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Teaching in Hunter-Gatherers

Adam H. Boyette[1] · **Barry S. Hewlett**[2]

Abstract Most of what we know about teaching comes from research among people living in large, politically and economically stratified societies with formal education systems and highly specialized roles with a global market economy. In this paper, we review and synthesize research on teaching among contemporary hunter-gatherer societies. The hunter-gatherer lifeway is the oldest humanity has known and is more representative of the circumstances under which teaching evolved and was utilized most often throughout human history. Research among contemporary hunter-gatherers also illustrates a complex pattern of teaching that is both consistent with and distinct from teaching in other small- and large-scale societies with different subsistence practices and cultural forms. In particular, we find that the cultural emphasis on individual autonomy and socio-political egalitarianism among hunter-gatherers differently shapes how teaching occurs. For example, teaching clearly exists among hunter-gatherers and appears in many forms, including institutionalized instruction in valued cultural and technical skills. However, teaching tends to be less common in hunter-gatherer societies because people live in small, intimate egalitarian, groups that support each other's learning in a variety of ways without teaching. Furthermore, foundational cultural schemas of autonomy and egalitarianism impact the nature of teaching. For example, adults and older children limit their interventions, permitting autonomous learning, and, when they occur, teaching episodes are generally brief, subtle, indirect, and situated in a present activity (i.e. knowledge is not objectified or intended to be generalizable). We discuss the implications of this research in terms of discussions of the evolution of human cognition and the co-evolution of teaching and culture through the process of cultural niche construction.

✉ Adam H. Boyette
adam.boyette@duke.edu

[1] Duke University, Box 90025, Durham, NC 27705, USA

[2] Washington State University, 14204 NE Salmon Creek Avenue, Vancouver, WA 98686-9600, USA

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1 Introduction

Knowledge of teaching among hunter-gatherers has immense value for our understanding of teaching as a social learning process and a human cognitive ability. The vast majority of our current knowledge of teaching comes from research among people living in large, politically and economically stratified (i.e., unequal access to power and resources) societies with formal education systems and highly specialized roles within a global market economy. There is also a more limited literature concerning teaching of craft industries (e.g., textiles) in subsistence agricultural or pastoralist societies (Greenfield 2004; Maynard 2002; Tehrani and Collard 2009). Hunter-gatherers—their culture and way of life—are unique from these two other groups. In the discussion of forager uniqueness that follows, we will refer generally to these other groups as "stratified market economy" cultures and subsistence "farming" cultures (including pastoralists) as a shorthand.

Hunter-gatherer uniqueness bears on our understanding of teaching in at least two ways: 1) to evaluate hypotheses about the evolution of teaching and whether or not teaching is a human universal and 2) identify diverse forms and contexts of teaching. First, the hunter-gather lifeway is the oldest humanity has known and therefore more representative of the circumstances under which teaching may have evolved and was utilized during human history. Subsistence agriculture has been practiced for about 10,000 years, and industrial production emerged fewer than 300 years ago. Prior to either of these social and economic innovations, throughout the evolution of our species—from our divergence with the chimpanzee evolutionary line 7 million years ago and the emergence of *Homo sapiens* 200,000 years ago—and our eventual spread from Sub-Saharan Africa to the far reaches of the Earth before 40,000 years ago, all humans lived as hunter-gatherers. We were able to achieve the ecological dominance we now maintain only by having the capacity to create and transmit culture (Boyd et al. 2011; Henrich and McElreath 2003), and many think that teaching was one, if not the single most, crucial cognitive ability that pushed our culture-learning capacity beyond that of our ancestors (Csibra and Gergely 2011; Laland 2017; Strauss and Ziv 2012; Tomasello et al. 2005; Whiten and Erdal 2012). Studies of contemporary hunter-gatherers provide one evidence-based approach for evaluating claims about the nature and role of teaching in the evolution of cumulative culture.

Second, research among contemporary hunter-gatherers provides the opportunity to understand the diverse forms and contexts of teaching by identifying how teaching in hunter-gatherers is different or similar to teaching in farming or stratified cultures. In particular, the emphasis on cultural values and structures that promote individual autonomy and socio-political egalitarianism among hunter-gatherers differently shapes the ways that teaching occurs among hunter-gatherers, and might reveal a profound shift in the population level implications of cultural learning after the advent of agriculture. This shift may be evident in the research trends on teaching in stratified cultures, in which ideas about teaching are filtered through a cultural emphasis on teaching as a formal, top-down method of knowledge transmission.

In this paper, we review the current state of knowledge of teaching among past and contemporary hunter-gatherers. We start by providing an overview of common features of hunter-gatherer cultures and then move on to review two general clusters of research results: a) studies that suggest that teaching is rare or does not exist in hunter-gatherers

and b) studies that indicate that teaching is one of several processes of social learning in hunter-gatherers. The studies differ in their conclusions, but we hope to demonstrate that they complement each other and provide a holistic and integrated view of teaching in hunter-gatherers. Within each of these two groups, three different methodological approaches are represented: cross-cultural surveys, descriptive ethnographic studies, and observational studies. Cross-cultural surveys generally examine several (often more than 20) cultures on a particular topic whereas descriptive ethnographic studies consider one or two cultures in depth. The cross-cultural studies use published descriptive ethnographic studies to conduct their research while descriptive ethnographic studies are based upon original fieldwork. Observational studies mean that the researcher focused most of his/her time and energy in one or two cultures collecting systematic quantitative behavioral data, often following or videotaping individuals or groups of children to code particular features of learning. Some studies in the review focus specifically on teaching, but many of them examine social/cultural learning in general and describe teaching in that broader context.

For several researchers the very definition of "teaching" is at issue (Hewlett and Roulette 2016; Kline 2015; Lancy 2016). At this point, we prefer to the use a working definition of "teaching" from Hewlett and Roulette (2016: 4), which is similar to definitions proposed by Caro and Hauser (1992), Thornton and Raihani (2008), and Kline (2015):

> An individual modifies her/his behavior to enhance learning in another…Teaching cannot be a by-product of another activity. For instance, if someone in a hunter-gatherer camp sees a poisonous snake and yells "snake" this may provide a learning opportunity for others but it is not teaching because the individual did not modify his or her behavior to enhance the learning in another; the learning is a by-product of warning others about the snake. We also agree with Thornton and Raihani that contingent communication or some sensitivity between teacher and learner, which they call "behavioral coordination", is an important feature of teaching.

This definition is rooted in behavioral biology and does not rule out the possibility that other species have evolved to teach in certain contexts as a solution to the problems faced in their environments (Franks and Richardson 2006; Raihani and Ridley 2008; Thornton and McAuliffe 2006). Perhaps the most widely cited example of teaching in another species is Thornton and McAuliffe's (2006) observations of teaching among meerkats. Adult meerkats selectively provision young with either scorpions that are either dead or have had their stingers removed. As the pups get older, the adults increase their provision of living or intact scorpions. The advantage of this definition is that it makes no assumptions about the cognitive mechanisms that must be in place to classify a behavior as teaching. Several (about 60%) of the papers in this review used this or a similar definition of teaching.

Other definitions of teaching retain similar criteria (e.g. some kind of "behavioral coordination"), but there are important disagreements. Some take the term "teaching" to refer only to Western-style formal education, with lessons and a strictly formal teaching context (Lancy 2010, 2016; K. MacDonald 2007). This view of teaching is obviously more limited than our working definition, and thus these researchers tend to find that teaching is rare or absent in some or most human cultures and non-existent in non-human animals. On the other hand, the view from cognitive science is that teaching is

unquestionably part of human nature, but it is unique to humans and involves the capacity to infer intentionality from the behavior of others (Tomasello et al. 1993; Kruger and Tomasello 1996; Strauss et al. 2002). According to this perspective, humans uniquely expect children to learn and children, beginning around age 4, are able to recognize the mental states of others and thus infer their intention to teach them. This metacognitive awareness would increase the efficiency of teaching in humans.

