SOCIAL LEARNING DURING MIDDLE CHILDHOOD AMONG
AKA FORAGERS AND NGANDU FARMERS
OF THE CENTRAL AFRICAN REPUBLIC

By
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To the Faculty of Washington State University:

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Abstract

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_Homo sapiens_ are uniquely characterized by a lengthy juvenile period we call
childhood and a pronounced reliance on social learning for the acquisition of an adaptive
behavioral repertoire, commonly referred to as culture. Anthropologists have been long
been interested in children’s social learning, but recent interest in cultural transmission by
other disciplines, notably biology and psychology, offers an important opportunity for
interdisciplinary integration. This manuscript is the first systematic, comparative study of
children’s social learning in two small-scale societies: the Aka forest foragers and Ngandu
farmers of the Central African Republic. Herein, I review the social learning process and
cultural transmission modes argued to make the transmission of complex, cumulative
human culture possible and culture as a distinct inheritance system evolve. I then build a
set of hypotheses derived from evolutionary models of social learning and cultural
transmission theory, and informed by a developmental niche perspective. I find that
evolutionary models of optimal social learning schedules, and adaptive cultural
transmission modes generally hold, but vary in ways predicted by core cultural differences
between foragers and farmers.

Among my major results are: Each social learning process decreases with age, trading off with individual learning as predicted by evolutionary theory; Same-sex cultural transmission of work behavior is associated with cultural variations in the sexual division of labor; Social play is a major social learning process for child-to-child transmission of foundational cultural schema such as competition versus cooperation; Teaching is present among both foragers and farmers but consists of at least three different social learning processes, and teaching via vertical transmission is of less importance during middle childhood among foragers than among farmers; Food sharing norms are transmitted to Aka forager children through multiple social learning process and cultural transmission modes, but Ngandu farmers rarely have the opportunity to observe food sharing.

The results of these novel analyses provide new insights into the culture learner-culture teacher interface, and help to better characterize the dynamic interplay between childhood and culture in human adaptation.
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CHAPTER ONE

INTRODUCTION

Among the defining attributes of our species, \textit{Homo sapiens}, are a lengthy juvenile period we call childhood and a pronounced reliance on social learning for the acquisition of an adaptive behavioral repertoire, commonly referred to as culture (Bogin 1990; Hill, Barton, and Hurtado 2009). Studies of child rearing and socialization have been a part of anthropological inquiry since the burgeoning of the field (Firth 1970 [1936]; Fortes 1970 [1938]; Malinowski 1929; Mead 1928), yet only with the recent interest in cultural transmission among psychologists and biologists has there been a systematic focus on the processes of social learning that make the transmission of complex, cumulative human culture possible and culture as a distinct inheritance system evolve (Whiten et al., 2011).

With attention to the child as an evolved learner embedded in a social network of potential teachers, research into the culture learner-culture teacher interface offers the opportunity to bring together the fields of evolutionary biology, developmental, social, and comparative psychology, evolutionary anthropology and the anthropology of childhood, and provide new insights into how natural selection has shaped the processes of cultural transmission across the life course. As an example of such research, this study is the first empirical, observational, comparative study of social learning during children’s daily lives in two small-scale societies: the Aka forest foragers and Ngandu farmers of the Central African Republic.

While the evolutionary relationship between childhood and human culture learning
remains a topic of much debate (Blurton Jones, Hawkes, & O’Connell, 1999; Leigh, 2001), experimental evidence has recently accumulated indicating humans have evolved a suite of adaptations for learning culture that emerges throughout development (Chudek et al., 2012; Csibra & Gergely, 2011; Dean et al., 2012; Harris & Corriveau, 2011; Haun & Tomasello, 2011; Schmidt, Rakoczy, & Tomasello, 2011; Schmidt & Tomasello, 2012; Whiten et al., 2009) suggesting the need to learn cultural information is advantageous from early in human development. At the same time, there are at least two major developmental transitions in socio-cognitive abilities that are thought to be of particular importance for children’s culture learning.

The first occurs roughly around the age of four, during what developmental psychologists refer to as “early childhood.” Bogin (1997) argues early childhood, what he simply calls childhood, is an evolutionarily novel ontogenetic phase in humans. It is characterized by an extended period of post-weaning dependence, slow, steady somatic growth, and a high rate of brain growth. Early childhood is hypothesized to have evolved in order for human females to resume reproduction earlier than would our hominid ancestors who had faster growing offspring and longer requisite breastfeeding durations (Bogin, 1997, 2006). According to Tomasello and colleagues (1993), during this phase, at the age of 4-years-old, children for the first time demonstrate a capacity to internalize instructions, which they believe is associated with an awareness of others as mental agents. For example, children of this age begin to use words referring to others’ thoughts and knowledge. Similarly, after the age of four, children reliably pass the false-belief task, indicating they recognize when someone else’s mental perspective differs from their own.
Tomasello and colleagues argue that only with an ability to reflect on something from an instructor's point of view and explicitly compare it to their own can a child begin to mentally recreate those instructions and reapply them in the absence of the instructor. In terms of culture learning, to the extent that they are physically able, children 4 years and older can independently perform complex behavior patterns they have observed or were instructed in and will demonstrate them to others. However, they cannot yet understand the wider meaning of behaviors in the sense of their being done for particular social reasons. This requires the ability to cognize second-order mental states, which develops later.

The second major developmental transition is completed by roughly 7-years-old when children are said to enter “middle childhood”, which extends until puberty. Bogin (1990, 1997, 2006) calls this the juvenile phase of life history, to emphasize that it is common to all mammals. However, the human pattern is unique in that children during middle childhood exhibit the slowest growth rate since birth, rather than the typical mammalian pattern of continual growth at a velocity near to the maximal rate (Bogin, 1997). Thus, it is argued that humans trade off potential physical growth during middle childhood for the freedom to learn and work without the economic and sexual responsibilities of adolescence (Bogin 2006). Tomasello and colleagues (1993) argue that children of this age are first capable of “recursive-intersubjectivity”. That is, while 4-year-olds are able to infer other’s intentions in performing a behavior (e.g. A does behavior X in order to produce result Y), they are not able to infer about others’ inferences (e.g. that A performs behavior X because B is present and A knows B needs X to be done to produce
result Y). After around 7-years-old children can reflexively coordinate multiple perspectives allowing them to learn collaboratively. Moreover, during middle childhood children demonstrate the ability to scaffold another’s learning through contingent teaching, responding sensitively to a learner’s increasing level of competence (Strauss & Ziv, 2012). This new type of cognition is also associated with children’s emergent understanding that one’s behavior is followed and remembered by others, such that self-presentation can impact one’s reputation (Hill & Pillow, 2006; Zeller et al., 2003).

In sum, during middle childhood, there is evidence for an improved ability to learn and transmit generalizable technical knowledge, as well as normative beliefs and values, which require both the ability to imitate others and an understanding of the importance of behavior within a social network. The emergence of children’s advanced social cognition during middle childhood is recognized across cultures and is said to be a time when children become intelligent, or “get sense”, and is associated with increased trust in children to perform chores and to independently enter the community away from the family home or communal living space (Rogoff et al., 1975).

One major gap in our understanding of the developmental aspects of cultural transmission is a lack of systematic field studies of social learning during children’s daily lives from early childhood to adolescence, most notably among modern foragers. The aim of this study is to begin to fill this gap.

Culture is transmitted through social learning processes during daily life. Social learning processes refer to how individuals learn from others. Cultural transmission modes refer to whom children learn from. In the rest of this chapter, I outline several social
learning processes that have been described previously and that I set out to measure in the field. I then summarize the theory and empirical research regarding dominant modes through which culture flows between individuals. Lastly, because culture is not transmitted in a vacuum, and both social learning processes and cultural transmission modes are theorized to vary depending on the social and cultural context in which children grow up, I use Super and Harkness’ (1986) developmental niche framework to organize the major differences between foragers and farmers that will inform the comparative hypotheses I derive below.

SOCIAL LEARNING PROCESSES: HOW DO CHILDREN LEARN?

Cultural is transmitted between individuals through a variety of social learning processes. While thorough taxonomies of social learning processes and strategies exist in the animal behavior literature (e.g. Heyes, 1994; Laland, 2004; Whiten, 2000; Whiten et al., 2004), there has not be a comparable compendium of processes specific to the unique culture learning abilities of humans—notably language and perhaps shared intentionality. I will review only those that seem to be of particular theoretical importance to human culture learning and have been previously described in the anthropological literature. These include: Observation/Imitation, Social Play, Teaching, Approving or Disapproving Feedback, and Competency Building Through Commands.

Observation/Imitation

Observation, or listening in the case of auditory stimuli (e.g. language, music,
birdsong, alarm calls), is regarded as the basis for almost all social learning in animals. Only humans are able to learn a behavior from another without ever having seen (or heard) it as a result of our ability to represent ideas through symbolic means. Despite our symbolic abilities, however, there is little debate among anthropologists that observation and subsequent imitation is the primary way children learn in small-scale societies (Gaskins & Paradise, 2010; Lancy, 1980; Mead, 1964; Odden & Rochat, 2004; Paradise & Rogoff, 2009; Rogoff et al., 2003). What’s more, cultural transmission theorists have proposed that humans possess evolved cognitive mechanisms that facilitate adaptive cultural transmission by enabling individuals to preferentially imitate others based on observed behaviors. These cognitive mechanisms, including prestige bias (Henrich & Gil-White, 2001) and conformist bias (Boyd & Richerson, 1985; Henrich & Boyd, 1998), implicitly rest on the assumption that humans observe and assess the relative frequencies of behaviors of particular qualities in the population, such as deference to particular individuals or the relative number of people performing a behavior, and measurements of observation times in the laboratory are used as evidence for the existence of these mechanisms (Chudek et al., 2012; Foulsham et al., 2010a).

However, while there is little doubt observation and imitation are crucial social learning processes, there is ambiguity across anthropological, biological, and psychological literatures that draws attention to at least two issues in need of discussion before

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1 I would venture to suggest it is also crucial to informal education in societies with formalized, rote symbol learning-based education as well. Take the concerns of some in the U.S. over media violence as a form of cultural transmission of anti-social values, for example. This view seems much the same as Mead’s (1964) that children in so-called “learning societies” (as opposed to “teaching societies”) learn through “osmosis.”
proceeding with analysis: the definition of “imitation”, and the degree to which actual performance of observed behavior is social versus individual learning.

First, the use of the term “imitation” is defined more specifically in biological and psychological usage than in anthropology with regards to learning. When anthropologists refer to “imitation” it is sometimes meant to refer to the performance of an observed element of adult life that is something other than the full performance of the behavior, such as when work is represented in play (Gaskins & Paradise, 2010; Rogoff, 1981). This contrasts to how “imitation” is used in experimental fields like developmental, social, or comparative psychology in which imitation is said to have occurred when a subject produces the behavioral phenotype of a model just observed (Gergely and Csibra 2006; Meltzoff 1995; Mesoudi and Lycett 2009; Over and Carpenter 2009; Whiten et al. 1996; Whiten et al. 2009). This would then be considered cultural transmission by social learning. According to this definition, both children’s participation in their community’s work activities and the pretense of work in children’s play would both be imitation to the extent that a phenotype is copied. Additionally, Zentall (2012) makes the distinction that observational learning can only be assumed if an observed behavior had not previously been part of the individual’s repertoire. Otherwise, it would be considered “performance” of an imitated behavior.

To be consistent, I will follow Zentall (2012) and use the term “performance” for all behaviors presumed to have been learned through observation and subsequently imitated, with or without additional learning via the processes described below. Performance in play is distinguished from non-play performance in that the means of a behavior are
implemented without the ends, be they associated with labor, ritual, or other aspects of culture. However, in contrast to Zentall’s (2012) distinction, I assume that performance can lead to learning throughout childhood and beyond. In this respect, I follow the implicit usage of “learning” in anthropology as a potentially long-term process. Arbitrary, normative cultural behavior becomes an internalized, motivating force over human action through practice (sensu Bourdieu, 1977). Additionally, technical skills in even the most technologically simply societies can require a long time to master. For example, Kaplan and colleagues (Kaplan et al., 2000; Kaplan & Robson, 2002; Kaplan, 1996) report that hunters in foraging or horticultural-foraging societies do not reach their peak productivity until their mid-thirties. Based on such evidence, they argue in their embodied capital model that childhood evolved in order for humans to learn the necessary skills and knowledge for success in a complex, extractive foraging nice favoring high quality, difficult-to-acquire resources. Therefore, their model rests on the notion that humans require a long life to learn technical skill by continued performance. This model has been critiqued for relying heavily on the notion that foraging productivity increases with time spent in learning (Blurton Jones & Marlowe, 2002). For example, Blurton Jones and Marlowe demonstrated more experience did not necessarily improve Hadza forager children’s performance in tuber digging or archery, and other authors have demonstrated that forager children can be highly productive in a range of cultural and ecological contexts, and their productivity may only be limited by growth and ecological factors, not experience (Bird & Bliege Bird, 2005; Bliege Bird & Bird, 2002; Blurton Jones, Hawkes, & Draper, 1994; Tucker & Young, 2005).
However, Bock (2002, 2005) has shown that growth and experience additively and independently influence the acquisition of skill proficiency among part-time forager communities in Botswana. He found that older children performed better than younger children at wood chopping, mongongo nut cracking, and grain-pounding even with the same level of experience, but that those with more experience at a task were better skilled than same-aged individuals. Bock also measured children’s time spent in play at subsistence tasks in relation to their productivity (Bock & Johnson, 2004; Bock, 2002) and found time spent in play grain-pounding trades off with time spent pounding real grain and improvement in grain-pounding ability in girls (boys at his field site do not pound grain).

Whether or not childhood evolved as a result of the need for long-term culture learning, there is no doubt that, because of human cultural niche construction (Flynn et al., 2013; Odling-Smee, Laland, & Feldman, 2003), most if not all skills and knowledge human children acquire come from others, and much of this is likely transmitted via observation and imitation.

