



# Ecological and Developmental Perspectives on Social Learning

## Introduction to the Special Issue

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### Abstract

In this special issue of *Human Nature* we explore the possible adaptive links between teaching and learning during childhood, and we aim to expand the dialogue on the ways in which the social sciences, and in particular current anthropological research, may better inform our shifting understanding of how these processes vary in different social and ecological environments. Despite the cross-disciplinary trend toward incorporating more behavioral and cognitive data outside of postindustrial state societies, much of the published cross-cultural data is presented as stand-alone population-level studies, making it challenging to extrapolate trends or incorporate both ecological and developmental perspectives. Here, contributors explore how human life history, ecological experience, cumulative culture, and ethnolinguistics impact social learning and child development in foraging and transitioning societies around the world. Using historical ethnographic data and qualitative and quantitative data from studies with contemporary populations, authors interrogate the array of factors that likely interact with cognitive development and learning. They provide contributions that explore the unique environmental, social, and cultural conditions that characterize such populations, offering key insights into processes of social learning, adaptive learning responses, and culture change. This series of articles demonstrates that children are taught culturally and environmentally salient skills in myriad ways, ranging from institutionalized instruction to brief, nuanced, and indirect instruction. Our hope is that this collection stimulates more research on the evolutionary and developmental implications associated with teaching and learning among humans.

**Keywords** Childhood · Child development · Social learning · Foragers · Transitioning populations · Teaching

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Our current understanding of teaching and learning is largely based on research conducted among the less than 15% of the world's population that live in economically and politically stratified societies with formal education systems and a high degree of market integration (Gurven, 2018; Henrich et al., 2010). In these large-scale postindustrial state societies, the social and physical environments encountered by children growing up have been shaped by heretofore historically unknown institutions and technologies. The question, then, of how teaching and learning might differ in small-scale nonindustrial societies is an empirical one that has been gaining momentum across anthropology, psychology, and cognitive science for decades (Lancy, 2010; Mesoudi et al., 2015; Rogoff, 2003; Tehrani & Collard, 2009; Whiting & Whiting, 1975). To add to this growing body of literature, we focus our attention on how variation in social and ecological conditions may influence how, what, when, and from whom children learn.

The very definition of “teaching” can be challenging (if not impossible) to operationalize across disciplines or perspectives. For the sake of our argument here, we provide the following working definition, based on the definition developed by Caro and Hauser (1992) and modified by Hewlett and Roulette (2016): “Teaching is when an individual modifies their behavior to enhance learning in another and the behavior is not a by-product of another activity.”

We do not discuss teaching across the animal kingdom, given space constraints and the fact that our expertise lies outside of such comparisons. We focus our discussion, rather, on the long-standing debate as to whether or not teaching exists in small-scale societies. Some scholars who study pedagogy define “teaching” in a more structured way (see Lancy, 2016); others define it along the lines of the above offered definition (Boyette & Hewlett, 2018). Such a definition, we argue, does not assume any particular culturally constructed niche, allowing us to explore the behaviors of learners in a way that pays careful attention to the intentionality of others, variation in learning, and teaching outcomes (see Boyette & Hewlett, 2018; Gopnik, 2020; Tomasello & Carpenter, 2007; Tomasello et al., 1993). It also allows us to interrogate how teaching and learning are critical to cultural niche construction (Flynn et al., 2013; Odling-Smee et al., 2003), the process whereby the local social and ecological landscape impacts ontogenetic development and shapes the culture and biology of a group over time (Boyd et al., 2011; Henrich & McElreath, 2003). Cross-cultural examination of learning and teaching, then, is critical to increasing our understanding of the contexts (or domains) in which teaching is present and the ways in which different environments support culture learning.