An alternative cognitive view is held by Csibra and Gergely (2011; Gergely & Csibra, 2006) who hold that "shared intentionality" is not required, but that the cognitive basis of teaching evolved in humans in response to the unique challenge of providing opaque knowledge about technology. They propose that humans have adaptations for "natural pedagogy" to solve this problem. According to their hypothesis, teachers mark their behavior by ostensive cues that indicate they are providing learners with generalizable information about properties of objects. Learners are thus sensitive to these cues starting from infancy (i.e. before the development of theory of mind or shared intentionality).

We discuss evidence for these different perspectives on teaching below as they pertain to our understanding of hunter-gatherer teaching. However, for now, our justification for using our working definition is that it is generalizable across species and observational contexts and does not make assumptions about associated cognitive mechanisms such as shared intentionality. This does not mean we deny that humans possess specific cognitive adaptations for teaching that evolved to solve unique problems our ancestors encountered in their environment. We believe that human cognition co-evolved with culture (Boyd et al. 2011; Laland 2017; Morgan et al. 2015; Whiten and Erdal 2012). However, we do not believe there is reason to define away the possibility that other species independently evolved the capacity to teach. For example, an important criterion shared at least implicitly by all definitions discussed is that teaching is marked by some form of coordination, monitoring, or evaluation of learners' skill levels by potential teachers. We would be hesitant to accept as teaching behavior which does not evince some persistence by the teacher in helping the learner achieve learning. Meerkat scorpion provisioning is an excellent example, where teachers increase the challenge of the lesson in response to the abilities of the learner by giving them live or intact prey. Thus, while we recognize that some might argue a definition that does not include intention might over attribute "teaching" to simple behavioral regulation, we take the meerkat example to demonstrate that a broader set of behaviors may, in an evolutionary sense, serve the same function as intentional teaching even if we cannot be certain intention is involved.

Similarly, we believe that teaching in humans may actually present certain challenges to demonstrating this quality of the teacher-learner interaction, and perhaps especially in hunter-gatherer contexts. We say this for two reasons. First, teaching may progress over multiple interactions some of which may not happen in front of the observer. We do not think that instances of demonstration without observed follow-up, for example, should be discounted, given that the teacher may continue the "lesson" hours or days later. Such situations may be especially common among hunter-gatherers because, as we will describe, teachers and learners are in frequent daily contact and know each other intimately, and the opportunities for learning most skills and knowledge occur regularly offering many repeated "teachable moments." A teacher could easily follow the progress of a learner and intervene at any moment over an extended

period. Second, as we will discuss, hunter-gatherers prioritize individual autonomy, such that signs of monitoring or evaluation by teachers may be quite subtle so as not to be perceived as undue intervention in the autonomous learning process. The studies we review suggest that concerted, persistent teaching is most likely to occur in domains that are challenging to learn individually (e.g. esoteric ritual knowledge) or that involve particularly important social skills (e.g. sharing).

2 Overview of Hunter-Gatherers

In this paper, the term "hunter-gatherers" refers specifically to peoples that currently or historically subsist on wild foods, live in small (approximately 25–35 individuals per camp), mobile populations that move several times a year for social or economic reasons, and who practice an immediate-return subsistence strategy (Woodburn 1982) in which consumable goods that are brought into the community are consumed immediately (i.e., no storage for the future), typically in shares distributed to everyone present, and where there is no structural dependence on specific others (e.g., clan members). In the literature, mobile hunter-gatherers are also referred to as foragers or gatherer-hunters (e.g. Bird-David 1990). Ethnographic research among contemporary groups highlights that being a "hunter-gatherer" is much more a matter of identification with hunting and gathering as a way of life than the proportion of daily calories that actually come from wild foods (Bird-David 1990, 1992; Lewis 2002). In fact, most contemporary hunter-gatherers spend at least part of the year doing agricultural labor for themselves or for neighboring farmers, or wage labor for NGOs, logging companies, or tourism operations.

2.1 Foundational Schemas

Part of this shared hunter-gatherer identity is constituted by a number of core cultural values that are influenced by common aspects of socialization. Drawing from cognitive anthropology (D'Andrade 1992; Shore 1996), we refer to these core values as foundational schemas, which are ways of thinking and feeling that organize and motivate behavior across a range of cultural domains. Foundational schemas are actively socialized in that there are sanctions for contrary behavior. As we will discuss, teaching may be crucial to the cultural transmission of foundational schemas during early and middle childhood. The nature of hunter-gatherer teaching is also constrained by these schemas.

Hunter-gatherer foundational schemas include sharing, egalitarianism, and respect for autonomy (Hewlett et al. 2011).[1] A sharing foundational schema is manifest in the institution of demand sharing (Peterson 1993; Schnegg 2015), or what Bird-David (1990) refers to as "the sharing economy," where it is expected that anyone can demand material resources from others and is obligated to give. Food and material culture

[1] Lewis (2016) also describes music as a foundational schema among Congo Basin hunter-gatherers, emphasizing its unique role in constructing hunter-gatherer cultural uniqueness. We will not discuss music here specifically as a foundational schema but will review his work below. Here we are concerned with pan-hunter-gatherer schemas.

sharing has received the most focus in the literature (e.g. Gurven 2004) but others have noted that physical and social space are also characteristically shared unreservedly (Draper 1973; Hewlett et al. 1998; Lewis 2016; Sugawara 1984).

Egalitarianism as a foundational schema means that in principle all people have relatively equal access to resources; political, gender and age distinctions are limited. Leaders, if they exist, have very limited authority in hunter-gatherer society and a variety of institutions have been described across hunter-gatherer cultures that limit the power and access to resources of single individuals, no matter how instrumentally valuable they are to the group (e.g. excellent big game hunters; Lee 1969; Lewis 2002; Wiessner 2002; Woodburn 1982). "Rough joking" is a typical form of sanctioning those who boast or attempt to coerce others (Hewlett 1991; Lee 1969; Lewis 2015).

Finally, respect for the autonomy of others is a paramount value among hunter-gatherers. No one can coerce anyone else, and children are often given freedom to decide what to do. Respect for autonomy is crucial to maintaining a prosperous and socially stable foraging community (Endicott 2011; Gardner 1991; Wiessner 2002; Woodburn 1982). As soon as anyone feels they are being treated unfairly, they can leave, diffusing potential conflicts. Since leaving means someone is taking social resources away from the group, harmony is usually in everyone's best interest and greatly emphasized. At the same time, the institution of demand sharing supports the shuffling of people around the landscape (Lewis et al. 2014), which also means knowledge and resources are circulated widely as a result of people having the autonomy to move at will to wherever they maintain good relations (Hill et al. 2014; MacDonald and Hewlett 1999; Wiessner 1982).

2.2 Cultural Niche Construction

Hunter-gatherer foundational schemas also are manifested in and reinforced by cultural niche construction—the shaping of the social and physical environment, which affects the ontogenetic development of individuals and may shape the biology and culture of a group over time. We wish to emphasize the distinct importance of cultural niche construction for human learning. As Menary (2014) puts it:

> Humans are born into a highly structured cognitive niche that contains not only physical artefacts, but also: representational systems that embody knowledge (writing systems, number systems, etc.), skills and methods for training and teaching new skills… *Knowledge systems, skills and practices are real and stable features of the socio-cultural environment*. (291, italics added)

In other words, young humans grow up embedded in environments that support culture learning and structure the domains where teaching might be required, the personnel who might perform teaching, and the most effective methods by which teaching causes learning.