To the degree that performance of imitated behaviors can be defined as social learning beyond the initial time spent in observation is, perhaps, debatable. The distinction between performance and play as individual versus social learning has theoretical importance and leads to different hypotheses as to the developmental trajectory of learning. Because social learning can potentially lead to the transmission of maladaptive behavioral phenotypes (Rogers, 1988), theoretical models indicate that a mixed strategy of social and individual learning is often the most advantageous (Borenstein, Feldman, & Aoki, 2008) and an optimal learning schedule includes social learning early in the life cycle.
followed by individual learning (Aoki, Wakano, & Lehmann, 2012; Lehmann, Wakano, & Aoki, 2012). Theoretically, this allows for “critical social learning” (Enquist, Eriksson, & Ghirlanda, 2007) in which an individual saves the time and energy required to learn individually through trial-and-error or insightful exploration early on by observing others and honing in on the adaptive phenotype, and then later refining their behavior through individual learning.

Below, I examine the developmental trajectory of observation and imitation as they relate to children’s participation in productive activities to test the hypothesis that children spend less time observing work and more time performing it as they age. While this is intuitive, it has not been explicitly demonstrated by quantitative analysis, nor have the cultural transmission modes been examined in a comparative framework, as will be established below. Additionally, performing of work in play will also be analyzed as an early culture learning activity, and the tradeoff between work and play will be explored in terms of the relative representation of different domains of work in children’s play.

**Social Play**

Performance of work in play with other children is one type of social play. Defining behavior as play versus something else has been a persistent challenge for play researchers (Fagen, 1981; Lewis, 2005). One commonly cited definition by biologists Bekoff and Byers (1981) is the following:

“Play is all locomotor activity performed postnatally which appears to an observer
to have no obvious immediate benefits for the player, in which motor patterns resembling those used in serious functional contexts may be used in modified terms. The motor acts constituting play have some or all of the following structural features: exaggeration of movements, repetition of motor acts, and fragmentation or disordering of sequences of motor acts.” (301)

This definition helps to differentiate play from non-play across species, but it excludes, or perhaps under-defines, the representational play of humans, which may or may not involve “motor patterns resembling those used in serious functional contexts.” For example, playing with toy cars may incorporate some aspects of actual driving (e.g. wheeled movement, “honking” a horn, making the motor “rev”) while lacking any of the actual motor patterns. This could be construed as simply a greater degree of modification of the motor patterns in that the player performs them only in their mind. Unfortunately, anthropologists, who have studied the representational aspects of children’s play, have offered no widely accepted ethological definition of play and some are critical of its reduction into categories altogether (Schwartzman, 1976, 1978). However, because this study is concerned with cultural transmission through social learning processes, I believe it is important to delineate types of play behavior by the degree to which they involve imitation or representation of scripts from the wider cultural context. Therefore, I expand on Bekoff and Byers’ definition to specifically include as play performance of 1) behaviors according to a cultural script but involving representation of the means without the ends (e.g. play work, play ritual), 2) behaviors derived from children’s cultural settings but not
involving motoric imitation of scripts (e.g. creating songs or toy representations), 3) behaviors involving cultural scripts without direct functional equivalents, whether or not derived from adult culture (e.g. games, sports), 4) physical activity involving energetic interaction with others or the surrounding environment (e.g. climbing trees, rough housing), and 5) spontaneous and innovative behavior not performed by adults nor necessarily performed more than once by anyone.

Imitative and spontaneous play behavior is common in many mammalian species, and has been reported in other taxa as well, indicating deep phylogenetic roots to play (Fagen, 1981). Play researchers have noted that play is energetically costly and it often entails risk on the part of the playing animal, either through physical activity during play or by drawing the attention of predators. Thus, it has been accepted by many that play is an evolved behavior and therefore must have adaptive value. Biologists have emphasized the importance of play for the development of neuromuscular coordination (Byers, 1998), for example. Among primates, however, social play is very common and is the most common play form among the great apes, suggesting that interactive play may have consequences for social functioning (Lewis, 2005). Primatologists have noted that signals specific to the play context, such as the “play face”, serve to differentiate play behavior from non-play behavior that may appear otherwise similar. By using such signals, play becomes an important context for practicing social behavior without the consequences of, for example, real aggression (Lewis, 2005).

Humans have the most complex social behavior of any primate, and thus play likely has an important social learning function, through the performance of social and cultural
behavior such as gender roles or rituals (Edwards, 2000; Lancy, 1996; Whiting & Edwards, 1988), and different types of play may serve different functions. This type of functional account construes play as performance of observed adult behavior—as a means of enculturation. However, some anthropologists also consider play a means to transit culture between children, with some elements not existing in adult culture. These researchers emphasize the creative, spontaneous and even counter-cultural aspects of children’s play (Schwartzman, 1976). While these may be important, I argue that the incorporation of scripts derived from adult culture, in various ways and to varying degrees, serves as a venue for expression and collaborative learning of foundational schema, even if not through imitation.

Anthropologists who have researched children’s play in small-scale societies tend to find the same categories of play exist across cultures. Taxonomies tend to include the following as universal play types: pretense, or fantasy play; object play; physical, rough-and-tumble or chase play; object play; and ruled games. Each of these categories may involve behaviors that fit one or more of the criteria above and each is also claimed to have some social learning function.

The conclusion that these types are universal confirms assumptions made by developmental psychologists whose data comes from children in industrialized societies, where the contexts of play are very different (Smith, 2005). However, anthropologists have also found that culture influences the quantity and quality of children’s play. For example, Mayan farmer adults require work from children at a young age and discourage play, stating that it takes away time from helpful labor (Gaskins, 2000; Kramer, 2002). Rough-
and-tumble play has been proposed as a universal form of play, but Fry (1988) found that the cultural acceptance of aggression determined the amount of rough and tumble play he observed between two communities of Zapotec children in Mexico. In the community where physical punishment of children and horseplay among adolescents and adults was more common, his sample of 3- to 8-year-old children engaged in more rough and tumble play and for longer durations.

Below, my analysis of play behavior will be oriented around hypotheses regarding expected cultural variation based upon foundational schema. Therefore, children’s social play is expected to be an important component of children’s daily culture learning in both the Aka and Ngandu, but as I will outline below, there is reason to expect children’s social play should culturally vary in both quantity and quality.

**Teaching**

Based on a thorough survey of the ethnographic record, David Lancy (Lancy & Grove, 2011; Lancy, 2010) has argued that teaching is extremely rare across human cultures and of relatively little importance in the transmission of culture to children. Instead, he and others with extensive ethnographic field experience observing children and child-rearing in small-scale societies—outside of institutionalized educational settings—draw attention to the importance of play (Lancy, 1996; Schwartzman, 1978), observation (Gaskins & Paradise, 2010; Odden & Rochat, 2004), and “pitching-in” through self-motivated, peripheral participation in the activities of daily life (Paradise & Rogoff, 2009; Rogoff, 1981; Rogoff et al., 2003). To these authors, teaching is a social learning process
primarily associated with large-scale, post-modern cultures, in which an expert transmits information to novices in an assembly-line fashion outside the context in which the information is to be used (Rogoff et al., 2003). This striking contrast in educational style has been noted by anthropologists at least since Mead (1964, 1970).

In contrast, developmental psychologists Csibra and Gergely (Csibra & Gergely, 2009, 2011; Gergely & Csibra, 2006) contend that teaching in humans must be universal. They argue humans possess a set of adaptations for ‘natural pedagogy’ that evolved to facilitate high fidelity cultural transmission, a theoretical prerequisite for the evolution of cumulative culture (Enquist et al., 2007; Tomasello et al., 1993). For these authors, humans uniquely produce and attend to ostensive signals like eye-gaze and pointing, and expect these signals to refer to objects with generalizable functions or properties. Human material and symbolic culture is often teleological and causally opaque, such that only through ostensive communication do cultural novices, usually young children, make the necessary inferences regarding general properties of objects. Csibra and Gergely (2011) critique anthropologists for suggesting little teaching exists in their cultures of study without quantifying how little compared to other social learning processes, such as imitation or individual learning.

Evolutionary biology provides a middle ground between these two accounts of human teaching, and offers a framework to predict the conditions under which teaching should occur. Specifically, Caro and Hauser’s (1992) functional definition of teaching has spurred a body of empirical and theoretical research on the evolution of teaching in animals. According to them, teaching requires the teacher modify their behavior in the
presence of the learner, thereby incurring a cost, or not receiving an immediate benefit, in order for the learner to more easily acquire information. Based on this definition, the focus of research has been establishing when teaching should occur given the costs and benefits to both the teacher and the learner (Hoppitt & Laland, 2008; Thornton & Raihani, 2008). Teaching should not be expected if the knowledge, skill, or other information could more easily be learned through imitation or through individual learning only. Nor would teaching be selectively favored if teachers are likely to be unreliable because the information is too difficult to acquire (Fogarty, Strimling, & Laland, 2011) or the environment is unstable (Boyd & Richerson, 1985; Cavalli-Sforza & Feldman, 1981a). The cumulative nature of human culture (Tomasello et al., 2005), which results from relatively small improvements on a theme over time (Boyd, Richerson, & Henrich, 2011), would reinforce the fitness value of costly information transfer, such that teaching and cumulative culture might coevolve, explaining the arguably widespread nature of teaching in Homo sapiens (Fogarty et al., 2011).

If teaching is costly, genetic kin are favored as teachers because of the inclusive fitness benefits of helping their kin learn adaptive information (Cavalli-Sforza & Feldman, 1983). Shennan and Steele (1999) propose that teaching is a form of parental investment, and make the point that parents should adapt their investment to both the developmental stage of their offspring and the difficulty of the task at hand. However, modeling by Fogarty and colleagues (2011) suggests that in a cumulative culture context teaching can persist even in populations with low genetic relatedness because of population-level benefits of making difficult-to-acquire, fitness-relevant information available for diffusion.
Furthermore, they observe that most of the likely cases of animal teaching occur in cooperative breeding species, including humans (Hrdy, 2009). In cooperative breeding contexts, experienced individuals might share the teaching burden as an extension of their shared investment in offspring, effectively lowering per capita costs of teaching. Therefore, while genetic relatedness may increase the likelihood of teaching, other factors can increase the benefits of teaching non-kin, such as the exchange of teaching burdens within cooperative groups.

Additionally, costs and benefits of teaching for learners may change throughout their development and influence whom they might seek out as teachers. Henrich and colleagues (Henrich & Broesch, 2011; Henrich & Henrich, 2010) and Aunger (2000) have proposed two-stage models of social learning in which children should learn first from parents or other experienced members of their household, who are accessible, low-cost models, and then update their knowledge as they get older and have access to other models with potentially better, or more expert, information. Recent evolutionary modeling supports this proposal, offering additional insights into potential tradeoffs between individual and social learning processes throughout the life course. For example, Aoki and colleagues (2012) show that a schedule in which social learning from older individuals occurs first, followed by a combination of individual learning and learning from others of the same generation (horizontal transmission) is an evolutionary stable strategy.

To summarize, evolutionary theory supports the proposal of Csibra and Gergely that teaching is unique in humans in so far as there is more difficult to acquire information in human behavioral repertoires, which would increase the fitness advantages of teaching. At
the same time teaching may be rare or difficult to observe in small-scale human societies because it is 1) concentrated early in life, replaced by individual learning as children get older, 2) restricted to specific difficult to imitate domains and, 3) likely to involve only kin, especially early in life, and may only be used to gain expert knowledge from specific others later in life.

**Approving or Disapproving Feedback**

While there is now a fairly robust understanding of the costs and benefits of teaching, there still remains no clear use of the term within anthropology. Arguably, Caro and Hauser’s (1992) definition might include a variety of characteristically human contingent social behaviors not as distinct in their relative costs and benefits as natural pedagogy, demonstration, or verbal instruction. One such contingent behavior is social feedback through an expression, verbal or non-verbal, of approval or disapproval of another’s behavior without offering additional information regarding an alternative, more or less favorable, form of behavior. This fits Caro and Hauser’s functional definition in the sense that a teacher alters its behavior to encourage or discourage a learner (Strauss & Ziv, 2012). It may be difficult to distinguish negative feedback from punishment, but as long as the delayed payoff of learning what not to do is greater than the immediate cost of punition, then feedback would constitute a form of teaching (Thornton & Raihani, 2008). Castro and Toro (2004) argue such a capacity to approve or disapprove of other’s (especially offspring’s) behavior was an evolutionary precursor to direct instruction and a derived trait in the line leading to *Homo* necessary for the evolution of cumulative culture.
(also proposed by Mead, 1964, p. 45). Among humans, feedback may represent an effective, low cost, alternative method to teach unique aspects of human cultural behavior, such as adherence to social norms, through the effects on the learner’s prosocial emotions (e.g. guilt, shame, pride), which may underpin the evolution of human cooperation (Bowles & Gintis, 2005).

**Competency Building Through Commands**

Additionally, using directive language to give children commands has been noted as a common way of scaffolding, more or less intentionally, children’s abilities to perform necessary work tasks in a variety of farming cultures (Whiting & Edwards, 1988; Whiting & Whiting, 1975). Draper (1976) also notes that much of the work that !Kung forager children did during the day was in response to informal commands by adults. Similarly, Marlowe (2010) describes Hadza children as eager to do things asked of them, and quick to anticipate adult commands. Commands are differentiable from direct instruction because they do not provide new information regarding how something is to be done but, if followed, provide experience performing a behavior.

Commands may be argued to directly benefit the “commander” and therefore not teaching, but the benefits are contingent on compliance by the child. Moreover, whether or not the child complies, the interaction can be seen as a teacher providing a learner with an experience to learn from that might also lead to indirect benefits to the teacher over the long run if the child is kin or may later cooperate with the teacher (Strauss & Ziv, 2012). Degree of compliance to commands is expected to vary cross-culturally. Whiting and
Whiting (1975) found that, out of six farming cultures, compliance with commands varied with level of cultural complexity, with the children of the most complex society, rural mid-century America, being the least compliant. However, having an idea of whether children comply out of fear of punishment or cooperativeness would be useful in better understanding this diversity. For example, hunter-gatherer children tend to comply with the commands of others, but punishment for noncompliance is nearly absent in contrast to farming cultures (Ember & Ember, 2005; Hewlett et al., 2011). Indeed, reports of hunter-gatherer children cooperating are as common as reports of indulgent parenting.