Many recent cross-cultural studies have shown that the manifestation of teaching and learning is heavily influenced by formal education (Klein et al., 2010; Reyes-García et al., 2016) and market integration (Scribner & Cole, 1973), and that learning *itself* can be culturally learned (Davis et al., 2020; Mesoudi et al., 2015). Children growing up in postindustrial environments appear to learn in very predictable ways—where learning is primarily organized and overseen by adults and is conducted didactically by facilitating knowledge acquisition through explicit instruction (Morelli et al., 2003; Rogoff et al., 2007). In contrast, data collected among small-scale societies suggests that learning in these environments is characterized by far less adult-to-child, directed instruction (Hewlett, 2016; Hewlett et al., 2011; Kline et al., 2013; Lew-Levy et al., 2017) and is

likely dependent on cultural circumstances or socialization practices (Corriveau et al., 2014; Lew-Levy et al., 2021).

Although we know that children in all societies learn the normative skills and beliefs of their communities, ethnographers have long been impressed by the vast body of ecological and technological expertise exhibited by foragers, forager-horticulturalists, and forager-pastoralists despite an apparent absence of *direct instruction* (e.g., Blurton Jones & Konner, 1976; Gould, 1969; Lee, 1966; Nelson, 1986:9), which generally implies verbal explanations. However, absence of explicit instruction is not evidence of the absence of teaching. Over the past three decades, ethologists have identified an array of behavioral strategies that appear to subserve knowledge transmission (e.g., Byrne & Byrne, 1995; Laland, 2004), which has been instrumental in the development of teaching taxonomies (e.g., Hewlett & Roulette, 2016; Kline, 2015; Strauss et al., 2002). Other studies have documented a range of different teaching behaviors that occur in extant and past forager groups (e.g., Garfield et al., 2016; Hewlett & Roulette, 2016; Scalise Sugiyama et al., 2020a; Tehrani & Riede, 2008).

A complementary line of research has sought to elucidate the demographic pathways of knowledge transmission (e.g., Hewlett & Cavalli-Sforza, 1986; Ohmagari & Berkes, 1997) and the cognitive processes that guide attention (e.g., Csibra & Gergely, 2006) and imitation (e.g., Boyd & Richerson, 2005; Gergely et al., 2002; Henrich & Broesch, 2011) in the transmission process. During childhood, for example, the extended and focused observation of others (Lancy, 2014; Odden & Rochat, 2004), imitation (Lew-Levy et al., 2018), and child-child play activities (Lancy, 2016) occur during the same developmental periods when children are establishing themselves within gendered labor niches (Crognier et al., 2002; Hames & Draper, 2004) and learning both emotional regulation and social independence (Edwards & Whiting, 1980; Moller et al., 1992). Although these efforts have gone a long way toward mapping the cognitive and behavioral landscape of cultural transmission, debates and questions persist (e.g., Claidière & Sperber, 2010; Tennie et al., 2009), and reconciling these issues remains challenging—both within and across disciplines. Data collected from a wide variety of subsistence-based economies are thus valuable and will afford us a better understanding of how processes of learning and teaching play out in the absence of formal institutionalized settings across ecologies. In this special issue, contributors explore the role of teaching, other forms of social learning, and individual environmental experiences from a wide variety of perspectives, using different methodologies across various populations. Despite geographic, methodological, and temporal differences, all of the studies converge on a central premise: learning and teaching are influenced by myriad factors, including ecological and social settings, childcare practices, peer interactions, and existing cultural norms. Below, we briefly discuss their findings in terms of three broad themes: (1) life history, (2) ecology, and (3) cumulative culture and social learning.

## Life History and Learning

It is argued that, in contrast to other great apes, the prolonged period of early human development functions to provide children with the time needed to learn, develop, and acquire culturally relevant knowledge from their social group (Bruner, 1972;

Kaplan & Robson, 2002; Konner, 2010; Kuzawa & Bragg, 2012; Meehan & Crittenden, 2016; Tomasello & Carpenter, 2007). This is further evidenced across the animal kingdom, where there is a documented correlation between the length of cognitive and physical immaturity, relative brain size, and a dependence on learning (Bennett & Harvey, 1985; Bogin & Smith, 1996). Aspects of human life history and cognition, such as our long childhood and extensive use of teaching, theoretically evolved to facilitate the acquisition of complex tasks. As Sterelny (2011:810) argues, this depends not only on cognitive adaptations that enable social learning, but also on “developmental niche construction”—that is, the creation and maintenance of a suitable learning environment. On this view, learning environments can include activities (e.g., hauling water, gathering firewood, childcare) in which learners make valuable contributions to their community while they are learning.