Many features of hunter-gatherer cultural niche construction impact social learning, including: a physically and socially dense living environment, multiple child caregivers (cooperative breeding), cosleeping beyond infancy, and a lack of expectations around juvenile contributions to the economy.

Hunter-gatherers share space in highly intimate living conditions. Typically, houses are small, close together, and used only for sleeping (Draper 1973; Hewlett et al. 1998). Within the houses a whole nuclear family shares a bed approximately 2 by 5 ft in size. Infants are breastfed on-demand and cosleeping beyond infancy is common (Hewlett and Roulette 2014). Children will cosleep with a favored relative or friend if not with their nuclear family. Childcare is cooperative: many individuals share the burden of care with mothers. Who delivers care depends on the unique family situation (e.g. health of parents, couple living matrilocally versus patrilocally; Meehan 2005). Once they are able to walk, children explore camp without restriction and spend much of their time with other children of mixed ages. These intimate conditions permit extensive observation of a variety of models throughout childhood, which may facilitate observation and imitation without the need for teaching. At the same time, these others intimately know individual children and their skill levels across a range of domains, enabling them to scaffold learning through teaching when appropriate.

Additionally, children will remain close to many of the people they know throughout their lives, and they will remain trusted caretakers and sources of knowledge about the world. In Western developmental psychology studies, trust has been found to be a key determinant of how likely a child is to learn from an older individual. For example, work by Harris and colleagues (Harris and Corriveau 2011) has shown that young children are more likely to learn from attachment figures than other familiar individuals, but as they grow older are more likely to learn from those whose knowledge can be trusted as reliable regardless if they are an attachment figure or not. We have suggested that the sharing of space and resources among hunter-gatherers starting from infancy inculcates a fundamental trust in the social and ecological environment (Hewlett et al. 2000). For hunter-gatherer children, the world is replete with attachment figures and people whose reliability they have ample opportunity to verify. Children come to see others as trusted caretakers because they always receive food from others and are seldom scolded for entering their houses or using their material possessions—behaviors resulting from and serving to promote the foundational schema of sharing in young children.

In accord with the foundational schema of respect for autonomy, children follow their own interests in learning and choose what and when to learn. The availability of all the materials of cultural and economic life and children's freedom to use them affords them the opportunity to engage in self-directed practice of skills of interest (Boyette 2016b; Crittenden 2016; Endicott and Endicott 2014; Konner 2005). Moreover, children in most hunter-gatherer societies are not expected to contribute to family subsistence (although they may still do so (Bird and Bliege Bird 2005; Bliege Bird and Bird 2002; Blurton Jones et al. 1989; Crittenden 2016), so much of their learning, even of crucial subsistence skills, is casual or in the context of play (Boyette 2016a; Crittenden 2016). The self-directed nature of learning and the ample opportunities for play likely generate positive affect that enhances learning (Gordon et al. 2003; Knutson et al. 1998). Moreover, hunter-gatherer play is typically collaborative rather than competitive, which may enhance the value of shared early experience for acquiring a trusting view of others (Boyette 2016a, b). The basis for this collaborative learning is the mixed-sex, mixed-age playgroup, a common feature of the hunter-gatherer child's post-weaning social experience (Konner 2005). Much social learning occurs within the context of these groups, which calls into question the assumption maintained by many that all learning comes ultimately from adult sources (Boyette 2016b)

3 Teaching is Rare or Absent in Hunter-Gatherers

3.1 Cross-Cultural Studies

Lancy has conducted several broad cross-cultural surveys of social learning in hunter-gatherers and other small-scale cultures and concludes that teaching is very rare and is not an important source of cultural learning in these cultures (2010, 2012). He views teaching as "Unnecessary Interference" (2010: 82). He has been particularly staunch in his argument that teaching is a recent product of Western industrialization and stratified market economies. His review of the ethnographic literature indicates that,

> Teaching – even if defined, minimally, as self-conscious demonstration – is rare in the accounts of anthropologists and historians…The kind of nuanced, student-centered, developmentally appropriate instruction by dedicated adults that we today take as the operational definition of teaching is a recent *product* of a long process of *educational* change…Teaching has been largely superfluous in the process of cultural transmission throughout human history. (2010, p. 97, emphasis in original)

Ethnographic examples from hunter-gatherer cultures in his study include the following (2010: 82):

> "No formal instruction is practiced among the !Kung…learning…comes from the children's observation of the more experienced." (Marshall 1958, p. 51)

> "[There] is relatively little meddling by older [Inuit] people in this learning process. Parents do not presume to teach their children what they can easily learn on their own" (Guemple 1979, p. 50)

Lancy reviewed about 1500 published and unpublished reports that were "comprehensive in terms of geography and subsistence patterns" (2010: 82). His study was not limited to hunter-gatherers and he did not use a standardized cross-cultural database such as the Human Relations Area Files (HRAF). Lancy's definition and perception of teaching were influenced by Western stratified culture's views of teaching (e.g., authoritative, classroom-based, top-down transmission), so it is not surprising to us that he finds little evidence of teaching. Lancy's study is consistent with earlier studies by cultural anthropologists that have been interested in identifying differences in learning between "primitive" and "civilized" or Western and non-Western cultures. Like Lancy, these studies point out that children in hunter-gatherers and other small-scale culture do not need schools to learn complex skills and knowledge. These studies do not use the definition of teaching used in this paper and instead rely upon a definition or conception of teaching from institutionalized formal education systems.

MacDonald (2007) also reviewed the ethnographic literature pertaining to how traditional hunters learn to hunt. Her interest was to test predictions from evolutionary

models of the costs and benefits of learning to hunt at different parts of the life cycle. For example, Shennan and Steele (1999) predict that, because hunting is complex, learning should be early when it costs the least for the learner, and parents should invest in their children's learning through teaching and other means. Her review included both hunter-gatherers and other hunting groups of different levels of socio-economic complexity, and she did not specify her search methods or process of inclusion or exclusion of relevant studies. In the end, she concluded that teaching was uncommon and of little importance. Rather, she found the evidence to favor Bock's (2002) model of early practice of hunting through play, and a step like progression toward real hunting as children gained experience, size, and strength—a view that also places a high value on parental investment in children's learning through task assignment, not through teaching (in the sense of direct instruction).

That being said, she did find an array of instances of "teaching" in the sense of instruction, as well as demonstration and providing learning opportunities among the hunter-gatherers in her sample. These included older Ju/'hoansi (same culture as !Kung) mothers or older children teaching toddlers how to shoot a bow and arrow, and adults offering advice "on the peculiarities of the weapons and how to use them" (390). She also notes that provisioning small hunting weapons facilitates the learning of hunting and manufacturing skills. Moreover, adults were also found to convey ethnobotanical or ethnozoological knowledge.

Finally, Whiten et al. (2003) published an influential paper that compared human and chimpanzee social learning; the paper describes a limited cross-cultural survey of hunter-gatherer learning and concluded that teaching did not exist in foragers and that it was likely a recent postagricultural invention (i.e., consistent with Lancy). The hunter-gatherer studies cited in the survey often utilized conceptions of teaching from formal education institutions.

3.2 Descriptive Ethnographic Studies

Several ethnographers that have conducted research for a year or more with a specific hunter-gatherer group have noted a distinct lack of direct instruction in the enculturation process. Like Lancy, many of these ethnographers conceive of "teaching" as an institutional top-down process common in formal educational systems. But unlike Lancy, they do not reject the hypothesis that teaching is a human universal, and instead argue that teaching in hunter-gatherers is rare because it is incompatible with hunter-gatherers' value for individual autonomy and an egalitarian ethos. They describe some contexts under which teaching exists, but they and their informants emphasize the importance of autonomy to individual learning and egalitarianism.