To the extent that obliging a child to carry out one’s wishes becomes exploitation, such that the only benefit to the child is avoiding punishment, it would be more difficult to argue commands are teaching. Differentiating the point at which commanding becomes exploitation presents a hazard in defining commands as teaching.

Below, unless otherwise specified, I will use the term “direct instruction” to refer to behaviors including natural pedagogy, demonstration, or any verbal or non-verbal transfer of information as to how or why an individual should behave a certain indicated way. For simplicity, I will use the term “teaching” to refer to direct instruction as well as approving or disapproving feedback and competency building through commands, though I recognize the weakness of this term in the case of the latter two social learning processes.

**MODES OF CULTURAL TRANSMISSION: FROM WHOM DO CHILDREN LEARN?**

Cultural evolutionary or dual inheritance approaches to the study of culture hold
that genetics and culture are two parallel but interacting inheritance systems (Boyd & Richerson, 1985; Cavalli-Sforza & Feldman, 1981a; Durham, 1991), each capable of transmitting adaptive traits between generations. However, unlike genetic traits, cultural traits can be transmitted within generations and can be lost and reacquired numerous times during an individual's lifetime (Strimling, Enquist, & Eriksson, 2009). Culture, at least among humans, is also characteristically cumulative, such that a single individual can not possibly know how to recreate the trail of innovations leading to a any one cultural trait (Richerson & Boyd, 2005; Tomasello, 1999). Yet, that at least some of these traits are transmitted is crucial to human survival and reproduction (Henrich & McElreath, 2003). This profound fact has led to a body of theory and an accumulation of empirical data indicating that humans possess capacities to distinguish phenotypic characteristics of individuals or groups that indicate who is likely exhibiting the most adaptive cultural variant in a domain or across multiple domains (Boyd & Richerson, 1985; Henrich & Boyd, 1998; Henrich & Gil-White, 2001). These capacities are construed as cognitive biases that influence from whom we are most likely to socially learn.

Drawing from epidemiology, cultural transmission theorists refer to modes of transmission to describe the pathways through which knowledge, beliefs, values, and skills are disseminated in a population (Cavalli-Sforza & Feldman, 1981a). Variants of a discrete cultural trait (e.g. types of dances or hunting techniques) are construed as varying in their fitness as defined as the frequency the trait is exhibited in a population. Since the fitness of particular variants of a trait (e.g. the fox trot, the bow-and-arrow) depends on the ecology and cultural setting in which it exists, dominant modes of transmission may vary for
different traits (Hewlett and Cavalli-Sforza 1986) and over time given variation in environmental conditions (McElreath and Strimling 2008). Field studies of cultural transmission have previously used three methods to measure the relative importance of different modes of transmission: self-reports of recalled or preferred transmission sources, correlations of measures of shared cultural traits (e.g., knowledge, practices, beliefs) between different classes of individuals, and a single study (Kline, Boyd, & Henrich, N.d.) quantified reports of cultural transmission and social learning processes. Using the first method, a number of studies have found vertical transmission, from parents to their children, to be the most common mode for a variety of skills, beliefs, values, and types of knowledge, among active and former hunter-gatherer groups (Hattori, N.d.; Hewlett & Cavalli-Sforza, 1986; Ohmagari & Berkes, 1997), Fijian villagers (Henrich & Henrich, 2010), Iranian weavers (Tehrani & Collard, 2009), and Indian honey collectors (Demps et al., 2012).

However, Aunger (2000) argues that self-report measures of cultural transmission are likely to over-estimate the importance of vertical transmission because of normative biases. Among self-report studies finding non-vertical transmission, Hewlett and Cavalli-Sforza (1986) found Aka forest foragers learned new hunting techniques and dances from non-parents, and Henrich and Henrich (2010) found that about one third of Fijian women interviewed learned specific food taboos from older, knowledgeable women who were not

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2 Some traits also are argued to change in frequency over time at random based on their frequency alone, suggesting they are not being selected for by cultural or natural selection, similar to gene frequency changes resulting from genetic drift (Bentley et al., 2007; Bentley, Hahn, & Shennan, 2004; Hahn & Bentley, 2003; but see Mesoudi & Lycett, 2009)
3 Here, in Tehrani and Collard (2009), I refer to their micro-evolutionary results, not the results of their analysis of cultural macro-evolution.
kin—via oblique transmission. Aunger (2000; 2002) compared self-report and correlational methodologies and found greater support for oblique and horizontal— intra—generational—transmission modes of food taboos among farmers in the Ituri Forest of the Democratic Republic of the Congo when correlational methods were used. Similarly, examining correlations between individuals and their parents, parents’ cohort, and same—age peers, Reyes—García and colleagues (2009) found Tsimane’ horticultural—foragers acquire ethnobotanical knowledge and skill somewhat more via oblique than vertical transmission. Kline and colleagues (N.d.) also find that oblique teaching grows in importance with age for critical and high—skill level tasks.

The relative importance of horizontal transmission is debated. Some have argued based on evidence from developmental psychology and cultural anthropology that learning from one’s same—age peers is an important source of children’s cultural knowledge (Harris 1999; Lancy 1996). However, cultural transmission studies have found evidence that horizontal and oblique transmission are more important during adulthood than during childhood relative to vertical transmission as individuals gain exposure to a greater variety of social models and engage in more complex or strength—dependent activities as they get older (Aunger, 2000; Demps et al., 2012; Hewlett & Cavalli—Sforza, 1986; Kline et al., N.d.). Theoretical models predict horizontal transmission should be relatively more important in unstable environments in which older members are less likely to possess up—to—date adaptive cultural traits (Cavalli—Sforza & Feldman, 1981a). If modern technocratic societies can be considered unstable with regards to accelerated technological turnover, than two early correlation studies do provide weak support for this prediction, finding correlations
between friends equal to or smaller than correlations between parent-child pairs (Cavalli-Sforza et al., 1982; Chen, Cavalli-Sforza, & Feldman, 1982).

THE DEVELOPMENTAL NICHE: INTEGRATING PROCESSES AND MODES

Harkness and Super (1983; Super & Harkness, 1986, 2002) have proposed the developmental niche concept as a framework for delineating the multiple influences of a child’s environment on social and cultural development. According to them, three sub-systems organize development across cultures: 1) physical and social settings, 2) normative child rearing practices, and 3) culturally-derived values and beliefs of caretakers. It is my contention that a child’s developmental niche influences the social learning processes that operate to transmit culture, and the dominant modes by which cultural traits are transmitted. As discussed above, different modes are more adaptive in more or less stable environments, and also can transmit cultural traits at differential rates. For example, horizontal transmission is rapid and can quickly spread innovations in a populations, whereas vertical transmission is more conservative (Cavalli-Sforza & Feldman, 1981b). Therefore, by their influence on social learning processes and cultural transmission modes, different developmental niches can lead to different patterns of cultural evolution. This view parallels a recent attempt to synthesize the evolutionary theory of niche construction with developmental psychology (Flynn et al., 2013), but I make explicit the influence of culture by using Harkness and Super’s framework. To this end, I will outline the relevant features of the contrasting developmental niches typical of forager and farmer communities in order to build hypotheses regarding cultural variation.
in social learning and cultural transmission between the Aka and the Ngandu.

First, in using the term “forager” I follow Wiessner (2005) in referring to groups characterized by low population density, high mobility, and a lack of food storage, or those whom Woodburn (1982) has termed “immediate-return hunter-gatherers.” It has long been understood that much of human social behavior and cognition evolved while all members of our species were living in such groups on the African savanna—some 99 percent our history (Bowlby, 1969; Lee & De Vore, 1968; Tooby & Cosmides, 1992). While not a homogenous group (Kelly, 1995), nor lacking in history or culture change, as are inherent to all human societies, modern foragers share a distinct pattern of social structure and subsistence strategy that offers researchers the opportunity to draw inferences regarding the human past (Marlowe, 2005), and to better understand the scope of modern human diversity.

Furthermore, I use the term “farmers” to refer to small-scale societies whose primary means of subsistence is agricultural production, independent of their degree of market integration. Small-scale farming cultures are also highly diverse, however there are several aspects of the developmental niche for children in farming societies that allow for some reasonable generalization and comparison with foragers.

Draper (1973) characterized the intensely intimate nature of the physical and social settings of life in !Kung forager communities. !Kung foragers of the Kalahari desert live at a population density of one person per 10 square miles, yet in residential camps people occupy a space of 188 square feet per person—a little over half of what was recommended by the American Public Health Association when she conducted her research, at a time
when "human press" was a public health concern in urban settings. This intimacy in use of physical space is typical of forager communities and extends beyond keeping houses close together. In fact, houses are mostly used for sleeping and staying dry. Most social life is conducted outdoors in public view of all members of the community, and often in close physical proximity with others. Ethnographers working with other forager groups have written extensively about the importance of close physical contact and touch to forager social life (Dentan, 1978; Sugawara, 1984; Turnbull, 1978). Beginning at infancy, forager children are in physical contact with others nearly constantly (Konner, 1976, 2005).

Hewlett and colleagues found Aka infants were held 91 percent of the day, whereas Ngandu farmer infants were held only 54 percent of the day (Hewlett et al., 2000). Forager children are held more than farmer children continually into early childhood (Fouts, Hewlett, & Lamb, 2005), and Hewlett and colleagues (2011) report that Aka forager children and adolescences never slept alone, whereas farmer children over 7-years-old slept alone 30 to 40 percent of the time. A study by Fouts and Lamb (2009) illustrates that the value of physical and emotional intimacy is acquired early in children's lives in forager communities. They found that Bofi forager toddlers were more likely to have conflicts over being close to other children than were farmer children (38% versus only 2% of conflicts, respectively), whereas farmer toddlers’ conflicts were more often about possession of objects (48% of farmer toddler conflicts versus 14% of forager conflicts).

The layout of farming villages varies substantially, but in addition to more physical distance between people, spaces between family compounds are usually more distant from each other. Houses are also larger and more permanent in construction, the latter, of
course, owing to a more sedentary life. Greater housing space is at least partially attributable to the greater need for storage of the tools and products of agricultural subsistence, but it is also associated with an increased usage of privacy and social separation between families afforded by permanent enclosed spaces (Kelly, Poyer, & Tucker, 2005). Hewlett and colleagues (1998) measured Ngandu houses to be on average 12.19 meters by 6.10 meters, having one to three rooms, and separated from each other by an average of 12.19 meters. In contrast, Aka forager houses are .30 to 1.22 meters from each other and have enough room for a fire and a single bed 1.22 meters long, slept upon by at least two individuals and often more.

Variation in normative parenting practices and the beliefs and values of parents reflect foundational schema (Hewlett et al., 2011) and are evident in the degree of autonomy granted children in their development niche. Autonomy is one such foundational schema common to forager cultures (Gardner, 1991). Among modern foragers, childhood after weaning has been summarized by Konner (2005) as being free of responsibility and characterized by multiage children’s groups, whose activities consist of abundant play and are minimally influenced by adults. Draper (1976) was the first to systematically observe forager children between the ages of four and early adolescence and initially described this pattern. She found that !Kung children performed virtually no productive work, and adults gave but rare requests that children do simple chores such as fetching objects in camp. When children participated in work, it was by their own choice. Later research has drawn into question the generality of forager children’s lack of participation in production. For example, children among the Tanzanian Hadza hunt and gather as much as 50 percent of
their daily calories by 10 years of age. Forager children in a number of other populations are also both efficient and productive hunters and gatherers depending on ecological hazards (e.g. getting lost, predators), their size and strength, and their level of interest (Blurton Jones, Hawkes, and Draper 1994; Bird and Bliege Bird 2005; Bliege Bird and Bird 2002; Hawkes, O’Connell, and Blurton Jones 1995; Tucker and Young 2005). Consistently across reports, however, forager children’s activities are autonomous of parental influence after weaning and carried out in multiage groups of children, within or outside the visual range of adults. Therefore, among foragers, horizontal and oblique transmission is likely to be at least as important as vertical transmission for social learning of work during middle childhood.

Such a pattern is distinct from that of farming societies. In these groups, production is oriented around individual households, women's contribution to labor is high, and their tasks take them away from the home for long periods of the day. Within these contexts, childhood is characterized by the assignment of responsibilities from roughly 6-years-old (Rogoff et al., 1975), though sometimes as early as four, and foundational schema include responsibility and obedience to older individuals, including older children (Barry, Bacon, & Child, 1957; Munroe, Munroe, & Shimmin, 1984; Whiting & Edwards, 1988; Whiting & Whiting, 1975). Gaskins (2000) reports that Yucatec Mayan parents emphasize the primacy of adult work and involve children in labor activities as early as they are able to perform them, discouraging play as competition with work. Therefore, it can be said a pronounced emphasis on vertical transmission is more typical of farmers in the domain of work.

The common farmer institution of sibling caretaking, or use of “child nurses” to care
for toddlers, is illustrative of the responsibility training emphasized by farmer parents. Wiesner and Gallimore (1977) describe the obligation of farmer children to watch after their younger siblings or others so their parents can attend to other labor responsibilities as the “predominant socialization experience” in these cultural contexts (172, emphasis is original). Through such an institution, the value of social hierarchy is made highly salient to children as they must both care for their young charges and obey the demands placed upon them by their parents. As Whiting and Edwards (1988) write of their cross-cultural sample of farming societies: “Because parents delegate the care of younger children to older ones, they accept the implicit right of older children to exercise authority over younger ones. Parents expect that children will command their younger siblings and appropriate a greater than equal share of ‘turns’ or ‘resources’” (214).