This idea is explored by the contribution of Lew-Levy and colleagues (Lew-Levy et al., 2021), who empirically examined the relationship between difficulty of subsistence task, age of acquisition, rate of teaching, and rate of oblique transmission among a large sample of forager children among BaYaka residing in the Congo and Hadza residing in Tanzania. Children in each society contribute to the food economies of their households—in different ecologies with different target resources. The study found that although same-sex transmission was normative in both societies, BaYaka transmission tended to be more female-biased whereas Hadza transmission was more male-biased. They argue that this difference is largely tethered to the strong cultural precedents (i.e., less flexibility) in the sexual division of labor found among the Hadza—a finding replicated by Crittenden et al. (2021). They go on to argue that the BaYaka are more likely to report learning via teaching, compared with the Hadza (who reported more learning via observation), possibly due to differences in socialization practices and camp formation (i.e., relative opportunity for observation in rainforest versus grassland ecosystems). Their findings underscore the significance of treating the processes of teaching and learning as part of niche construction.

Extending the discussion of sex differences, Schniter and colleagues (Schniter et al., 2021) explore the acquisition of ethnobiological knowledge among Choyeros, a pastoralist population residing in rural Mexico. Using a culturally relevant ethnobiological knowledge assessment tool, they found that knowledge of hazardous and edible substances is mastered by early adulthood, but that acquisition of more esoteric ethnobotanical knowledge—linked to sex- and age-specific labor domains—continues well into middle age. Their finding that the most knowledgeable individuals in this regard are postreproductive suggests that some of the distinctive life history and cooperative breeding patterns exhibited by humans may be understood, in part, in terms of strategies aimed at maximizing knowledge acquisition and provisioning across the lifespan.

The relationship between cooperative breeding and knowledge acquisition is also explored by Kramer (2021), who demonstrates that children are simultaneously both producers and consumers. In her analyses of demographic, time allocation, and food return data among Savanna Pumé foragers in Venezuela, she finds evidence to suggest that children are key contributors. They care for their siblings, contribute to the economy, learn by doing rather than by instruction, and spend their time largely

in the company of other children. Thus, in contrast to industrialized contexts, children in small-scale, subsistence-level societies spend much of their time in the company of mixed-age and -sex groups of children, teaching and learning experientially from each other (Hewlett et al., 2011) with little adult direction (Cristia et al., 2019). Kramer concludes that these data underscore the significance of how children learning from other children can function to develop cooperation—a key adaptation of our species.

## Ecological Variation and Learning

One of humanity's central adaptations is our ability to inhabit diverse ecological and social niches, and childhood may operate as a component of our unique life history, allowing children extended opportunities to learn from others and adapt to a diverse array of environments (Boyd et al., 2011). How children live and navigate within and around their community, and the complexity of the environment where they spend their time, should then affect how and what children learn (Davis & Cashdan, 2019; Kleinfeld, 1971). However, both the exogenous restrictions imposed by the environment itself (Kelly, 1983) and the ways in which children engage with their surroundings while growing up are influenced by the expectations and limitations set by cultural norms and parental decisions (Bock, 2002; Davis & Cashdan, 2020; Super & Harkness, 1986).

In some societies, children begin food identification and collection at relatively young ages and can make substantial contributions to their subsistence (Bird & Bliege Bird, 2005; Bliege Bird & Bird, 2002; Crittenden et al., 2013; Froehle et al., 2019; Tucker & Young, 2017). These high return rates, however, tend to occur under ecological conditions that do not demand extensive skill or knowledge—for example, when easily extracted resources are targeted, when risk of predation or other environmental hazards is low, or when travel distances are short and navigation is straightforward (Blurton Jones et al., 1994; Scalise Sugiyama & Sugiyama, 2011). As a result, and with a few notable exceptions (Quinlan et al., 2016; Reyes-García et al., 2009), the question of how ecological knowledge is acquired has gone largely unexplored using evolutionary theory.