For example, Lewis (2016) argues that, for the Mbendjele of the northern Republic of the Congo, teaching is relatively rare and not institutionalized because knowledge is highly diffuse, and there are very few domains where individual authority can be claimed over knowledge. Spirit plays (*mokondi massana*), a form of intellectual property, are an example where adults must pay to be taught how to capture the spirit and orchestrate its dance. However, during childhood, Lewis observed that most learning among the Mbendjele is done through play and social foraging without any teaching:

> [In play—*massana*—] they [children] cultivate expertise by becoming increasingly aware of the intentions behind the other's actions. Learning is implicit and self-motivated. The egalitarian ethos of Mbendjele society makes overt instruction potentially offensive since it implies power differences. (Lewis 2009, p. 250)

Similarly, Omura (2016) describes teaching children and adolescents among the Canadian Inuit hunter-gatherers as "discourteous." For the Inuit, because children develop a sense of reason during middle childhood, their autonomy must be respected. Adults are thus "encouraged to help them learn spontaneously" through observation and collaboration. Before they have acquired reason, Omura writes, adults use teasing as a type of "pre-learning" to inculcate a motivation to learn spontaneously and a positive attitude toward learning. Teasing, which may not be direct instruction but can be considered a form of teaching because the one teasing modifies his/her behavior to help the child learn important cultural values, often involves counter-intuitive statements or morally ambiguous questions that serve to open up more questions in the child and motivate individual learning and emotional regulation. The teasing ordeal typically ceases after adults believe the child has acquired reason after which their autonomy to learn on their own is respected.

Naveh (2016) claims that the South Indian Nayaka hunter-gatherers also "avoid any kind of direct teaching even between parents and children", again citing a value for autonomous self-directed learning. By contrast, he gives a rare example of teaching when his informants taught him phrases in their language in order to make his "joining" with the group "more enjoyable". For Naveh, their rationale for teaching as well as the phrases he was taught in that moment were representative of an overriding value for and focus on forming and maintaining relations between people. In this case, teaching was a way to facilitate relations by giving a novice linguistic tools. Later, though, he provides the example of children's learning to trap wild game to demonstrate that children are more likely to learn important skills from collaborative trial-and-error learning than teaching—again, emphasizing that collaboration involves being together. For the Nayaka, he argues, knowledge (e.g. how to make a trap) is not objectified and given from one person to another but comes from shared experiences.

He further describes the acquisition of social skills and "wisdom," or *budi*, as following the same process—Naveh's informants explicitly emphasized autonomous learning. For example, the Nayaka do not ask "how" or "what" questions. Rather,

> what may possibly be learned from answers to a 'how' type of question is directly acquired mainly in two ways (usually a combination of the two): being with someone who is performing what one wishes to know while that someone is doing it; and trying to do what one wishes to know by oneself – which usually involves a process of trial and error.

These two complementary ways of answering "how" questions among the Nayaka reflect the hunter-gatherer foundational schemas of sharing (in the sense of being together, or sharing space) and autonomy. On the surface, they can seem contradictory: Why learn on one's own rather than with a knowledgeable other?

Naveh's work follows from that of Bird-David whose own was influenced by Woodburn. Bird-David (1999) argues that the Nayaka possess a "relational

epistemology"—a way of thinking that is built upon being together and knowing about the world through knowing the humans and non-humans who dwell in it. With regards to teaching, Naveh concludes, "it's not just that a lot of learning takes place by being with others, but also that knowing to be with others is seen locally as one of the main goals of learning." However, Naveh's account of Nayaka learning also illustrates a theme in hunter-gatherer culture identified by Woodburn (1982): the Nayaka tell Naveh that a major reason they seek *budi* is "to live one's life without being dependent on others…". Woodburn (1982) regards a lack of dependence on specific others as central to maintaining egalitarianism. As long as everyone can, theoretically, live without others, no one can hold authority over another. Naveh's work, similar to Omura's discussion of teasing, illustrates a social mechanism by which hunter-gatherer values of togetherness and autonomy structure how children learn and how these values are socialized simultaneously through a specific pattern of social and individual learning. For the Nayaka, we see again how direct, top-down instruction is seen as antithetical to core hunter-gatherer values and autonomous learning essential to them.

Among the Batek hunter-gatherers of Southeast Asia, Lye (2004) echoes the idea that many of the features of the forager culturally constructed niche would enhance individual and observational learning and decrease the need for teaching. She proposes that the Batek learning process is best described as *embodiment* as opposed to what we commonly call learning — that is, as a largely intellectual endeavor. For example, she notes that children in play freely move about camps, "in the interstices between adult spaces. All of this has vast implications for what the children come to know *accidentally* and what they come to assimilate perceptually about movement, place, and environmental change". Later in adolescence, young hunters may "select their teachers for themselves", but much of what they learn is through listening to hunting stories and then practicing themselves. Yet, Lye is clear that parents are involved in regulating children's behavior: Batek parents signal "to the children at all times what they can and cannot, should and should not do." Thus, in this case, "sustained teaching" is reserved for the domains of social and ritual norms.

Takada (2016) also does not rule out instruction as a hunter-gatherer process of social learning, but argues that it occurs at the level of actions, not the level of institutions as among stratified cultures. He sees hunter-gatherer social learning processes as occurring largely through situated learning (Lave and Wenger 1991; Rogoff et al. 2003) where not only the domain of learning but the nature of the specific social interaction is what causes learning. He gives the example of a young girl learning to dance among G|ui/G||ana of the Central Kalahari. In a scene he video recorded and analyzed, a toddler watched adolescent girls dancing and began to imitate them. The older girls encouraged her participation through positive feedback and then gave instructions to the younger girl. He notes that in this case, the instructions guided her through the culturally constructed dance script—a general cultural model of the performance—and did not specify every move, since an essential part of the dance is improvisation. Thus, Takada's microanalysis demonstrates in the most fine grain common features of hunter-gatherer teaching: While simple and brief, the girls teaching served to perpetuate the flow of social interaction (togetherness) and facilitated situated learning of a typical social/ritual action: individualized participation in a shared joyful experience (Lewis 2016).

Hewlett (2015) conducted the final ethnographic study that tends to de-emphasize the importance of teaching. Hewlett was interested in how the Chabu hunter-gatherers of Southwest Ethiopia conceived of social learning and asked 5 men and 5 women to list the ways they learned 6 key gender-linked subsistence skills. The salience score (a score closer to 1.0 means greater salience and more likely to be listed at the top of their list) for watching (*yé*) was above .90 for both men and women, followed by scores of .33 (men) and .23 (women) for practicing (*doya*), and scores of .19 (men) and .10 (women) for receiving advice (*itote*). The indigenous views of social learning among the Chabu were somewhat consonant with the ethnographic studies mentioned above in that they emphasized the importance of observing and practicing/participating in order to learn skills and knowledge. Teaching (advice) was listed and recognized but it is not viewed as important as the other processes.