A prominent aspect of children’s work in farming societies is the relatively consistent finding that girls work more than boys during middle childhood. For example, Yucatec Mayan boys work an average of 9 percent the number of hours their parents’ work between the ages of 3 and 8, but girls at this age already work about 20 percent of the hours their parent’s spend in work. By age 15 boys perform 95 percent of an adult work day and girls have surpassed their parents in hours spent working (Lee & Kramer, 2002). Farmer children between the ages of 6 and 8 in Java and Nepal are reported to contribute between about 40 and 50 percent the average work input of 15 year old males (Nag et al., 1978), but similar to the Mayan children, girls in Java and Nepal work more than boys at all ages (Nag et al., 1978). Whiting and Edwards (1988) attribute girls’ greater labor contributions to differential socialization of responsibility for females, and they have found
that boys who perform more culturally-defined "feminine" tasks also perform more female-associated social behavior (Whiting & Edwards, 1973). Furthermore, they note that work generally associated with males is often not amenable to children’s contributions, as it either requires considerable strength or takes men far from home (Whiting & Edwards, 1988). Across the farming societies in their cross-cultural analysis, boys worked more when they could be assigned care of domesticated animals, a characteristically masculine task that boys could begin to do during middle childhood.

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It is not clear that forager boys and girls pursue different activities nor consistently work more or less than the other sex when children do engage in foraging activities (Bird & Bliege Bird, 2005; Tucker & Young, 2005). In general, forager social structure is characterized by relative age and gender egalitarianism (Woodburn, 1982). Women and men equally control the means of production and their contributions are seen as complementary, neither more important than the other (Lewis, 2008; Turnbull, 1978).

Nonetheless, there is commonly a division of labor among forager adults. Women generally target commonly acquired, low risk foods of small size and high processing costs, while men target large, asynchronously acquired, high risk foods with lower processing costs (Bliege Bird, 1999). This developmental discontinuity seems to contradict a strong version of the socialization hypothesis, since girls and boys are not assigned different tasks but simply begin to perform gender-associated foraging when they can physically accompany adults away from camp (Bird & Bliege Bird, 2005; Draper, 1976; Hill & Hurtado, 1996).

One possible explanation for variation in children’s work associated with sex and culture independent of child rearing practices is that individuals have an innate tendency
to socially learn from those who share similar qualities (Boyd & Richerson, 1985; Cavalli-Sforza & Feldman, 1983; Laland, 2004). Usually, when task assignment occurs in farming societies, it coincides with the increased awareness of gender in children between the ages of 4- and 7-years old (Rogoff et al., 1975; Whiting & Edwards, 1988). The fact that male children do little work may in part be related to the availability of male models and their behavior when they are available. The hierarchical societies reviewed here also patriarchal, and males hold a higher social status, are deferred to by their wives, and enjoy reduced labor loads relative to women. In contrast, while there is a division of labor among forager adults, it is often more malleable, and women possess equal political power to men in forager societies. Additionally, foraging activities such as net-hunting offer opportunities for sharing of subsistence and childcare responsibilities between men and women. While net-hunting, Aka men contribute substantially to infant care (Hewlett, 1992) and women similarly contribute to hunting returns (Noss & Hewlett, 2001). Noss and Hewlett (2001) identify four aspects of the forager developmental niche associated with equality in the sexual division of labor: 1) overlap in the productive/reproductive benefits for males and females who engage in cooperative subsistence, 2) absence or greatly reduced male control ideologies (i.e. foundational schema) and level of patriarchy, 3) cultural history and precedents for female participation in hunting, and 4) the social and ecological settings (e.g. absence of male dominance and ecological possibilities for female contributions to subsistence). Children older than 5-years-old also participate in net-hunts, and would therefore have the opportunity to observe self-similar models cooperating and sharing labor responsibilities during a time when gender identification develops as a feature of
social cognition.

The developmental niches of foragers and farmers also influence the quantity and quality of social learning possible through social play and the potential transmission modes. The forager foundational schema of autonomy and the lack of task assignment has led some to hypothesize that forager children should play more often than children from other cultures, since they have no labor responsibilities and play is an enjoyable and likely beneficial activity (Bock & Johnson, 2004; Konner, 2005, 2010). Konner (2005) has also proposed that the demographic features of forager societies, including average group sizes of between 25 and 35 people, and long inter-birth intervals, usually greater than 2.5 years, would make it unlikely that children would have the opportunity to play in same-age peer groups. Same-age peer groups are common in societies who are sedentary with larger populations and they have been proposed to increase the frequency of competitive play (Whiting & Edwards, 1988). Thus, forager children would be expected to engage in less competitive play than farmers because they lack appropriate partners with whom to compete (Konner, 2005). In terms of the framework of cultural transmission through social learning used in this study, this proposal is equivalent to hypothesizing competitive behavior is transmitted through social play via horizontal transmission, and since foragers have less opportunities for horizontal transmission during play, competition is less likely to be transmitted. Additionally, as noted above, Fry (1988, 2005) found that children’s frequency of rough-and-tumble or aggressive play corresponded with the acceptance of aggression in adult culture in two Zapotec farming communities, and non-violence is a foundational schema common to forager cultures (Montagu, 1978). Therefore, rough-and-
tumble play should be less common among foragers than among farmers. In other words, there are fewer opportunities for vertical and oblique transmission of aggression among foragers than among farmers, and therefore less frequent performance of aggressive social play.

Above, I argue that play serves as a venue for the expression and collaborative learning of foundational schema, in addition to being a safe context to perform imitation of observed behavior. Non-violence and cooperation (versus competition) are two such foundational schema informing interpersonal relations among foragers. Bird-David (1990) also characterizes the relationship of foragers with the natural ecology on which they rely as based upon a foundational schema of trust and sharing. Hewlett and colleagues (2000) expand on Bird-David’s analysis and propose that the foundational schema, or internal working model after Bowlby (1969), is rooted in the secure attachment fostered by the intimate caregiving typical of foragers, as opposed to the more distant caregiving of farmers, who are also more distrusting of the natural environment. The contrasting schema of trust and sharing in relation to the environment is hypothesized to be evident in forager children’s play, and I would argue there might be an additional functional aspect to social play involving the natural ecology, as it is crucial that children explore and learn about their environment. In contrast, farmers typically have a foundational schema of opposition with the natural environment, as something to be controlled if not feared, and farmer children’s play would therefore be less likely to involve exploration or representation of natural ecology. Of course, the materials available and environment in which children live (e.g. in a village versus in a camp surrounded by desert, savanna or forest) would also
necessarily influence the nature of children’s play.

As noted above, the role of teaching in children’s social learning across cultures is currently a matter of much debate. However, there is reason to believe that the manifestation of teaching in forager and farmer societies would vary owing to variation in the domains children must learn (e.g. different technical skills), but also to normative child rearing practices as well as foundational schema. Arguing for the importance of culture learning through children’s participation in adult activities over explicit instructions, Rogoff (1981) reports that out of 1,708 observations of 9-year-old Mayan farmer children only six occurrences of “teaching”, presumably by adults, were recorded (.35%) outside of church or school contexts. However, she does not mention the contexts or domains of these instances of teaching. Kline and colleagues (N.d.) interviewed adults in a small-scale Fijian horticultural-fishing community about how children learned necessary skills. Teaching, as defined locally, was reported to be a process of knowledge transmission for domains important to success in the village—of high fitness value—and to be primarily from parents to children early in life (vertical transmission), but more from non-kin experts as individuals age (oblique transmission), in line with predictions of the two-stage model of social learning reviewed above. This study indicates teaching is locally recognized and valued in this hierarchical horticultural-fishing society.

Kline and colleagues (N.d.) presents the first empirical evidence for fitness tradeoffs to teaching in a small-scale society in accordance with evolutionary theory. However, we lack sufficient systematic qualitative or quantitative data on teaching from forager populations. A broad understanding of teaching across cultures requires data from forager
societies, and the available evidence suggests teaching occurs throughout child
development among modern foragers. In particular, the sparse data indicates a
concentration of teaching during infancy among foragers and an early focus on locomotor
development (Konner, 1976), sharing (Konner, 2010; Wiessner, 1982), and kinship
relations (Guemple, 1988; Wiessner, 1982). In the first systematic study of parent-infant
teaching among foragers, Hewlett has been collecting one-hour naturalistic video samples
of Aka infants and is finding conclusive evidence of a variety of teaching acts, not limited to
the forms of natural pedagogy described by Csibra and Gergely noted above (preliminary
results noted in Hewlett, Fouts, Boyette, & Hewlett, 2011). Draper (1976) reports that
!Kung children aged 4 through 14 received an average of 1.5 “adult interruptions” every
hour, which is suggestive of some investment in influencing children’s behavior during the
middle childhood years. In the most thorough description of teaching of craft-skill in
hunter-gatherers, Hewlett (2012) describes her experiences of observing and being taught
basket-making by Aka adolescent girls and women, and describes unmistakable use of
direct instruction.

While it seems that teaching, including natural pedagogy and other forms, is a
feature of social learning among foragers, the relative frequency of teaching across small-
scale societies still remains unknown. Indeed, culture is not discussed as a possible
influence over the costs and benefits of teaching among the evolution of teaching literature,
but is at the foundation of anthropological accounts, which contrast the West with small-
scale societies. However, there is likely to be variation within these broad groupings. In
particular, compared to peoples practicing other forms of subsistence, foragers strongly
value autonomy and disapprove of authority (Woodburn, 1982), and therefore Lewis (2009) has argued teaching would be discouraged because it implies an imbalance of authority over knowledge. Denial of authority or social inequality is an active aspect of politics and daily life among egalitarian cultures (Wiessner, 2005; Woodburn, 2005). According to this viewpoint, there would be a greater social cost to teaching within a forager cultural context. Therefore, counter-intuitively, we would expect more teaching in those cultures who have been most thoroughly studied and among whom teaching is claimed to be minimal by Lancy and others (2011; 2010, 2012; Odden & Rochat, 2004; Paradise & Rogoff, 2009; Rogoff et al., 2003): small-scale farming societies with hierarchical social systems.

Lastly, one salient aspect of the developmental niche of any society is the institutionalized distribution of food, and a major unexplored area of research in the study of human cooperation is the role of social learning in the ontogeny of food sharing behavior. In order to build culturally informed hypotheses regarding children's learning to share, I will review what is known about the contrasting patterns of learning to share in forager and farmer cultures. Food sharing patterns are integrated into all parts of a child's developmental niche, through the intersection of subsistence economy, producer-to-consumer provisioning patterns, and values regarding rights of access to resources.

Notably, there are no systematic studies of how children in foraging societies learn to share food despite the importance of food sharing among modern foragers to models of human cooperation. Anthropologists studying human food sharing from an evolutionary perspective largely agree that humans have a tendency to cooperate that derives from the
Darwinian fitness advantages of sharing food in small, mobile foraging groups (Gurven, 2004). At the same time, much of human behavior, including food sharing, is informed by local social norms culturally transmitted through social learning processes (Boyd et al., 2011; Henrich & McElreath, 2003). Indeed, institutionalized resource distribution is central to the social structure of all human societies but modern foragers uniquely hold sharing—in the sense of communal rights to resources—as a core value and institution (Woodburn, 1982; Peterson, 1993; Wiessner, 2005), and sharing pervades their worldview (Bird-David, 1990).

In a landmark field study of cultural transmission Hewlett and Cavalli-Sforza (1986) found that 100 percent of Aka forager children aged 7- to 12-years old reported knowing the proper way to share game meat, among a great many other social and technical skills. Eighty-four percent of the children in their sample claimed they learned to share from a parent (vertical transmission), and most said they learned from a same-sex parent. While seminal work, the methodology used in this study is problematic for studying the transmission of culture as discussed above. As discussed above, Aunger (2000) used a similar recall measure to examine the transmission of food taboos in the Democratic Republic of the Congo, and compared the results with independent measures of food taboos people actually shared. He found recall measures tended to over-represent parents as sources of taboos, as noted above, and that people shared taboos with other elders and same-age individuals more than was recalled—or at least reported (also see Reyes-García et al., 2009). Furthermore, the method does not provide a sense for the nature of parents’ contributions to their children's learning (Lancy, 2012). Children’s recall might not have
been sensitive to having learned cumulatively over time, and within a group context, such that naming parents as teachers may be a typical response because parents were their first teachers or the most salient of many. Finally, the method of transmission is not clear. Children could have been instructed deliberately or they could have observed and subsequently imitated others’ sharing behavior.

Unfortunately, there are few other field studies to draw from concerning how children learn to share resources during daily life and the role of specific social companions in the process. However, what is written represents a relatively wide diversity of human societies. For example Raum (1970) notes that among the hierarchical Chaga agro-pastoralists, food, originally distributed to children by mothers, is used by boys to gain allies in competition for dominance in boys’ groups. Among the West African Tallensi, Fortes (1970) reports that boys spontaneously share any small game they catch among friends or siblings according to their age and sex. He also reports that girls between 6- and 11-years-old, after having cooked “porridge” during play cooking, share the pretend porridge according to the pattern of family distribution—boys, in the role of “husbands” are served first. In Tonga, another hierarchical society, sharing food is seen as a core value and a foundation of social ties. Children learn to share in the household among their siblings, and while women told Morton they teach their children to “share without return” (Morton, 1996, p. 86), she describes creating social debt using food and other goods as a core feature of Tongan culture. Tongan adults are reported to command children to share when there are conflicts over food, and certain norms appear to be learned and enforced early, as Morton recounts a 3-year-old reacting with anger and rejection to her brother’s attempts to
steal food she would have otherwise offered to share with him.