Using distinct approaches, McNamara and Wertz (2021), Crittenden and colleagues (Crittenden et al., 2021) and Davis and colleagues (Davis et al., 2021) each focus their attention on the links between environmental experiences and learning in childhood. Using interviews with parents and children and a time-to-touch experiment on avoidance behaviors, McNamara and Wertz (2021) explore the acquisition of plant knowledge among Indigenous Fijian infants and young children whose community subsists by horticulture. They argue that some explicit knowledge acquisition begins early in childhood, before the age of 3, and that cultural context is key—as it flexibly shapes the development of ecologically relevant cognition required for age- and sex-specific tasks. It is the flexible nature of these cognitive processes that likely allow children to openly learn new information about their surroundings and function competently under

a multitude of conditions during development (Amir et al., 2020; Ellis et al., 2017; Gopnik et al., 2017) and across the lifespan (Pope et al., 2019).

To successfully navigate and thrive in any environment requires an ability to recognize and avoid unnecessary risks. Actively avoiding environmental dangers—as perceived both by children and by their parents—may have profound effects on spatial exploration and mobility more generally. Crittenden and colleagues thus explore the relationship between harm avoidance and mobility among Hadza foragers, oft-overlooked aspects of ecological knowledge in hunting and gathering communities. Their robust exploratory study analyzed data on average daily distance traveled by young children and adolescents and compared these with the temperament dimension of harm avoidance, measured both from parental and child perspectives. Their analysis aims to determine whether any sex differences in mobility and harm avoidance emerge, and the extent to which parental and child ideas about mobility and freedom of movement across the landscape converged. The average daily distance traveled between the sexes was similar, and few age- or sex-related patterns in harm-avoidant responses were found. The few sex differences that were present were tethered to ecological differences in physical threat encountered in sex-specific food collection tasks (i.e., hunting versus gathering). The data were characterized by a high degree of individual variation—yet children and their parents were often in alignment on their perspectives. These data underscore how important it is to evaluate the acquisition of ecological knowledge in culturally specific settings, including (in this case) communities transitioning away from foraging to a more market-integrated food economy.

Davis and colleagues (Davis et al., 2021) expand on this theme to examine whether some spatiocognitive skills are responsive to shifts in children's day-to-day mobility patterns and activities. Focusing on how physical and social settings influence learning (Rogoff et al., 2007; Super & Harkness, 1986; Whiting & Whiting, 1975), they interrogate how early environmental experiences influence the development of both large- and small-scale spatial skills during childhood. To accomplish this, they measure mobility, navigational skills, and performance on small-scale spatial skills using a series of experiments (mental rotation task, Corsi blocks task, and water-level task) among forager-pastoralist children in the Kunene region of northern Namibia. Interestingly, in contrast to previous findings among adults and parents from the same communities (Vashro et al., 2016), their findings suggest few sex differences on measures of mobility and spatial task performance. Further, children performed equally as well as adults or even outperformed them on small-scale spatial skills. The authors posit that this lack of age and sex patterning can be attributed to higher rates of schooling, which requires frequent long-distance travel and learning abstract spatial reasoning, technology, and test-taking, which provide children with vastly different day-to-day experiences when compared with the childhoods of their parents. The findings of both Crittenden et al. (2021) and Davis et al. (2021) underscore how important it is to study communities in transition.