4 Teaching is a Process of Social Learning in Hunter-Gatherers

4.1 Cross-Cultural Studies

Kruger and Tomasello (1996) conducted one of the first cross-cultural surveys of teaching. Their sample included but was not limited to hunter-gatherers. It is not clear how they selected their sample ("we surveyed the anthropological literature for several human societies" (1996, p. 377). They distinguish two types of teaching: guided learning (learning that needs scaffolding assistance) and designed learning (learning that needs direct instruction). They also describe what they call expected learning, where adults expect children to learn on their own but are prepared to one type of teaching or the other if needed. They use a definition for teaching that is different from the one described above: "a behavior in which one animal intends that another learn some skill or acquire some bit of information or knowledge that it did not have previously" (1996, p. 374). These researchers are particularly interested in shared intentionality and "theory of mind" and consequently include an intentional component in their definition. This definition implies that teaching may not exist in non-human animals because only species with this cognitive ability can teach. This paper is piece of a larger argument that teaching is one side of cultural learning in humans (Tomasello et al. 1993). Consistent with the cultural niche construction view, they argue that much learning occurs by individual experiences with the physical environment and everyday practices around which they are raised (that is, *habitus*, in the sense of Bourdieu 1977). Yet, certain human knowledge and abilities are only transmissible via cultural learning. In support of their argument, their survey concludes that teaching is part of human nature and that some form of teaching exists in all cultures.

A recent systematic cross-cultural study by Garfield et al. (2016) used the electronic Human Relations Area Files (eHRAF), a searchable, digitized database of ethnographic literature, to conduct a systematic survey of social learning in 23 hunter-gatherer groups from all parts of the world. They used the working definition of teaching mentioned at the start of this paper. Their search produced 146 relevant ethnographic descriptions of social learning from 77 different references. Teaching was very commonly described in the ethnographic texts as a method of cultural transmission, accounting for 58% of their data. Observation and imitation was the second most commonly mentioned process,

found in only 22% of the passages. Teaching was used to transmit a broad range of domains (Table 1). The commonly mentioned domains taught included "Cultural Values and Kinship," "Manufacture (non-subsistence)," and "Religious Beliefs and Practices." Stories, not mentioned in the above research, were categorized as a method of teaching if the story provided specific information about skills, knowledge, or religious beliefs.

Garfield and colleague's study shows that when looking across domains there is a trend for descriptive ethnographers to mention teaching as an important social learning process among hunter-gatherers. This study directly refutes—quantitatively—the conclusion of others that teaching is a cultural product of Western stratified cultures and is therefore of no importance among hunter-gatherers, including those using the same or similar ethnographic literature in their surveys (Lancy 2010, 2012, 2016). It is also consistent with Kruger and Tomasello (1996) in showing, in this case more systematically, that a broader view of teaching as more than formal instruction reveals its universality.

Finally, Scalise Sugiyama (2017) argues that storytelling among hunter-gatherers has been a neglected piece of evidence supporting Csibra and Gergely's (Csibra and Gergely 2011; Gergely and Csibra 2006) natural pedagogy hypothesis and a critical type of teaching in these groups. In her survey of the literature, she presents substantial evidence that hunter-gatherer storytelling involves extensive ostensive cues and conveys generalizable knowledge, the two criteria for natural pedagogy. For example, storytelling involves direct eye-gaze toward the audience, modified prosody, inclusion of singing, changes to timbre, body language, redundancy, and specific settings – all of which mark the storytelling as a teaching context. Typically recounted stories also tend to focus on "recurrent problems of forager life" (6). That is, they convey generalizable knowledge about themes such as warfare, ecological knowledge, and topographical information. Far from being casual or recreational forms of communication, she argues that storytelling is a serious and critical teaching method among hunter-gatherers.

4.2 Descriptive Ethnographic Studies

Several clear ethnographic descriptions of teaching in hunter-gatherers exist but we limit this section to four cases. First, in a chapter titled "Teaching Social Relations to

Table 1 Summary of percent of ethnographic texts in eHRAF with data on social learning that mention teaching as a method of transmission for different domains (Garfield et al. 2016)

Domain (total # of passages evaluated)	Teaching: General	Teaching: Stories	Teaching: Demonstration
Subsistence skills and knowledge (82)	28%	16%	2%
Religious beliefs and practices (30)	43%	10%	20%
Language (3)	67%	0%	0%
Ecology (14)	21%	21%	29%
Miscellaneous skills (25)	24%	28%	0%
Manufacture (28)	46%	7%	0%
Cultural values and kinship (36)	58%	0%	17%
Totals	37%	12%	8%

Inuit Children," Guemple (1988) describes "regular learning sessions" (138) during which parents will hold their infant and point to other members of the family all gathered in the dwelling and ask, "Where is x?", where x might be the term for "paternal aunt," for example. The young child is expected to respond with the appropriate term for their kinship relationship to the individual indicated, including fictive kin, until they can name the whole group, which they typically do by fourteen to eighteen months of "training." This process involves the whole group and has two stages of progression. First, when the parent asks, "Where is x?" the group all make eye contact with the named individual. The infant follows the group's eye gaze to arrive on the correct individual. Later, the parent might ask the infant to point at the person, and the group withholds looking at the named relative. In each stage, after a correct response, Guemple describes the group laughing and cheering in praise of the child. It is interesting to note that this is the same reference that Lancy uses above to suggest that teaching does not exist in hunter-gatherers.

The second case is teaching *hxaro* ritual gift exchange among the Kalahari !Kung San. *Hxaro* is a "system of mutual reciprocity" that is embedded within a broader regional social network that serves to distribute social resources across the highly variable Kalahari environment (Wiessner 1982, 2002). According to Wiessner, "The *hxaro* relationship involves a balanced, delayed exchange of gifts, whose continuous flow gives both partners information about the underlying status of the relationship – one of a bond of friendship accompanied by mutual reciprocity and access to resources" (66). In Wiessner's sample, the mean number of *hxaro* partners for an age category ranged from 10 to as many as 24, with the adults with mature children having the most. About half of a person's *hxaro* partners are kin, whereas the other half are of uncertain genealogical relationship, and !Kung make regular visits to the communities of their *hxaro* partners. Thus, these partnerships extend quite broadly the range of social resources available, and thus are socialized early and directly. By very early in life—six weeks to six months—children are brought into the *hxaro* system by receiving gifts from their grandmothers, and then others. A mother might cultivate certain partnerships by returning the *hxaro* for their child. Subsequently,

> Symbolic training for *hxaro* begins between six months and one year, when the grandmother cuts off the child's beads, washes them and puts them in the child's hand to give to a relative. She then replaces them with new ones. From this point on, whether the child agrees or not, the parents or grandparents periodically cut off the child's beads and encourage the child to give them to a grandparent, aunt, uncle or another person who takes an interest in the child. The parents continue to do so until the child does *hxaro* of its own accord, generally between the ages of five and nine. (72)

Once children are aware of *hxaro* and are at least peripheral participants, they also develop play partnerships with their peers. Again, it is worth noting that Lancy's survey mentioned above that found no evidence of teaching in hunter-gatherers included the !Kung.

A third ethnographic example of teaching in hunter-gatherers is the practice of *kaba sembe,* or "sharing plates," among the Aka and Mbendjele (collectively called BaYaka; Lewis 2002) of the Congo Basin. Among the BaYaka, food sharing during meal times typically involves a process with the following steps: 1) each household (signified by

their own hearth) prepares a meal; 2) depending on the amount of food available, a household asks others to bring a plate to their hearth; 3) food is distributed to all the plates that appear at a household's hearth; 4) and the plates are then carried back to where they came. Thus, depending on the size of camp and the amount of food (game meat is distributed more widely than vegetable foods), each family receives a portion of food from one or many more households. Children are typically called on to carry the plates and are therefore involved in steps 2 through 4 of the process. When Aka children were asked how they learned to "share," they specifically referred to involvement in the *kaba sembe*, reporting that their parents say, "Share like this" (indicating portion allotment) and "take this to so-and-so" (Boyette 2013). In this way the practice echoes the formality of teaching in learning kinship relations among the Inuit and *hxaro* exchange among the !Kung.

