism; they were also more likely to consider their own group as more formidable and jihadis as weak, which may facilitate aggression against the “enemy.”

Our findings paint a picture of devoted actors who feel viscerally connected with a primary group, have strong values, and are willing to make extreme sacrifices (including willing-

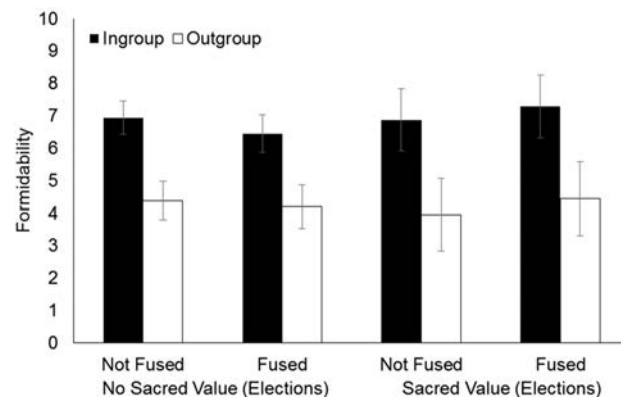


Figure 7. Formidability without threat (control; with 95% confidence intervals).

ness to fight and die) when they believe their values to be under threat. Pushed to the extreme, it is this personal commitment to sustain the primary reference group's exceptional principles and positions, preferences and privileges—and to do so regardless of apparent risks or costs—that characterizes the devoted actor.

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