Evolutionary Cultural Anthropology

Containing Ebola Outbreaks and Explaining Hunter-Gatherer Childhoods

by Barry S. Hewlett

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.

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 identity 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 (onchocerciases), 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.

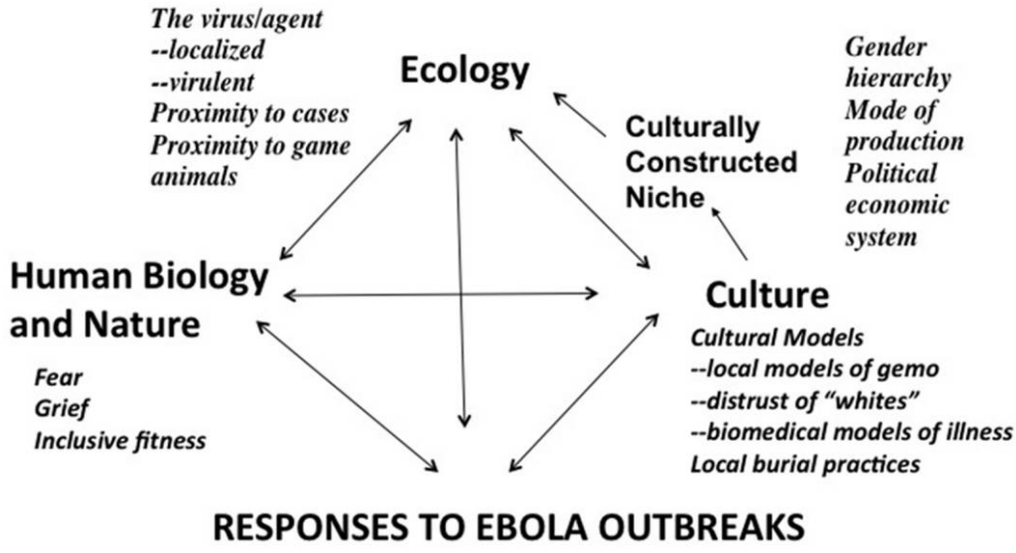

Figure 1. Integrative ECA framework to human responses during Ebola outbreaks.

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 contributers 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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