The final explicit ethnographic example of teaching in hunter-gatherers comes from a study of the lives of Aka women. Bonnie Hewlett (2013) asked women to teach her how to be an Aka woman. In order to show her how to make a basket, a woman sat next to her, touching her and never left her side. The woman started the basket, ripped it apart, then asked her to try it on her own. As she tried to weave, some Aka laughed and commented; after a short time, a 12-year-old girl came over, sat next to her in the same way as the adult woman, demonstrated again how to do it, and then handed it back for her to try. Hewlett was not weaving correctly so the girl took her hand and helped her weave the twine. The mother and the 12-year-old spent three weeks, hours at a time, sitting right next to Hewlett until she completed the small children's basket. Both the Aka mother and young girl had pedagogic skills, knew how to use demonstration, pointing, feedback, and scaffolding.

4.3 Observational Studies

Three recent observational studies demonstrate that teaching is present in hunter-gatherers but manifests itself in ways that reflect distinct hunter-gatherer foundational schemas. Together, they also demonstrate quantitatively a developmental trend in the nature of teaching from early through late childhood.

First, Hewlett and Roulette (2016) analyzed hour long video recordings of ten infants of between 12 and 14 months of age among the Aka of the Central African Republic. They were interested in coding any type of social learning but focused on teaching and used the definition of teaching described above. They identified nine distinct behaviors that fit the definition of teaching above (Table 2) in addition to imitation.

They used the video-recorded observations to test several hypotheses from the psychological and anthropological literature on teaching. Based on their analysis, not only does teaching exist among the Aka, but it is diverse in manifestation and was used to teach infants not only social norms as has been described in the ethnographic literature reviewed above, but critical skills such as how to dig for roots, cut food, hold a newborn, build a house, or climb a tree.

Critically, though, the teaching events observed were short; nearly half were only three seconds in duration or less. They also seldom exhibited elements previously claimed to be universal in humans based on research in stratified market economy cultures, including infant directed speech, baby talk, and face-to-face interaction between the caregiver and the baby. The authors were surprised by the relatively high frequency of teaching events during infancy (about 10 events per hour).

Table 2 Teaching behaviors observed in Hewlett and Roulette (2016)

Type of teaching	Definition
Natural pedagogy	Use of eye contact, infant's name, contingent reactivity, motherese, or pointing (i.e., ostensive cues) to draw attention to information otherwise difficult to acquire, can occur with or without demonstration.
Negative feedback	Caregivers make displeasing sounds (woo, eye) or comments when infant tries particular tasks or violates cultural norms (slap another, hit with stick).
Positive feedback	Caregivers smile or make positive sounds (eee) or comments when infant does something.
Opportunity Scaffolding/Stimulus Enhancement	Caregiver provides learning opportunity with an object (e.g., knife, machete, digging stick) without demonstration or ostensive cues
Distribution Teaching	Infant on caregiver's lap or touching caregiver's leg and the caregiver turn the infant so she/he faces others in the camp. Caregivers place infants in a position to interact and learn from others.
Demonstration	Caregiver demonstrates how to do particular task (e.g., use knife) without ostensive cues and interaction; caregiver may give infant object after demonstration; may include moving infant's body to demonstrate.
Task Assignment	Caregiver(s) gives infant task (e.g., transport something across camp).
Redirect	Infant is redirected to another location or activity by pointing or moving infant's body (e.g., take arm) because she/he slaps or threatens to slap others, does something dangerous (e.g., going into fire, tipping hot pot on fire) or inappropriate (e.g., tries to step inside mortar).
Move Body	Caregiver moves infant's body to engage in particular activity (e.g., eat). Can also co-occur with natural pedagogy, demonstration, or redirect.

Hewlett and Roulette also observed a common cultural practice they termed "distributed teaching," in which the caregiver modified his/her behavior to place the infant facing outward away from the caregiver to draw its attention to the actions of others. Distributed teaching was seen in all tapes analyzed. This form of teaching is consonant with hunter-gatherer socialization of trust in and learning from many others. In terms of learning, it optimizes the infant's view of a variety of community members who may model, demonstrate, help, correct, or provide feedback to the infant. Furthermore, caregivers would physically mold infants' actions in relation to object use, for example, which corresponds well to the general hunter-gatherer value for closeness and sharing space. This was often seen in the context of demonstration, a common form of teaching observed.

Much of what they found is consistent with Kruger and Tomasello's (1996) idea of guided learning, as they commonly involve scaffolding infant's learning in some way, though the nature of this scaffolding is not consistently clear due to the nature of the data coming from a single camera focused on the infant (e.g. in the case of distributed teaching). However, two specific predictions from developmental psychology were upheld. Pointing was used frequently, which is a behavior held by cognitive psychologists Csibra and Gergely (2009) to be unique and universal to human teaching. Additionally, educational psychologist Strauss and colleagues (Strauss et al. 2002; Strauss and Ziv 2012) have argued that teaching is a naturally developing cognitive ability in humans, and, in line with this idea, Hewlett and Roulette observed children as young as two-years-old guiding infants' learning by using ostensive cues like pointing.

Boyette and Hewlett (2017) also examine teaching in the Aka hunter-gatherers, but their sample included children from 4- to 16-years old. They applied the same operational definition of teaching and observed an overlapping but different set of behaviors fitting the definition. The variation in observed teaching can be attributed to a number of factors. Boyette conducted focal follows of 50 individual children, observing each for an average of about 4 h spread out across times of the day. The children were also older and the age range broader, capturing the role of teaching at a very different stage of the life cycle. Boyette also recorded when the focal children did the teaching in this sample.

When they were taught, negative feedback was still relatively more common than verbal or non-verbal instruction among these older Aka children, and manifested in exactly the same way as among the infants (e.g. brief vocalization such as "eye!" or "oh!"). Negative feedback tended to be directed at breaches of social norms, such as not sharing or being aggressive. Teasing, or rough joking, was also used across these middle childhood years, typically in response to selfishness, fearfulness, or failures of physical or social skill, as is common among hunter-gatherers more generally and across the life course (Briggs 1991; Lee 2013; Wiessner 2002). However, other behaviors observed among the older Aka children were more particular to their level of experience.

For example, Hewlett and Roulette's categories of "Task Assignment" and "Opportunity Scaffolding/Stimulus Enhancement" were captured in a broader category of teaching behavior called "Commands." As implied, this form of teaching involved a verbal directive, usually to do small tasks but also at times to perform subsistence work, share or become involved in social activities. This was by far the most common type of teaching reported in Boyette and Hewlett (2017). While with this measure the authors could not rule out instances that were possibly "by-products" of fulfilling the needs of the "teacher" (e.g. bringing them a cup of water), commanding children to perform a variety of activities is a potentially rich learning experience.

Indeed, the authors argue that teaching via commands can be thought of as "demand cooperation," in which opportunities for learning experiences are circulated in the community analogous to how food and materials are circulated by the practice of demand sharing. Teaching by commands is unique from other forms in that it requires both complex language and prosociality (willingness to cooperate) from the learner to carry out what is asked. In this way, "demand cooperation" presents an opportunity to learn individually what is being asked and serves to inculcate a cooperative mindset. Of course, among the Aka, no one is ever coerced to carry out a command, thus an interpretation of these data is that children are being given frequent opportunities to consider the relationship between cooperation and autonomy in specific activity-relationship contexts (see also Endicott 2011; Myers 1986).