Cultures with more egalitarian social structures show a different set of patterns. Adults among the relatively egalitarian Kaluli of the New Guinea highlands use teasing as a method of expressing displeasure at a child’s behavior, and teasing most often involves food sharing (Schieffelin, 1986). According to Schieffelin, teasing to enforce food-sharing norms includes “rhetorical questions, third-party threats, formulaic expression and sarcastic statements to tease and shame” (170). Damas (1972) briefly notes an early report of Copper Eskimo children of 7- or 8-years old acting as couriers of food portions. Such a practice may be common to foragers. Bird-David (2005) describes Nayaka forager children excitedly running to successful hunters upon their return, and taking an active part in the butchering and distribution of the game, carrying portions to their respective nuclear family hearths. Other forager researchers have given Bird-David similar accounts, and Kitanishi (1998) notes the same for the Aka. Guemple (1988) describes a form of explicit instruction being used to teach Inuit infants by rote the terminology of social relations, including the term for their “ritual sponsor” with whom the child will share a special lifelong exchange relationship. Guemple interprets the “ritual sponsor” relationship to be the foundation for learning the general social obligation to share. Among Ju/'hoansi foragers, adults largely respect the autonomy of children past infancy and only infrequently attempt to influence their behavior, by demanding they do minor chores, for example (Blurton Jones, 1993; Draper, 1976). However, similar to the Inuit example, direct instruction in ritualized hxaro exchange begins as early as six months, when a grandparent cuts off a child’s beads, places them in the child’s hands and encourages them to give the
gift to a relative—a process continued until the child is as old as nine (Wiessner, 1982).

Although Wiessner does not specifically detail the process of learning to share food, *hxaro* and food sharing are two separate but intimately linked institutions among the Ju/'hoansi. Given such early and deliberate instruction in *hxaro*, it is not surprising children always independently share the food they hunt or gather amongst each other, no matter how few calories it represents (Wiessner, 2002). In the only systematic study of social norm enforcement among foragers I am aware of, Wiessner (2005) notes that Ju/'hoansi children were always present during conversations in which norms were enforced. Notably, generosity was never praised in conversations she recorded. Rather, norms were most often enforced through criticism and joking or mocking among the Ju/'hoansi. Such a form of enforcement is low cost and reduces the chance of aggression. Significantly, the shaming and joking reported by Schieffelin and Wiessner are examples of *disapproving feedback* as I defined it above.

While sparse, these examples demonstrate that, across cultures, children commonly express explicit knowledge of food sharing norms and, in some cases, enforce other children's violations at least by middle childhood. While it is not necessarily surprising that children are aware of normative sharing practices, the cultural variation in the social learning processes and cultural transmission modes involved has not been explicitly compared. To summarize what is known, among farmers, whose social systems are hierarchical, food distribution patterns are subject to producer controls, children learn to use food politically in exchange for status, and there is evidence adults take an authoritative role in enforcing children's food distribution. Among egalitarian forager or
forager-horticulturalist societies (e.g. Kaluli), for whom there is more data and among whom food is regarded as a communal resource, there is evidence that explicit instruction in sharing begins very early in childhood, after which children are given a role in the practice of communal food sharing, and adult involvement in enforcement of norms involves teasing, shaming, or joking (i.e. disapproving feedback), rather than use of authority to force distribution. This method encourages sharing by evoking feelings of shame or guilt while respecting children’s autonomy.

In summary, the forager developmental niche includes intimate, open physical and social settings; a high degree of autonomy, little responsibility, and emphasis on complementarity between the sexes; much play, but little competitive or rough-and-tumble play; seemingly early use of teaching by parents and others (vertical and oblique), but perhaps relatively little instruction as it conflicts with autonomy; and early vertical and oblique instruction in food sharing followed by inclusion in the performance of food sharing, and enforcement of sharing norms through disapproving feedback. On the other hand, the typical small-scale subsistence farmer developmental niche includes more distant physical and social settings; pronounced vertical transmission of responsibility and obedience, age and gender hierarchy, as well as corporal punishment; relatively greater frequencies of horizontal competitive and rough-and-tumble play; and learning food sharing through authoritarian (vertical or oblique) control over distribution.
HYPOTHESES

In the following analyses, I will test a series of integrative hypotheses derived from the current state of knowledge reviewed above. These will pertain to four major subjects: Observation and imitation in children’s participation in work; social play; teaching; and the integrated analysis of learning to share.

Hypothesis 1a: Independent of culture, children should spend less time observing work and more time performing work as they get older.

Hypothesis 1b: Performance of work should tradeoff with performance of work in play, as children’s competency increases.

Hypothesis 1c: Variation between cultures and between sexes in time spent in work should depend on the opportunities to observe self-similar models.

Hypothesis 2a: Given greater autonomy, Aka children should play more frequently than Ngandu children (Konner, 2005).

Hypothesis 2b: Aka should exhibit less competitive play with defined rules, and less aggressive (rough-and-tumble) play than the Ngandu.

Hypothesis 2c: Given the value of trust and necessity of knowledge of the forest, Aka social play should involve greater engagement with the natural environment, whereas Ngandu play should reflect foundational schema of materialism which forms the basis of social relationships and cultural success.
Hypothesis 3a: All forms of teaching (direct instruction, feedback, and commands) should decrease in frequency with age, as social learning is traded-off with individual learning.

Hypothesis 3b: Children learn from their parents first (vertical) and learn proportionally more from other kin and non-kin with age (oblique).

Hypothesis 3c: Independent of age, the Aka should receive less direct instruction than should the Ngandu.

Hypothesis 4a. (Replication of Hewlett and Cavalli-Sforza 1986) Aka children should state they learned to share from a same sex parent.

Hypothesis 4b. Children should observe more sharing and receive and give more teaching regarding sharing than should Ngandu children through multiple social learning processes—observation, direct instruction, task commands, and feedback (punishment for improper sharing).

Hypothesis 4c. (Alternative to Hewlett and Cavalli-Sforza 1986) Among the Aka, children should learn to share via multiple cultural transmission modes, whereas Ngandu children should learn proportionally more via vertical transmission.
CHAPTER TWO:
ETHNOGRAPHIC SETTING

In this chapter I will summarize ecological, economic, cultural, and socio-structural features of Aka and Ngandu culture, as well as aspects of interethnic relations pertinent to children’s experiences. Many important aspects of Aka and Ngandu parenting, infancy and toddlerhood have been noted above, and this study is the first extensive study of childhood between 4-years-old and early adolescence, therefore I will not provide an extensive review of parenting, infancy and childhood here.

THE AKA

The Aka live in the northwestern region of the Congo Basin, in the tropical forests of southwestern Central African Republic (CAR) and northern Congo-Brazzaville. The region is approximately 100,000 km², stretching from the equator to 3 degrees north latitude. The dense, humid forest in this region is heterogeneous in composition. It is dominated by solid ground semi-deciduous forest, but is spotted with solid ground evergreen forests, swamp or marsh forests in the riverine valleys, and open savannah. Secondary forest also exists in regions recently abandoned farmers. The distribution of game varies across these various forest types and Aka hunt a number of species in each environment. The northern part of the region has a tropical climate with two seasons, and the southern part a subequatorial climate with four seasons. Average rainfall throughout is approximately 1700mm (1407-2381 mm), and the mean annual temperature is 24.5 °C (Bahuchet 1985; Hewlett 1992).
The Aka are estimated to number between 30,000-40,000 people, including a group of Aka in the southeastern area of their range known as the Mbenjele (Lewis, 2002). The local populations in any one area vary continuously as individuals come and go, visiting relatives in other areas for lengths of time. Ethnolinguistic studies show the Aka to have shared a common linguistic history with the neighboring Baka of eastern Cameroon (Bahuchet, 1993). Some of the vocabulary of this original language exists in the daily speech of both groups, but the Aka have since adopted the language of the Bantu farmers who moved into the region several centuries ago. The Aka language (diAka) is of the Bantu C10 family and is today distinct but mutually intelligible with the languages of the Ngandu and other neighboring farmers whose languages have the same historical roots. Sign language, paralanguage, song, and forest-sound imitation are also crucial aspects of Aka linguistic identity (Lewis, 2002, 2009).

Aka identify as a “people of the forest”, in opposition to the neighboring “people of the village.” To outsiders, Aka are famous for their skill in elephant hunting, honey collecting, and magic. Local group identity is defined by kinship and relation through marriage, and, depending on the region, identification with particular farmer families and clans of farmers. For example, Aka in the Lobaye region of CAR have a traditional “patron-client” relationship with specific farmer families, consisting of exclusive exchange relations. This type of relationship is common throughout the Congo Basin (see below). In this case, each farmer family has territorial rights to one of several trails that lead south from the village of Bagandou, which are used to access forest resources. These are clan trails and the Aka families associated with villagers of each clan are identified as members of that clan. It
depends on the particular Aka family how strongly they identify with their “patrons,” but each family enjoys substantial autonomy in this relationship, due to the Aka forest specialization and the villagers’ general fear of the forest environment (Bahuchet & Guillaume, 1982). The degree of autonomy of forest peoples in relation to their farming neighbors is still somewhat debated, though the most thorough ethnographic work among the forest foragers demonstrates they themselves feel autonomous, but acknowledge the value of sustained relations (Lewis, 2002, 2009).

Aka society is acephalous and highly egalitarian. In general, the nuclear family is the primary economic unit, consisting of a wife-husband pair and their children. A camp consists of a community of as many as 15 nuclear families, though usually only 20-35 people. Marriages are typically monogamous, though polygyny occurs, and marriages are typically clan (or trail) exogamous. Post-marital residence is nominally virilocal after a period of brideservice. However, personal choice is the most important determining factor of residence and most couples live bilocally. Exogamy and bilateral residence allows a couple to access a diversity of social relations, and therefore maintain flexible access to a wide range of social and economic resources. Woodburn’s (1982) summary of territorial inheritance among the !Kung, which he notes as similar if not more restrictive than that of the Hadza, also fits the Aka: “…what association with a particular locality seems usually to provide is a means of identifying oneself and others, a way of mapping out social relations spatially, rather than a set of exclusive rights” (437). There are regional bands of communities more or less interconnected through kinship, though the Aka do not have a term to describe these units. They consist of 50-150 individuals who share hunting and
gathering territory. Each band may consist of a core of 2 to 4 “clans”, though the clan level of identification is of more importance in relations between Aka and villagers than it is between groups of Aka (Hewlett, 1992).

There are three “specialists” within Aka society, who have important ritual duties but no special power outside of their domains. The *kombeti or mbai* “elder” is usually an older male within each camp whose knowledge and opinions are especially valued. This individual is concerned with the moral standards of the group and may speak to the forest as a representative of the camp to call for peace and fruitful hunting and gathering. There is no prohibition against a *kombeti* being female, and the wives of *kombeti* men are often especially influential as well. The *tuma* is a master elephant hunter and recognized as important in spiritual success in the hunt. Finally, the *nganga* diviner-healer is an important figure in Aka society. The *nganga* has special knowledge of medicinal plants and how to communicate with the spirits (Hewlett, 1992). These individuals may become so widely known and their powers heralded that heads of state will travel from the capital in Bangui to seek their divination or healing abilities. Thus, the *nganga* can be a substantial source of income for Aka communities. There is one famous *nganga* in the Lobaye region whose family operates a roadside clinic with a fairly regular patient load. *Ngangas* are almost always male and *tumas* are without exception initiated males. The last *tuma* in the Bagandou region I am aware of, Gbinda, died in February, 2012.

Most economic practices are collaborative affairs, and daily life consists of attending to subsistence and maintenance work, often leisurely and sociably. On average, one-third of the Aka diet comes from gathered forest foods, and the other two-thirds from hunted game,
usually mammals (Bahuchet, 1985). Aka knowledge of forest plants and animals is extensive. They primarily subsist on 63 species of plant, 20 insect species, and the honey from 8 species of bees, as well as meat from 28 species of game. Hunting technology is specialized for specific game, and what technique is used on any day will depend on the number of men available in camp and the time of the year (Bahuchet, 1988; Hewlett, 1992).

During the dry season, when camps are closer together, communal net-hunts are arranged, and several camps will join together. Men, women, and children may participate, one group acting as the “beaters” flushing game out of the bush toward the surrounding hunting nets where a second group of participates waits with spears ready. Also during the dry season, men may hunt individually during mornings or late in the evening with crossbows and poison darts. Wife and husband may also hunt porcupines together with hunting dogs if camp has to few members for net-hunting. Use of snares varies widely, but every young Aka boy (and probably many girls) is proficient in the construction of basic game traps before his adolescence.

Gathering activities also vary by season, though many fruits, nuts, fungi and the leaves of *Gnetum africanum* are gathered opportunistically, as are forest snails and tortoises. From about August through September (the height of the rainy season), moth caterpillars fall from the taller canopy trees to search for suitable ground in which to bury themselves to form chrysalides (Bahuchet, 1988). At this time, the Aka camp near to areas known for their quantities of caterpillars and all members of camp will spend the day gathering them. This resource is of great importance to the villagers throughout the Congo Basin as well, and the Aka trade large quantities to villagers who will dry them and sell.
them at markets throughout CAR. Dried, caterpillars can last for several months.

Sharing is a core value and foundational schema of Aka culture. As much as roughly 90 percent of food acquired by any camp member is shared with all other individuals in camp, even visitors (Kitanishi, 1998). If there is only a very small portion it may be shared within the nuclear family. Sharing is often formalized between families in camp. This is especially true of meat, which has specific distribution norms (Bahuchet, 1990). While the norm is to share foods that one brings to camp, it is a well-established practice to hide some foods or consume them in the forest so that one does not have to give them away. Honey in particular is often hidden and eaten at night with one’s nuclear family or consumed at the location it was gathered. However, continued stinginess is not tolerated and the group will eventually call out selfish individuals.

Aka religious beliefs are individualistic in nature. In general, there are two types of “ancestor spirits”. One type is more personalized and may have a name or belong to a particular family, and the other is nameless and generalized. Depending on the strength of one’s attributions, these ancestor spirits may mediate between the living and the great Forest Spirit, Dzengi, or Ezengi, who is responsible for the productivity of the forest. There is also consensus that a creator spirit exists, Bembe, who is no longer active (Bahuchet, 1999). Ceremonial dances are held frequently to ensure the productivity of the hunt, but also on the occasion of a death. To deal with private matters, more intimate rites may be performed, perhaps with the assistance of an nganga. The Aka have adopted villager beliefs about witchcraft and sorcery to various extents. Witches operate in secrecy and send poison darts into their victims. An nganga is the only one who can diagnose and cure the
attack of a witch (Hewlett, 1992).