## Cultural Transmission and Social Learning

The pathways by which children learn culturally encoded knowledge from others in their social group relies on both vertical (from adults to children) and horizontal (peer to peer) transfers of information (Cavalli-Sforza et al., 1982; McElreath & Strimling, 2008), which can operate through oblique, concerted, and other modes of transmission. Although vertical learning is assumed to be a more efficacious mode of transmission during early childhood (because it provides infants and young children easy/low-cost access to parents and the foundational knowledge of their culture), we know very little about whom children actually spend their time with as they age, and whether this varies across development and different cultural-ecological settings. Increasingly, empirical data suggest that intergenerational transmission, including horizontal transmission of knowledge and skills from child to child, is central to social learning in small-scale societies (Hewlett, 2016; Imamura & Akiyama, 2016; Lew-Levy et al., 2020; Maynard & Tovote, 2010). Broesch and colleagues (Broesch et al., 2021) expand the literature on information transmission and provide a rich cross-cultural study using naturalistic observations across five societies: Yasawas (Fiji), Tanna (Vanuatu), Tsimane (Bolivia), Huatasani (Peru), and Aka (Central African Republic; CAR). They report the proportion of time infants and young children spend with others, the ages and sexes of those individuals, and their relationship to the children being observed. They consistently note that, across populations, children under the age of 5 spend time with multiple others, but that the majority of their time is spent with one female adult. They further observe that focal attention by primary female caregivers decreases with child age, likely allowing for a shift to horizontal transmission observed in middle childhood, where around age 5 they see a clear shift toward children spending most of their time in the company of other children.

The dynamic structure of children's learning pathways maximizes their learning by shifting from acquisition of foundational cultural knowledge from adults and multiple caregivers in early childhood to learning processes that eventually promote the generation of new ideas in later childhood. As children develop, they become skilled imitators (Clegg & Legare, 2016a, 2016b) who track and adopt the skills and beliefs displayed by the majority of their social group (Corriveau et al., 2009, 2013; Haun et al., 2012; Henrich & Boyd, 1998). Whom children pay attention to, copy, and learn from varies across ecologies and cultures (Lancy, 2010; Nielsen, 2012). Although children may often rely on sources they trust (Harris & Corriveau, 2011) and/or those who demonstrate credibility-enhancing displays (Gervais et al., 2011; Henrich, 2009), prestige bias is not always demonstrated (see Garfield et al., 2016; Reyes-Garcia et al., 2008 for examples).

In an attempt to reconcile some internal inconsistencies in the ways in which the social learning literature predicts whom children are likely to learn from, Hewlett (2021) examines the transmission of cultural innovation in two hunter-gatherer communities, the Aka of southern Central African Republic and the Chabu of southwestern Ethiopia. Her findings point to the need for greater



understanding of the motivations that drive innovation, the circumstances that motivate novices to seek out innovators, and the means by which innovations are introduced into the existing corpus of collective wisdom. In each of these cases, these social learning behaviors can be culturally selected for in themselves since, if they generally lead to the copying of adaptive behavior in the future, individuals who have them will outcompete individuals who do not. Importantly, Hewlett concludes that teaching, while certainly present, is not the exclusive means of transmitting complex skills and social knowledge among these communities.

Questions regarding the *how* and *what* of children's social learning lead to one of the largest tracts of terra incognita in explorations of cultural transmission—namely, the logistics of teaching and learning. Little is known about the material means used in small-scale societies to accomplish the tasks of storing and disseminating accumulated knowledge. The overwhelming majority of human cultural transmission has been conducted in the absence of writing and permanent settlements—that is, with little in the way of durable external memory systems. This has sharply constrained the available options for storing and transmitting local knowledge. Thus, the immense volume of knowledge required for a successful adult life poses a daunting information management problem: local knowledge must be encoded, organized, stored, cross-referenced, retrieved, and disseminated in ways that are efficient and near to hand. Scalise Sugiyama (2021) explores this issue in her contribution by reviewing ethnographic descriptions of forager oral storytelling for evidence of the use of ostensive communication, a behavioral modification hypothesized to be an adaptation for transmitting generalizable knowledge. Her findings indicate that performed narrative is characterized by both the presence of generalizable (see also Garfield et al. 2016) knowledge and the widespread use of ostensive communication, suggesting that storytelling is an important means of teaching in forager societies.

## Conclusion

As noted above, there has been much debate over whether or not teaching occurs in small-scale, subsistence-level societies. This debate hinges on whether or not behaviors are modified with the intent to instruct. To revisit our definition adapted from Hewlett and Roulette (2016): “Teaching is when an individual modifies their behavior to enhance learning in another and the behavior is not a by-product of another activity.”