As expected from prior ethnographic work, verbal and non-verbal instruction from adults was less common than negative feedback—and significantly less common among the Aka than among a comparative sample of Ngandu farmer children—and tended to pertain to subsistence work or traditional ecological knowledge. Interestingly, there was no difference in mean frequency at which the Aka children received instruction from adults versus other children, which is consistent with the absence of a hierarchy of knowledge that Lewis (2016) ties to egalitarianism. As further evidence, among the hierarchical Ngandu, adults were significantly more likely to give instruction.

The focal Aka children also taught other children, as expected, and the types of teaching observed were of the same relative frequencies as among the adults: Commands were most common, followed by negative feedback, then instruction (positive feedback was also recorded but only seen twice across both adult and child teachers). Children tended to teach those younger than themselves, suggesting they were aware of the level of knowledge of those they taught. Such sensitivity is proposed as a part of a universal human teaching cognition (Kruger and Tomasello 1996; Strauss and Ziv 2012).

Finally, Dira and Hewlett (2016) studied teaching in the context of learning to spear hunt among the Chabu foragers of SW Ethiopia. Dira's fieldwork included informal interviews about learning to hunt and focal follows of adolescent males on hunting trips. In coding observations and in analyzing interview data, they used the definition of teaching described in the introduction, though exact categories of individual behaviors were adjusted to the ethnographic context and age group under study. Many of the forms of teaching seen among the Aka were observed among the Chabu. Interestingly, "verbal instruction" was the most frequently observed type of teaching during focal follows of hunts. While this contrasts with Boyette and Hewlett's finding that verbal instruction was rare overall, the use of this type of teaching during adolescents learning to spear hunt is consistent with Boyette and Hewlett's reporting that direct instruction (both verbal and non-verbal, and by adults and children) was most often used in the domains of complex ecological knowledge or subsistence skills. It is also well established that hunting skill in particular is very complex and takes a long time to learn and males do not begin serious training until adolescence (Gurven et al. 2006).

Dira and Hewlett also found that Chabu adolescents were autonomous in their choice of hunting partners (and therefore occasional teachers), and chose other men (e.g. their father, mother's brother, friends, or other) for a variety of reasons centered around the adolescents' trust of the person or their hunting knowledge. On the hunting trips, other less frequent forms of teaching were also observed, including teasing in ways similar to what was observed for the children in middle childhood in Boyette and Hewlett (e.g. for not knowing the correct direction to go on a trail). Opportunity scaffolding as described by Hewlett and Roulette was also observed when men would provide boys with spears or give them the opportunity to practice killing game. Men would also demonstrate the use of spears and explain the meaning of different animal tracts.

In summary, this limited number of observational studies provide a preliminary picture of hunter-gatherer teaching: First, an early concentration of relatively frequent teaching of skills involving demonstration, close manipulation of infants' use of objects, task assignment, and direction of infants' attention away from parents toward other potential teachers in the community, as well as negative feedback to shape social behavior; Second, demonstration and other forms disappear, but with the transition to middle childhood comes the use of directive language (e.g. commands) to provide learning opportunities via "demand cooperation," continued use of negative feedback and teasing in response to breaches of social norms, and some use of direct instruction in technical and ecological domains; Third, teaching becomes more focused on complex gender specific subsistence activities, such as hunting or basket making, where direct instruction becomes more important with other types of teaching integrated throughout informal "lessons" (e.g. hunting trips), such as demonstration, opportunity scaffolding, and teasing.

5 Adolescent Initiation

Researchers have not systematically examined the roles of teaching in adolescent initiation ceremonies, and these important events also tend to be ignored by those arguing against the universality of teaching (Lancy 2010; Rogoff et al. 2003), but there is good reason to believe that teaching occurs in this context. About 60% of hunter-gatherers have initiation ceremonies and hunter-gatherers are likely to have these ceremonies for both males and females (Schlegel and Barry 1991). Hunter-gatherers acquire more complex subsistence and social-religious knowledge starting in adolescence. Hewlett and Cavalli-Sforza (1986) found that most subsistence skills among the Aka were learned by age 10, but mating skills, how to hunt large game, and knowledge about special protective and curative medicines and core cultural beliefs about the supernatural began to be acquired in adolescence. Various forms of teaching are utilized to transmit several of these more complex skills and knowledge during Aka male and female initiation ceremonies. Ethnographic accounts of teaching during adolescent initiation exist in several of other hunter-gatherer groups and we provide three examples below.

Among the Tiwi of Australia:

> During his initiation period a youth spent long intervals isolated in the bush with a couple of older teachers from whom he received training in religious and ritual matters. At the same time, of course, it was inevitable that the novice absorb some of the older men's experience in bushcraft. (Hart and Pilling 1960, p. 49)

Among the Ona of South America:

> All young men in the old days had to pass through a period of initiation lasting for about two years. For several weeks the novitiate was brought frequently to the initiation lodge, where he was terrified by masked men representing various spirits. Here also he was instructed in tribal lore and inculcated with all manly virtues, while he had to prove indifference to pain by allowing wood splinters thrust in his arm to burn themselves out against his flesh. Finally, when deemed fit for manhood, the true nature of the spirits that had terrified him were revealed, after he had been sworn to secrecy especially as regards the women and children, who were terrified at intervals by the masked apparitions. (Lothrop 1978, p. 92)

Among the San of Southern Africa:

> When the tattooing is completed, the girl's mother takes her by the hand and gently leads her out of the seclusion hut. She holds to her daughter's forehead one after another of the food plants available at the time, pronounces the name of the plant and tells her daughter its uses and virtues. Then, stretching her arm out and pointing around the horizon, she introduces the band territory to her daughter. "This is the country of all of us, and of you; you will always find food here" (which also has the connotation of "you will always be at home here"). The girls and young women in attendance then run the girl through a symbolic shower of rain, which, apart from being intended to ensure that she does not suffer drought

in her life, associates her with the life-force of rain. This is not symbolic of fertility as such but of a wider view of life, which includes survival. (Silberbauer 1981, p. 152)

6 Summary, Discussion and Conclusion

The evidence above permits some generalizations concerning teaching among hunter-gatherers.

1) Cross-cultural, ethnographic, and observational data indicate that teaching exists among hunter-gatherers.
2) Teaching is used to transmit a large range of skills, knowledge and highly valued cultural norms and values.
3) Teachers use a broad range of methods, including pointing, demonstrating, verbal explanation and stories, negative and positive reinforcement, task allocation, opportunity scaffolding, moving a child's body, commands, and so on.
4) The limited number of studies that exist suggest that the frequency of teaching is U-shaped. Among the Aka, it is particularly common in infancy (about 10 events/h) when the infants are held all day and not walking, it declines substantially in middle childhood (about 2–3 events per day) when children spend most of the day learning collaboratively with other children, and then increases somewhat again in adolescence when they begin to learn complex or culturally valued skills and knowledge such as tool manufacture (baskets, cross-bow), ritual and religious knowledge, skills and knowledge to hunt large game, and specialized healing knowledge. Teaching is frequently used in formal initiation ceremonies to transmit these complex or culturally valued skills and knowledge in adolescence.
5) Teaching exists, but ethnographic and observational data indicate that many other processes of social learning, including observation and imitation and participation in adult activities, are substantially more common than teaching.
6) Hunter-gatherer foundational cultural schemas of autonomy and egalitarianism impact the nature of teaching. Adults and older children limit their interventions and teaching episodes are generally brief, subtle, indirect, and typically at the level of actions and in the context of specific activities in which learners are already participating.
7) Direct verbal instruction is relatively infrequent, but it does occur, both:
    a. spontaneously in the context of subsistence (e.g. hunting, gathering) and non-subsistence skills (e.g. manufacturing, dance), and traditional ecological knowledge;
    b. and in the domains of sharing and ritual knowledge.
8) Throughout childhood, ambiguous types of teaching such as negative feedback and teasing serve to encourage individual learning about social norms and values.
9) Children begin to teach early, from as young as two, and are equal to adults in their contribution to teaching other, especially younger, children during middle childhood.