The Aka concept of *ekila*, is a dynamic, individualized set of taboos that serves a function of spiritual and moral guidance. According to Lewis (2008), *ekila* is based on the multifaceted connections between one’s own growth and one’s relations to people, animals, and the forest itself through sharing and the hunt. *Ekila* beliefs stem from the association of menstruation with hunting success, the smell of menstrual blood having the effect of alerting game to one’s presence. It is extended, however, to a wider set of personalized prohibitions and proscriptions. A girl is called *ekila* when she begins to menstruate and now must adopt certain food taboos to protect her reproductive vitality, but also a hunter learns to take care of his *ekila* by always sharing and avoiding the jealousy of others. Children learn of their family’s *ekila* practices and beliefs when they reach the age of production (boys, when they join adult men’s hunts) or reproduction (girls, when they reach menarche).

**THE NGANDU**

Bagandou village is in the Lobaye province, in the southwestern corner of the Central African Republic, about six hours drive from the capital of Bangui. The village is situated along logging roads, which have been maintained by now regular transport of people and goods to and from the cities of Mbaiki and Bangui northeast of the village to Bagandou and points farther west. The village is surrounded on all sides by the extensive gardens, on which the Ngandu subsist and grow some surplus for sale, and coffee plantations, which the government buys for exchange on the international commodities
market. The Lobaye river lies north and east of the village, and south of the village past the gardens the landscape drops precipitously into the Congo basin tropical forest.

Bagandou is divided into roughly eight *quartiers* of around four to five hundred people and were historically established by patriclans. Recently, there has been considerable population influx in the *quartiers* near the main market center because of an increase in small-scale diamond and gold mining in the region.

Traditionally, the Ngandu speak diNgandu, a Bantu C10 language. However, Sango, an Ubangian language and the national language of CAR, has spread through its use by merchants and missionaries, and because of its usefulness as a *lingua franca* for immigrants moving into the region, especially from Cameroon and Chad. Today, the older generation still speaks diNgandu but most adults speak both languages. Children speak only Sango, though they understand diNgandu. Sango is the language of church and official politics, and “*vrai Sango*”, or the formal dialect of the language, is used in these contexts. Other Bantu languages are spoken in the village as well, including Isongo, Mbati and Bolimba, and many Ngandu can claim heritage from one of these culturally similar groups. Additionally, French is also a national language, and many villagers speak French at about a (French speaking) high school level of proficiency. More men than women speak French because men generally stay in school longer than women.

The Ngandu, Isango, as well as the Mbati, who are the majority ethnic group in the most northern *quartier*, Bombaketi, are historically and culturally inheritors of the Western Bantu tradition, which has its origins in central Cameroon, expanding west and east around 4000 years ago. Their ancestors likely reached the Ubangi river region by around 200 B.C,
according to Vansina (1990), and the Lobaye river region was settled over the following two millennia. There is also an increasing sense of political and ethnic affiliation with the state, beyond the local community, as more and more market integration occurs and the cultural diversity of the region increases.

Ngandu society is organized by a strict hierarchy based on age, gender, and status. While men receive far more privilege in general, women do have status through age and association with important men. For example, the mayor’s wife would be deferred to by men of equal age but lower status than the mayor himself. In general, quartiers are composed of a number of “houses” sharing patrilineal clan affiliation. Houses, or concessions, include a number of structures situated around a central plaza or facing the main road and are the centers of all domestic activity. Concessions consist of members of a patrilineage, and patrilocal post-marital residence is the norm. Women are free to return to their natal concessions to help with work, and do make frequent visits, especially in the early years of marriage. Roughly 40% of marriages are polygynous, and relationships between co-wives vying for resources is a serious source of tension in Ngandu households (Hewlett, 1992).

The village mayor is publically elected and represents the national government in the village. He presides over all official village business, including management of public facilities like wells and the public school, and the swearing in of the chiefs des quartiers. Quartier Chiefs’ major function is conflict mediation, and to act as local representatives to the mayor. Most conflicts revolve around sexual jealousy or witchcraft accusations. In the latter case, a place du justice is organized where testimonies are heard and the poison
oracle may be consulted. An Ngandu traditional healing specialist often administers the poison oracle, but an Aka nganga may be consulted. If found guilty of a crime, including witchcraft, the perpetrator is brought before the police chief who decides the sentencing (Hewlett et al., 2013).

Ngandu practice extensive slash-and-burn agriculture. Main crops include manioc, corn, plantains, oil palm, peanuts, and taro. Minor crops are diverse but include peppers, cucumbers, tomatoes, potatoes, eggplant and okra. Mango and citrus trees abound in the village. Many men own at least a small coffee plantation as a cash crop. There is a strict sexual division of labor. Men clear and burn the garden plots for planting, after which women manage planting, weeding, harvesting, and actually daily food preparation. Women also manage childcare and household maintenance while men, with some variation, spend the day politicking and drinking palm wine. Men do participate in hunting and trapping wild game. Some domesticated animals are also kept, especially chickens, goats, and pigs. Both men and women engage in commercial activities, and most families engage in some form of commerce, such as selling surplus produce from the concession or at market, selling prepared fish, meat or palm oil on foot in the street, or redistributing market goods from a small family market. Men may also specialize in a service trade (e.g. tailors, blacksmiths).

Ngandu commonly employ Aka in farm labor, hunting and in the collection of Gnetum africanum leaves, which are sold in the village as well as in the capital. The Ngandu invariable consider the Aka to be between themselves and wild animals in their worldview, although they are, paradoxically, highly respected as hunters and healers and are thought
to possess magic powers. Ngandu also regularly enter the forest, primarily to hunt. During
caterpillar season, from late July through early September, the village is virtually
abandoned as people leave to live in “caterpillar camps” from which they exchange
material goods with the Aka for caterpillars they will smoke and keep for consumption and
sale.

Ngandu culture, typical of similar small-scale farming societies, emphasizes family
communalism and obligation to one’s lineage. Therefore, economic contribution to labor is
required of family members from very early in life. Children are often put in care of infant
siblings or cousins, and by middle childhood Ngandu children are independently capable of
carrying out a variety of daily subsistence and household maintenance tasks.

Redistribution of material wealth amongst one’s paternal and maternal relatives, as
well as maintaining a general reputation as generous, is a constant part of daily life. Social
relations are based upon these material exchanges, and the value of particular relations
seemingly has a material rather than emotional basis. One important influence over
redistribution and reputation management is the fear of witchcraft accusations, which in
extreme cases can lead to murder.

Today, most Ngandu adults have had at least five years of grade school and can
speak French, though not all can read or write. Most children attend the public grade school
when the government pays the teachers. There are also three schools in the village
established by the Polish Catholic mission that can be attended for a fee. If the family can
afford it, promising children are sent to Mbaiki or Bangui to continue on to high school
once they pass the entrance exam. In general, schooling is considered essential but remains
a matter of economic possibility.

Most Ngandu are nominally Christians, with some having converted to Islam as well. However, traditional belief systems have more bearing on daily life. Among these, witchcraft beliefs are particularly important to social relations and the maintenance of social order. Witches, or sorcerers (there is no distinction here, in contrast to the Azande as described by Evans-Pritchard: Hewlett et al., 2013) eat people’s souls or flesh during the night, and can cause sickness in others of whom they are jealous because they have successfully gained more material wealth. In other instances, success may be attributed to the use of witchcraft to gain power, to work on one’s fields throughout the night, for example. While the subject of minimal research, witchcraft is often thought to serve as a leveling mechanism between households and clans, keeping others from getting ahead and not sharing their wealth. Evidence of witchcraft activities and the identity of sorcerers is a constant theme of gossip and rumor throughout the village, though true accusations are a serious matter and can result in arrest and imprisonment if brought to the police, or even murder should someone, usually a family member, take matters into their own hands.

INTERETHNIC RELATIONS

In tropical forest regions in the Congo Basin and elsewhere in the world, foragers and farmers maintain dynamic relationships founded primarily upon exchange of metal tools and agricultural produce for foods hunted or gathered in the forest. However, interethnic relations between foragers and farmers are nowhere simply a matter of economic exchange and are highly variable from place to place. I will briefly discuss the
case of Congo Basin peoples, and in particular the aspects of Aka-Ngandu interethnic relations pertinent to children’s experiences in the two cultures and at their interface. Forager-farmer relations in the Congo Basin has been the subject of extensive study (e.g. Bahuchet & Guillaume, 1982; Grinker, 1994; Joiris, 2003), but there has been no discussion of interethnic experiences of children.

Recent genetic evidence supports the case that continuous interactions between foragers and farmers throughout the Congo Basin are ancient in origin. According to an analysis by Verdu and colleagues (2009), the current diverse population of Congo Basin forager peoples (so-called pygmies) likely diverged from an ancestral population in western central Africa roughly 90,000 years before present and populated the forest thereafter. Subsequently, there was an expansion of the nonpygmy populations roughly 70,000 years before present. Based on variation in levels of genetic admixture, Verdu and colleagues (2009) report that the earliest gene exchange between these populations after their divergence coincides with the archaeological estimates of the rapid expansion of the nonpygmy peoples and the first appearance of metallurgy in the region, between 2000 and 5000 years before present (Phillipson, 2005). Verdu and colleagues (2009) conclude that the historical interaction of these two groups, Neolithic farmers and forest foragers, had a substantial impact on the subsequent historical differentiation of the forest dwelling peoples. Therefore, the exchange of forest goods for iron tools was likely one crucial factor in the historical trajectories of these groups throughout the region.

The oldest accounts of Westerners characterized the foragers as slaves to their farmer masters, a view reflecting the colonial mindset and one more inline with the view of
the farmers, who traditionally see themselves as “owners” of the pygmies (Bahuchet & Guillaume, 1982). However, Bahuchet and Guillaume (1982) trace the history of relations between the Aka and the various farmer ethnic groups living in their region, and portray the development over time of a relationship of interdependency rather than domination. The economic basis for the relationship today was established during the post-colonial era with the expansion of agriculture and the addition of coffee plantations during the 1960s. Bahuchet and Guillaume (1982) argue that this was the first time that the Aka were being employed for labor unrelated to their forest expertise. Now, Aka were valued for their labor, which was provided in exchange for food, manufactured goods and money. This new need for labor for the farmers and new opportunity to acquire resources for the Aka has led to a shift in Aka movement patterns and more time spent near to farmer villages. Today in Bagandou, where this study was collected, Aka are employed as laborers in fields and in the village, men are hired to go shotgun hunting, and there is a growing trade in the leaves of *Gnetum africanum* which might employ adults and adolescents of both sexes. All of these activities, but especially the latter two, have increased the flow of manufactured goods and cash into Aka communities and have established a greater interest in material acquisition among certain families.

Despite changes in the economic basis for interethnic relations, the ideological basis has not appreciably shifted. Traditionally, Ngandu men inherited “ownership” over specific Aka families from their fathers. This relationship persists, but with the increase in population in both communities, the Aka are treated more and more as an open pool of cheap labor. Regardless, the Ngandu see the Aka as lazy, poor, unreliable and devious. They
see themselves as obviously superior because of their use of farming and their access to material resources. Racism is entrenched in their culture. The term they use to refer to the Aka, babinga (the equivalent of “pygmy”), is derogatory, and meant to be so (not surprisingly, this was one of the earliest ethnonyms reported for the Aka by white visitors to the region, who used the farmers as their source of information). Amongst themselves, Ngandu will use the same word to insult someone for being lazy, irresponsible, or a thief.

The Aka perspective is reversed. The Ngandu are described as being like chimpanzees: loud and aggressive. The Aka defer to the Ngandu in their presence, but laugh at them in private. Aka women in particular will howl with laughter while dramatizing episodes in which Ngandu women have stormed into their camp and belligerently shouted angry, insult-ridden demands to repay debts or accusations of theft. Based on my experience, the Aka perspective is best captured by Lewis (2002, 2009), who describes the Mbenjele (Aka) as acting deferentially to the farmers for the same reason they mimic the sounds of game in the forest: to acquire the resources they desire. The Mbenjele and the Bagandou Aka do not see themselves as dependent and use the villagers as much as they need.

In terms of children’s social learning of interethnic relations, I have heard Ngandu parents refer to their children as babinga when a child acts improperly, and children use the term to insult each other and the Aka even more freely than do adults. Additionally, the discrimination against the Aka appears based on biological inheritance. For example, levels of genetic admixture between the Aka and Ngandu is relatively low (Becker et al., 2011), but children born of such unions, invariably between an Ngandu man and an Aka woman,
are not accepted in the village and are subject to stigma. On the other hand, their mothers’ communities accept these children without question.

Aka and Ngandu children do not usually work or play together, when their families are living in proximity. Notably, however, Aka children do not act deferentially to Ngandu children, even though the latter usually assert their dominance at every opportunity. One situation I have seen repeated on several occasions is illustrative of Aka and Ngandu children’s contrasting attitudes and behavior. As will be described below, the *ezambi* is a liana swing invariably set up by Aka children near their camp. While not as separate a children’s space as the *bobi* described by Turnbull (1962, 1978) among the Mbuti of the Ituri forest in the eastern Congo Basin, children commonly gather around the *ezambi* to play. During caterpillar season, Ngandu families regularly set up their camps near the Aka, or even share the same cleared forest space for shorter stays. When Ngandu children find an Aka children’s group playing on the *ezambi*, they invariably take over the swing, and the oldest or strongest Ngandu child will end up monopolizing it. The Aka usually do not resist the incursion and simply redirect their play or wait patiently. The interactions I have seen at the *ezambi* usually ended after the Ngandu child, usually a boy, who wrestled control of the swing swung too far or too close to the trees to which the swing was tied and ended up injuring himself. This context brought to my mind instances on the playground when I was a child where troublemakers pushed the game too far until someone got hurt and they ruined the fun.