By this definition, we do find evidence in this special issue that teaching is demonstrated. However, there is also evidence to suggest that some types of behavioral modification, such as storytelling and the use of natural pedagogy, also enhance learning in others, though they may be done unconsciously and unintentionally. Importantly, notwithstanding the continuing debate on definition among ethologists and anthropologists, the papers in this special issue demonstrate how important cultural and ecological context are to discussions of teaching and other forms of social learning. While it might seem obvious to make such a statement, it is worth repeating that many assumptions about normative teaching and learning are based exclusively on data from postindustrial states. In the cross-cultural literature, however,



different patterns emerge with regard to what constitutes teaching and how knowledge is transmitted and acquired.

Although wide-scale cross-cultural variation does exist, some patterns in learning and teaching emerge. From a young age, children tend to learn many of the skills associated with work, childcare, decision-making, and social interaction through engagement in mixed-age, mixed-sex groups, rather than from primarily or exclusively adult-directed teaching. For many tasks, children learn by doing rather than through direct training or instruction (Paradise & Rogoff, 2009). Moreover, the ethnographic, ethnolinguistic, and archaeological records indicate that many behaviors regarded as “recreational” or “nonutilitarian” in fact subserve teaching and learning. For example, European Upper Paleolithic parietal and portable art depicts animals that were important in the local economy. Mithen (1990) presents compelling evidence that these images and the geometric marks associated with them depict cues that are instrumental to locating, tracking, and hunting game, and they argue that this body of art was used for instructional purposes. Zoological information is also transmitted through animal mimicry, which is common in storytelling (Scalise Sugiyama, 2021), dance, play, and ritual. Songs provide yet another vector of knowledge transmission. In Western Arnhem Land, for example, songs that imitated bird calls and other ambient sounds were “chanted by children playing and dancing together” (Berndt & Yunupingu, 1979:90). These songs were taught by adults to “help children learn and remember the habits of various creatures—where to find them, what kinds of food they like, what sort of noises they make” (Berndt & Yunupingu, 1979:90). This last example indicates that distinguishing adult-directed teaching from peer teaching is not necessarily a straightforward process. Ethnographic descriptions of these behaviors are a potential treasure trove of data on the learning affordances and constraints of forager life and, by extension, on the nature of developmental niche construction. Games, for example, exhibit a number of cross-cultural patterns that merit examination vis-a-vis the knowledge and skill demands of forager life (Scalise Sugiyama et al., 2020b). It is important here to distinguish between games and play. Many reliably-developing play behaviors (e.g., play fighting, chase play, object play) are hypothesized to be adaptations that help build skills needed later in the organism’s lifespan (e.g., Fagen, 1974; Symons, 1978; Tooby & Cosmides, 2001). Games, on the other hand, are cultural constructs—rules and imaginative frameworks—that are superimposed on innate play behaviors and may serve to direct them in ways that increase their pedagogical efficiency.

We use rich ethnographic examples in this special issue to demonstrate that teaching/learning in forager and other small-scale societies take a wide range of forms, and that cultural transmission follows other pathways besides adult-to-child. Increasingly, data from a wide array of societies—the present studies included—suggest that learning in diverse environments is influenced by socialization practices and environmental conditions (Corriveau et al., 2014; Lew-Levy et al., 2021) and that, across small-scale societies in particular, there is less overt adult-to-child, directed instruction (Hewlett, 2016; Hewlett et al., 2011; Kline et al., 2013; Lew-Levy et al., 2017). Standing in direct contrast to how children in postindustrial environments have been reported to learn—through explicit instruction often overseen by adults—this special issue draws attention to how critical research in foraging and

transitioning societies will increase our understanding of teaching and learning as a human adaptation. It highlights the myriad ways in which these behaviors are manifest around the world, including communities undergoing transition to more formal education. In so doing, it offers a clear opportunity to gain insight from such natural experiments, where we are coming to appreciate that forms of learning are culturally learned (Davis et al., 2020; Mesoudi et al., 2015). Studying how children learn cross-culturally, therefore, moves us one step closer to understanding the nature of culture, human life history, cognition, social behavior, adaptive learning responses, and how humans respond to culture change. Children are taught—and learn—in modes that are as diverse as the cultural and ecological environments they inhabit.

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