6.1 Complimentary of Approaches

Researchers who emphasize that teaching is absent or rare in hunter-gatherers often identify a few contexts where it does exist, while scholars that describe multiple contexts of teaching in hunter-gatherers also demonstrate that several other learning processes, such as observation and participation, are as or much more common than teaching. Lancy's work reminds us that children around the world from all types of societies do not need classrooms or helicopter parents who regularly intervene (teach) in their children's lives, to learn important skills and knowledge. The works of Lewis, Omura, and Naveh illustrate indigenous views of learning as well as how the hunter-gatherer cultural values of autonomy and egalitarianism influence teaching. The systematic observational studies provide detailed precision as to the frequency and nature of the different forms of teaching in hunter-gather childhoods.

However, limitations exist with the various approaches. Lancy does not see teaching in the cross-cultural ethnographic in part because of his Western biased conceptions of teaching. He selects direct quotes from ethnographies in two hunting-gathering cultures, the Inuit and !Kung, to support his hypothesis that teaching does not exist, but other direct quotes from the very same ethnographic studies are used in this paper to demonstrate that teaching, as defined in this paper, does exist. Descriptive ethnographic studies provided a rich understanding of the contexts of teaching and learning but do not systematically define or focus on a particular topic or age range of children so they often miss subtle and rapid teaching events and interactions. Observational studies offer quantitative age-specific precision about various types of teaching but do not provide information about how foundational cultural schema or cultural institutions impact the observed patterns. Multiple perspectives are useful and provide an integrative and more holistic perspective on teaching, but substantially more work is needed to develop a consensus definition of teaching as well as a taxonomy of teaching that identifies common types of teaching at different ages that could be used in cross-cultural, ethnographic, and observational studies. For example, the frameworks of Kruger and Tomasello (1996) identifies two major types of teaching, but would require substantial ethnographic background for use in observational research to delineate what is a more or less complex or valued task, for example. Alternatively, the much more detailed ethogram approach of Kline (2015, 2016) is more objective and broadly applicable, although it is still intended to be grounded in ethnographic knowledge of teaching and learning.

6.2 Hunter-Gatherers and the Evolution of Teaching

We believe the diverse forms hunter-gatherer evidence support the view that teaching is an early developing cognitive ability in humans and a fundamental process responsible for human cultural transmission and evolution (Csibra and Gergely 2011; Strauss and Ziv 2012), and refutes the perspective that teaching is a process of social learning that emerged with the advent of formalized schooling in the West and, therefore, is not a universal, evolved feature of the psychology of human learning (Lancy 2010, 2016; Rogoff 2011).

We strongly agree that a long history of anthropological work, from the earliest work of such important figures as Mead (1928, 1964, 1970), Meyer-Fortes (1970), Firth (1970) and others, has established that observation and peripheral participation are

more common forms of learning in small-scale societies than is teaching of any type (see Boyette and Hewlett 2017 for a recent empirical account). Indeed, we argue the access to learning by observation, imitation, and participation is even greater among hunter-gatherers than farmers. However, since teaching may not occur daily, like it does for most children in the developed world, does not mean that it is unimportant among hunter-gatherers or any human society—or any species for that matter.

For instance, Fogarty et al. (2011) developed and analyzed a mathematical model of the evolution of teaching where teaching was defined simply as a trait that increased the probability of learning a piece of information but with added costs over learning individually or learning "inadvertently" from interaction with other individuals with the information (e.g. through observation and imitation). The costs represent possessing the cognitive hardware to teach and spending the time to teach. Their analysis indicated that teaching evolves in situations where the information is not too easy to acquire by other means but not too difficult to acquire such that most members of the population do not have the information. Furthermore, teaching is nearly always favored where learning a second trait dependent upon learning the first further increases fitness—that is, in a cumulative culture context.

The major implications of their analysis for our understanding of teaching in humans are: 1) teaching *should be rare across the natural world*, but 2) teaching would have been highly favored for information transfer in a species like ours that forages in groups (many people will have access to the information) and targets hard to extract natural resources (extraction techniques difficult to learn on one's own). As a result, 3) teaching would co-evolve with cumulative culture, which has deep routes in our evolutionary line (Enquist et al. 2011). Other modeling studies show that even very basic teaching behaviors, such as providing the kind of feedback noted often in the hunter-gatherer studies reviewed above, can get cumulative culture started (Castro and Toro 2004). It follows that the co-evolutionary process between culture and teaching makes possible cultural populations where teaching is relatively more rare than other social learning processes, as it may be among small-scale societies and especially hunter-gatherers, or relatively common as it is in socially and economically stratified cultures. This is the result of cultural niche construction.

Teaching is relatively rare in hunter-gatherers, in part, because knowledge is widely distributed across the social and physical landscape. People live in small, intimate groups that can support each other's learning in a variety of ways without teaching, including providing access to where much knowledge has been built into the environment (e.g. material culture). On the other hand, as Mead, Lancy, Rogoff, and others have pointed out, the complexity, scale and stratification of industrialized and post-industrial societies, their vast degree of specialization of knowledge, and separation of the centers of cultural reproduction ("work") from those of reproduction ("home") makes extensive direct instruction in a wide range of knowledge, skill, cultural or sub-cultural norms necessary for children to become competent adults. One can imagine the changes in population size and density that began to shape populations of complex hunter-gatherers and early farmers, and led to the emergence of social and economic stratification, also required increasing degrees of teaching dependent upon the distribution of specialized cultural knowledge. Such cultural niche construction would not necessarily decrease the importance of brief and subtle types of situated learning and teaching in more complex societies, but would rather increase the value of more formal types of instructed learning as a greater diversity of knowledge becomes esoteric.

Those who agree that teaching is a universal social learning process in humans still debate how it arose. For example, some argue teaching was necessary for high fidelity transmission of opaque information about the use and construction of complex tools (Csibra and Gergely 2011). On the other hand, Moore (2017) points out that reverse engineering may have been enough to ensure high fidelity replication of the first complex tools without teaching, but that would not have been the case with language or social norms—the arbitrary nature of which requires high fidelity transmission by other means. Indeed, our review revealed ethnographic and observational evidence that the most commonly observed and relatively low cost forms of teaching are used to transmit social norms (e.g. feedback, teasing, redirecting infants). Thus, we believe this evidence tends to support the view that humans have evolved to occupy a cultural or a socio-cognitive niche where having the cultural means for cooperation and communication were what set us apart from our ancestors (Boyd et al. 2011; Sterelny 2007, 2012a; Whiten and Erdal 2012). We are unique in the degree that we cooperate in food production and sharing, in childcare, and in the distribution of information (Sterelny 2012b). Teaching may have been central to the latter, and subsequently contributed greatly to the co-evolution of the other facets of human uniqueness (see also Hill et al. 2009).

6.3 Conclusion

We have reviewed the state of knowledge about teaching among hunter-gatherers and argued that it has its essential place in the transmission of culture. The pattern of hunter-gatherer teaching also illuminates the role of foundational cultural schema and cultural niche construction in shaping learning contexts across all human cultures and types of societies. It is a weakness of current science that those researchers who claim teaching is a natural human cognitive ability only study children from Western stratified cultures. The current paper expands our knowledge of teaching as a universal that has — with many aspects of the human mind—co-evolved with culture. Hopefully, we can now put to rest the notion that teaching is absent in some cultures and instead push further and wider to grasp the nature of our learning as a biocultural object of study.

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