To be clear, there are Ngandu who are kind and sympathetic to the Aka, and friendships certainly are forged across ethnic boundaries. However, these are not
normative and are easily shifted when intra-ethnic alliances are at stake. Interestingly, in my last trip to Bagandou in June of 2012, I saw Aka children playing soccer with Ngandu children in the village. The Aka children playing were boys from families who spend the majority of their yearly cycle near the village, and they were children who also have independently taken on paid labor selling cigarettes and candy in the Aka aggregation camps near the village for village merchants.
CHAPTER THREE:
METHODS

The data for this study come from field work conducted between July and November, 2008 and March and September, 2010 with the Aka and Ngandu living in or near to Bagandou village, Lobaye Province, CAR. My methodology included participant observation, systematic behavioral observations, and semi-formal interviews. I will describe in detail the latter two methods.

BEHAVIORAL OBSERVATIONS

Observational data for this study were recorded using focal follows (Altmann, 1974) of individual Aka and Ngandu children, aged four to sixteen, across a random sample of all daylight hours. Focal follows involve following a single individual for a specified period of time and recording behaviors during predetermined intervals according to a behavior coding scheme. This method, adopted from ethology, is widely used in quantitative studies in anthropology and has been used previously at my field site by other researchers (Hewlett, 1992; Meehan, Quinlan, & Malcom, 2012; Meehan, 2005). In 2008, only Aka children were systematically observed. Children were chosen at random and parental consent and child assent were obtained before beginning observations. When a child or parent refused participation, another child was chosen at random from those of the appropriate age and sex and asked to participate. Two Aka children refused participation in 2008. In 2010, one Aka boy was reluctant to participate, and one Ngandu father refused his
family's participation. The observation procedure was slightly different between the two years. In 2008, all children were observed during roughly the same daylight hours, each on a single day. In 2010, children were randomly assigned three two-hour sampling blocks between 6am and 6pm across a series of days. The latter procedure eliminates potential biases of observation of one child on only one day. In both years, each child was observed during a morning, midday, and evening period. Focal-child behavior was coded each minute using a 30-second-observe, 30-second record procedure. The 2008 sample included 35 Aka children (47% female) ages 4-17 (M=9.5, SD=4.0) who were observed a mean of 272.3 minutes each (SD=27.1) for a total of 9397 minutes of observation. The 2010 sample included 50 Aka children (52% female) and 48 Ngandu children (50% female) aged four through 16 years (M=9.3, SD=3.8). Children were observed for a mean of 233.6 minutes (SD=56.5) for a total of 22,896 minutes of observation.

As noted in Chapter 2, Aka families periodically aggregate in close proximity to Bagandou where labor for the Ngandu is a major factor in determining adult and, to a lesser degree, children's time allocation. Because my aim was to understand cultural transmission within Aka society, I sought as large a sample of Aka children living in the forest as time would permit. Therefore, after I’d gotten my feet wet amongst Aka living in village aggregations at the beginning of 2008, my assistants and I travelled extensively throughout the forest south of Bagandou, traversing five trails and living for at least a week’s time with seven different forest-dwelling communities in 2008, and eight communities during 2010. Three communities along two trails were visited both years and four children were in the sample both years. Four Aka families in the 2008 sample were living at a village
aggregation site during the study, and only one family was living near the village in 2010. That being said, Ngandu were present in forest camps on nearly a daily basis, as they too regularly occupy the forest for short periods to hunt and trade. Their presence in camp was especially common during caterpillar season.

Additionally, there is a public elementary school in Bagandou and most children at least periodically attend school when the CAR government pays the teachers salaries. School would obviously influence children’s time allocation in the village. However, all Ngandu children were observed in the village when elementary school was not in session.

In both years, the behavioral coding scheme was very similar and derived from previous observational studies of children (e.g. Bock & Johnson, 2004; Draper, 1976; Whiting & Edwards, 1988) and adjusted to the field site. The scheme was refined across the 2008 observations to better record the types of behaviors consistently encountered in the field, and therefore the 2010 codes better capture specific sub-categories of behavior, especially those regarding learning and sharing. Additionally, much of the analysis below is comparative across cultures and therefore uses only the 2010 data. Table 3.1 presents the behavior codes used in 2010. These only include more or more fine-tuned categories than what was used in 2008, thus represent the content of that behavioral coding scheme.

I will describe in detail how the social learning variables of observation, direct instruction, competency building through commands, and approving or disapproving feedback were coded.

Measuring observation times is a well-established procedure in ethological and experimental methods (e.g. Chance, 1967), and preferential visual attention to individuals
Table 3.1 Items coded every minute during focal child follows.

<table>
<thead>
<tr>
<th>Exchange</th>
<th>Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role</td>
<td>Resource</td>
</tr>
<tr>
<td>1=gives</td>
<td>1=gathered food</td>
</tr>
<tr>
<td>2=recipient primary</td>
<td>2=game meat</td>
</tr>
<tr>
<td>3=recipient secondary</td>
<td>3=honey</td>
</tr>
<tr>
<td>4=takes</td>
<td>4=garden food (Ngandu)</td>
</tr>
<tr>
<td>8=demands</td>
<td>5=garden food (Aka)</td>
</tr>
<tr>
<td>9=refuses demand</td>
<td>6=cooked meal</td>
</tr>
<tr>
<td>Notes: conflicts</td>
<td>7=tool</td>
</tr>
<tr>
<td></td>
<td>8=personal adornment</td>
</tr>
<tr>
<td></td>
<td>9=other object</td>
</tr>
<tr>
<td></td>
<td>10=cigarette</td>
</tr>
<tr>
<td></td>
<td>11=store-bought food</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning</th>
<th>Teaches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learns</td>
<td>1=is observed</td>
</tr>
<tr>
<td>1=observes/concentrates</td>
<td>2=gives verbal</td>
</tr>
<tr>
<td>2=receives verbal</td>
<td>3=gives non-verbal</td>
</tr>
<tr>
<td>3=receives non-verbal</td>
<td>4=gives positive reinforcement</td>
</tr>
<tr>
<td>4=receives positive reinforcement</td>
<td>5=gives negative reinforcement</td>
</tr>
<tr>
<td>5=receives command</td>
<td>6=gives command</td>
</tr>
<tr>
<td>7=imitates</td>
<td>8=rough joking</td>
</tr>
<tr>
<td>8=rough joking</td>
<td>10=verbal/non-verbal</td>
</tr>
<tr>
<td>Notes: eye-contact</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>General</th>
<th>Adult in visual range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting</td>
<td>1=mother only</td>
</tr>
<tr>
<td>1=forest camp</td>
<td>2=father only</td>
</tr>
<tr>
<td>2=forest net hunt</td>
<td>4=both parents</td>
</tr>
<tr>
<td>3=forest trail</td>
<td>5=parents and/or others</td>
</tr>
<tr>
<td>4=forest other</td>
<td>6=None</td>
</tr>
<tr>
<td>5=Aka garden</td>
<td></td>
</tr>
<tr>
<td>5=village camp</td>
<td></td>
</tr>
<tr>
<td>6=village trail in fields</td>
<td></td>
</tr>
<tr>
<td>7=village center</td>
<td></td>
</tr>
<tr>
<td>9=village other</td>
<td></td>
</tr>
</tbody>
</table>
Table 3.1 continued

<table>
<thead>
<tr>
<th>Primary Activity</th>
<th>Secondary Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1=eats/drinks</td>
<td>Hunt/gather</td>
</tr>
<tr>
<td>2=hunt/gather/work</td>
<td>1=gather (plant foods, caterpillars)</td>
</tr>
<tr>
<td>3=child hunt/gather/work</td>
<td>2=net hunt</td>
</tr>
<tr>
<td>4=play hunt/gather/work</td>
<td>3=spear hunt</td>
</tr>
<tr>
<td>5=social play</td>
<td>4=checks/makes snare</td>
</tr>
<tr>
<td>6=solo play</td>
<td>5=other hunt</td>
</tr>
<tr>
<td>7=childcare</td>
<td>6=honey</td>
</tr>
<tr>
<td>8=visiting</td>
<td>7=food prep (water, firewood)</td>
</tr>
<tr>
<td>9=dance</td>
<td>8=house construction</td>
</tr>
<tr>
<td>10=child dance</td>
<td>9=other</td>
</tr>
<tr>
<td>11=leisure</td>
<td>10=fishing</td>
</tr>
<tr>
<td>12=other</td>
<td>11=commerce</td>
</tr>
<tr>
<td>13=drum</td>
<td>12=garden/concession work</td>
</tr>
<tr>
<td>14=hygiene</td>
<td></td>
</tr>
<tr>
<td>15=work for villagers</td>
<td></td>
</tr>
<tr>
<td>16=travel</td>
<td></td>
</tr>
</tbody>
</table>

Vocalization

<table>
<thead>
<tr>
<th>Primary Activity</th>
<th>Secondary Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1=taking w/to someone</td>
<td>Play</td>
</tr>
<tr>
<td>2=sing/wistle/hum/yodel</td>
<td>1=object play (not play h/g or pretense)</td>
</tr>
<tr>
<td>3=yelling during net hunt</td>
<td>2=pretense play (not play h/g)</td>
</tr>
<tr>
<td>4=vocalizing to give/demand location</td>
<td>3=ezambi</td>
</tr>
<tr>
<td>5=vocalizing to give location</td>
<td>4=ndanga</td>
</tr>
<tr>
<td>6=other</td>
<td>5=other ball/ruled game</td>
</tr>
<tr>
<td>7=crying</td>
<td>6=rough and tumble</td>
</tr>
<tr>
<td>8=shouting</td>
<td>7=explore/roam</td>
</tr>
<tr>
<td></td>
<td>8=intimate</td>
</tr>
<tr>
<td></td>
<td>9=chase/hide</td>
</tr>
<tr>
<td></td>
<td>10=tree-climb</td>
</tr>
<tr>
<td></td>
<td>11=other</td>
</tr>
</tbody>
</table>

likely to provide useful (i.e. adaptively-relevant) information has been demonstrated in field settings with children (Hold, 1980; Hold-Cavell, 1996), and in laboratory paradigms with children (Chudek et al., 2012), adults (Foulsham et al., 2010b), and chimpanzees (Horner et al., 2010). Here, *observation* was intended to represent preferential visual
attention, and was coded if the child visually focused on the behavior of another individual or group for at least half of the 30-second observation interval. If they observed something continuously for multiple intervals consecutively, this would be recognized as a single “bout” of observation.

A bout of teaching was coded as direct instruction if it involved a teacher using clear ostensive cues, including any one or combination of verbal, gestural, or eye-gaze cues, to specify how or why to behave with explicit reference to the context or rationale for the behavior. This would include a variety of subtler types of teaching behavior that have been reported in the literature, such as local or stimulus enhancement (Heyes, 1994; Whiten et al., 2004). A command was recorded when, to the best of my understanding, by hearing it myself or by inquiring, someone issued an imperative statement to a child indicating a behavior that they wish performed. This is purposefully a broad measure of the use of commands as potentially creating learning experiences. A weakness is that using such an observational measure does not permit measurement of whether or not the child actually learned, only that the opportunity was presented through another’s behavior. Feedback was coded whenever I observed an expression, verbal or non-verbal, of approval or disapproval of another’s behavior without offering additional information regarding an alternative, more or less favorable, form of behavior.

Together, I will refer the these three variables as “teaching.” A teaching bout was coded whenever any of these three behaviors was observed during an observation interval. Bout duration is the number of consecutive observation intervals in which the same teacher(s) provided the same form of teaching. By measuring teaching this way, it can be
analyzed as a component of time allocation during daily life, and can be considered a measure of investment. Domains of teaching were first noted during coding and refined into composite domains when reasonable similarities were clear based on contextual notes taken during observation.

The following example briefly illustrates use of the coding scheme: If it was raining and a child was told to “Come inside”, this would be coded as teaching using a command. If the child was told, “It’s raining, come inside,” this would be coded as teaching using direct instruction. If a child was in the rain and a parent said “Oh! You’re going to get sick!”, this would be coded as disapproving, or negative, feedback. In each instance, the domain would be “health.”

Children’s social companions were also recorded every five minutes during focal follows. As the children were often in proximity to several individuals at any one time, it proved impossible to record the both behavior and nearest neighbors simultaneously every minute. However, a five-minute interval allowed for more consistent coding. Nearest neighbors were recorded with three distance measures: in physical context, within roughly 3 meters, and within roughly 6 meters. Each individual in the child’s camp, for the Aka, or in the focal child’s family and directly neighboring concessions (if occupied and in common interaction with the focal child, based on observations and interviews), for the Ngandu, were each given a personal “field” ID code. These were later re-coded to fit the broader ID coding system and their age, sex, and genetic relatedness were linked to their ID.

It was impossible to have an ID prepared for every person who would be in contact with each focal child. Therefore, exact ages in years of all nearest neighbors were not easily
Table 3.2 Theories of child development and major features of developmental stages.

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Child Development</th>
<th>Life History Theory</th>
<th>Aka (DiAka)</th>
<th>Ngandu (Songo)</th>
<th>Major Features$^{2,3}$</th>
</tr>
</thead>
</table>
| 3-6       | Early Childhood   | Childhood (unique to humans) | moanna      | molengue       | • moderate growth rate  
|           |                   |                     |             |                 | • nutritional dependency  
|           |                   |                     |             |                 | • 95% adult brain size at 3-4 |
| 7-12      | Middle Childhood  | Juvenile (all mammals) | moanna ngondo (f)/bokala (m) | kete masika wali (f)/koli (m) | • slowest growth rate since birth  
|           |                   |                     |             |                 | • nutritional independence  
|           |                   |                     |             |                 | • cognitive transition for learning  
|           |                   |                     |             |                 | • social independence  |
| 13-18     | Late Childhood/Adolescence | Adolescence | ngondo (f)/bokala (m) (m) | masika wali (f)/koli (m) | • growth spurt  
|           |                   |                     |             |                 | • secondary sex traits  
|           |                   |                     |             |                 | • sociosexual and economic maturity  |

$^{1}$Cole (2005)  
$^{2}$Bogin (2006)  
$^{3}$Tomasello et al. (1993)  
$^{4}$Kitanishi (1998) for adolescent males in NE Congo

obtained during the course of observations. As a compromise, all neighbors if previously unknown (i.e. without an “field ID”) were coded as one of five age-categories: infant (not yet regularly walking); early childhood (regularly walking-6 years old); middle childhood (7-12 y.o.); late childhood or adolescence (13-18 y.o.); adult (>18 y.o.). These categories are presented in Table 3.2 and have the advantage of being broad enough to accurately classify, and correspond to both Western (Bogin, 1990, 2006) and emic categories of child development (Hewlett, 1992). Sex was coded for each model as female or male. Kinship degree was established through genealogies and separated into close kin ($r=.5$), distant kin ($0<r<.5$), and non-kin ($r=0$) for the analysis below.
Semi-formal Interviews

Structured interviews were conducted with an opportunity sample of 31 Aka children ages five through sixteen (mean age 10 years, SD=3.8, 49% female). Parental consent and child assent were acquired before each interview. Interviews were conducted in or near to the child’s family’s camp and were done one-on-one as often as possible, though other individuals were often in the vicinity. When others were near, they were asked not to provide any input to the interviewee. Having others near seemed to increase the confidence of the shyer informants and did not demonstrably alter the nature of the responses.

Interview questions pertained to learning food sharing as well as childcare. The same series of questions was posed to each informant, but follow-up questions and probes were introduced ad hoc depending on depth of responses and patience of the child. I initially posed the questions in French and an Ngandu field assistant subsequently translated into DiAka. The questions regarding food sharing that will be subject to analysis below appear in Table 3.3. Responses were recorded in full and transcripts from my field notes were then subject to content analysis.

Table 3.3 Initial questions posed to Aka and Bofi forager children (N=39) regarding their learning to share food. Depending on children's depth of response and their willingness, follow-up questions were posed conversationally during the interviews.

<table>
<thead>
<tr>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you hunt or gather things in the forest or nearby to camp?</td>
</tr>
<tr>
<td>What do you find?</td>
</tr>
<tr>
<td>What do you do with [food mentioned]?</td>
</tr>
<tr>
<td>Why do you share food?</td>
</tr>
<tr>
<td>Who do you share with?</td>
</tr>
<tr>
<td>Who taught you to share food?</td>
</tr>
<tr>
<td>What did they tell you about sharing food? How did [people mentioned] teach you?</td>
</tr>
<tr>
<td>Did [people mentioned] tell you what would happen if you did not share? What did they say?</td>
</tr>
<tr>
<td>What would you do if you discovered someone in camp has hidden food and not shared it?</td>
</tr>
</tbody>
</table>
CHAPTER FOUR:
RESULTS

In this chapter I review the results of the four major sets of analyses conducted for this study: 1) the tradeoffs between observation and imitation in the realm of children’s work; 2) cultural variation in social play; 3) the contributions of instruction and related contingent social learning processes, their domains of learning, and the associated cultural transmission modes; and the 4) the special case of the social learning of food sharing. In each section I will briefly review the issues at hand and then sequentially present the hypothesis and results of my analysis. I will then conclude each section with a summary of the major results.

OBSERVATION AND IMITATION OF WORK

It is often written that children in small-scale societies learn essential skills and knowledge pertaining to daily subsistence through observation and imitation of adults. Additionally, imitation of work in social play is thought to be an important venue for early learning. Biologists consider observation and imitation to be the heart of social learning and subsequent performance to be individual learning. Evolutionary theory suggests that social learning should tradeoff with individual learning over the life course in order to quickly hone in on an adaptive behavior and fine-tune it with experience.

Previous studies have indicated that both forager and farmer children are capable of substantial productive work by middle childhood, but this varies by culture and between
the sexes: children from small-scale farming societies are often assigned age-appropriate work by their parents and girls have a heavier work burden than boys throughout childhood. On the other hand, forager children are given the autonomy to work by their own individual choice when it is feasible, and sometimes contribute substantially. Cultural transmission theory suggests that social learning should be biased towards learning from self-similar models, thus the behavior of same-sex models may be an influence over the emergence of the sexual division of labor during middle childhood.

**Hypothesis 1a:** Independent of culture, children should spend less time observing work and more time performing work as they get older.

First, Figure 4.1 shows Aka and Ngandu children’s overall time budget by sex. As can be seen, relative time spent in work ranges from roughly 11% of observations for Aka boys to roughly 30% of observations for Ngandu girls, not including childcare. Table 4.1 presents the relative frequencies of different work activities, and the representation of those activities in play work. As can be seen, gathering and food preparation were common work activities for all children, but were each more common among girls in both cultures. Similarly, boys were more often observed performing hunting activities. Notably, those work activities performed most frequently also tended to be the same most frequently represented in play. Table 4.1 also presents relative frequencies work and play work activities were observed by children. Observation of work was surprisingly infrequent. Children spent an average of about 4 minutes per day observing work being
Figure 4.1 Children’s time budgets by sex and culture.

performed, while spending an average of roughly 3 hours per twelve-hour day performing work (with substantial individual variation: SD=2.4 hours/day) and about half an hour performing work in imitative play (SD=.9 hours/day).

Negative binomial regression modeling was used to test the hypothesis that counts of observations in which children worked, performed work in play, or observed work were associated with children’s age. Culture and sex were included in each model, and interaction terms were tested and removed if not statistically significant. The modeling results are reported in Table 4.2. As predicted, time spent performing work was positively
Table 4.1 Frequencies children performed and observed Work and Play Work activities.

<table>
<thead>
<tr>
<th></th>
<th>Aka mean min/day participated (SD)</th>
<th>Ngandu mean min/day participated (SD)</th>
<th>Aka mean min/day observation (SD)</th>
<th>Ngandu mean min/day observation (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Females</td>
<td>Males</td>
<td>Females</td>
<td>Males</td>
</tr>
<tr>
<td>All Work</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gathering</td>
<td>85 (85)</td>
<td>29 (43)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Net Hunt</td>
<td>9 (23)</td>
<td>21 (47)</td>
<td>–</td>
<td>.4 (1)</td>
</tr>
<tr>
<td>Spear Hunt</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Snare</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Other Hunt</td>
<td>–</td>
<td>3 (10)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Food Preparation a</td>
<td>62 (56)</td>
<td>28 (40)</td>
<td>.8 (2)</td>
<td>.6 (1)</td>
</tr>
<tr>
<td>House Construction</td>
<td>.7 (3.6)</td>
<td>.1 (6)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Fish b</td>
<td>4 (19)</td>
<td>–</td>
<td>.1 (6)</td>
<td>–</td>
</tr>
<tr>
<td>Childcare</td>
<td>11 (19)</td>
<td>7 (21)</td>
<td>2 (2)</td>
<td>–</td>
</tr>
<tr>
<td>Commerce</td>
<td>.2 (1)</td>
<td>.3 (1)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>House Cleaning c</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Other Work</td>
<td>12 (9)</td>
<td>7 (12)</td>
<td>–</td>
<td>.3 (1)</td>
</tr>
<tr>
<td>All Play Work d</td>
<td>27 (46)</td>
<td>38 (47)</td>
<td>.4 (1)</td>
<td>4 (14)</td>
</tr>
<tr>
<td>Gathering</td>
<td>7 (16)</td>
<td>2 (4)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Net Hunt</td>
<td>3 (12)</td>
<td>15 (38)</td>
<td>.2 (9)</td>
<td>–</td>
</tr>
<tr>
<td>Spear Hunt</td>
<td>–</td>
<td>5 (15)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Snare</td>
<td>–</td>
<td>.4 (2)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Other Hunt</td>
<td>2 (6)</td>
<td>8 (17)</td>
<td>–</td>
<td>4 (14)</td>
</tr>
<tr>
<td>Honey</td>
<td>–</td>
<td>.1 (5)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Food Preparation</td>
<td>22 (64)</td>
<td>5 (13)</td>
<td>.2 (7)</td>
<td>–</td>
</tr>
<tr>
<td>House</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Fish</td>
<td>.3 (2)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Commerce</td>
<td>1 (6)</td>
<td>.1 (5)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>House Cleaning</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Other Work</td>
<td>6 (10)</td>
<td>6 (10)</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

a Includes fetching firewood and water.
b Includes bail and line fishing, the former being a typically female occupation.
c This refers to cleaning, sweeping, arranging, etc. an Ngandu family concession, both inside and outside the house.
d Note that playing childcare was not coded as playing work so it is not included here.
Table 4.2 Negative binomial regression model results.

<table>
<thead>
<tr>
<th>DV</th>
<th>IV</th>
<th>coef</th>
<th>SE</th>
<th>z</th>
<th>p</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Likelihood</td>
<td>Age</td>
<td>.12</td>
<td>.02</td>
<td>5.43</td>
<td>&lt;.001</td>
<td>[.08, .16]</td>
</tr>
<tr>
<td></td>
<td>Culture</td>
<td>.43</td>
<td>.15</td>
<td>2.78</td>
<td>.005</td>
<td>[.13, .73]</td>
</tr>
<tr>
<td></td>
<td>Sex</td>
<td>-.60</td>
<td>.15</td>
<td>-3.86</td>
<td>&lt;.001</td>
<td>[-.90, -.29]</td>
</tr>
<tr>
<td>Work Likelihood</td>
<td>Age</td>
<td>-.27</td>
<td>.08</td>
<td>-3.26</td>
<td>.001</td>
<td>[-.43, -.11]</td>
</tr>
<tr>
<td></td>
<td>Culture</td>
<td>-.03</td>
<td>.39</td>
<td>-.07</td>
<td>.944</td>
<td>[-.80, .70]</td>
</tr>
<tr>
<td></td>
<td>Sex</td>
<td>-2.1</td>
<td>1.1</td>
<td>-1.9</td>
<td>.058</td>
<td>[-.43, .07]</td>
</tr>
<tr>
<td></td>
<td>Age x Sex</td>
<td>.27</td>
<td>.11</td>
<td>2.48</td>
<td>.013</td>
<td>[.06, .50]</td>
</tr>
<tr>
<td>Observation of Work</td>
<td>Age</td>
<td>-.07</td>
<td>.03</td>
<td>-2.18</td>
<td>.03</td>
<td>[-.1, -.007]</td>
</tr>
<tr>
<td></td>
<td>Culture</td>
<td>-.46</td>
<td>.23</td>
<td>-1.96</td>
<td>.05</td>
<td>[-.9, .0006]</td>
</tr>
<tr>
<td></td>
<td>Sex</td>
<td>-.69</td>
<td>.25</td>
<td>-2.74</td>
<td>.006</td>
<td>[-1.2, -.2]</td>
</tr>
</tbody>
</table>

correlated with age, independent of culture and sex. The coefficient of .12 indicates a modest increase of about 1.1 times the minutes per day spent in work with every year of age (Cohen et al., 2003). However, both culture (Aka=0, Ngandu=1) and sex (female=0, male=1) were also significant predictors of time spent in work. Independent of age or sex, Ngandu children performed work about 1.5 times more minutes per day than Aka children. Additionally, independent of age or culture, boys spent about 1.8 times fewer minutes per day in work.

Also in support of Hypothesis 1a, frequency of observation of work decreased with age, independent of culture or sex, with 1.1 times fewer bouts of observation each year of age. Culture and sex were also independently significant predictors of time spent observing work. Aka children observed work about 1.6 times more often than Ngandu children, and the coefficient for sex indicates girls observed work about 2 times more often than boys, independent of culture or age.
It is notable that, according to these results, girls observed work and performed work more often than boys, yet Aka children worked less often but observed work more often than did the Ngandu children. This will be discussed further below.

**Hypothesis 1b**: Performance of work should tradeoff with imitation of work in play, as children’s competency increases.

Table 4.2 also presents the results of regression of play work on age, controlling for culture and child’s sex. Results show that play work decreased in frequency with age, but the significant Age x Sex interaction term indicates the relationship is dampened for males. In other words, independent of culture, both males and females performed work in play less frequently with age, but girls evidenced a larger decrease than boys for every year of age. Interestingly, the independent effect of sex remains marginally significant with the interaction term in the model, indicating that, overall, girls spent more time playing work, but their play decreased in frequency faster than did boys play. This relationship is presented graphically in Figure 4.2.

**Hypothesis 1c**: Time spent in work should vary depending on the opportunities to observe self-similar models.

The most dramatic pattern that is visible in Figure 4.2 is the relatively infrequent performance of work by Aka males throughout childhood, which would explain the statistical results that, independent of age, girls and Ngandu children work significantly more often than boys and Aka, respectively. To test the hypothesis that this trend is due to
differential opportunities to observe self-similar models (e.g. Aka males working), I have compiled the average sizes and constituents of children’s groups when they were working or playing work in Table 4.3. Groups are defined as nearest neighbors within 6 meters of a child. Mean group size was about 3 individuals, but a little larger for Aka boys when they were performing work activities in play. Children tended to be in mixed-sex groups, but boys groups were on average more male-biased. As would be expected, adults were more frequently members of children’s group when children were working compared to when they were playing work. These descriptive statistics indicate Aka children would have
Table 4.3 Average group sizes and constituents when children were working or playing work.

<table>
<thead>
<tr>
<th></th>
<th>Mean Size</th>
<th>Mean Sex Ratio</th>
<th>Younger child</th>
<th>Same-age child</th>
<th>Older child</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Work</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aka Females</td>
<td>2.7</td>
<td>1.08</td>
<td>0.92</td>
<td>0.74</td>
<td>0.16</td>
<td>0.34</td>
</tr>
<tr>
<td>Males</td>
<td>2.4</td>
<td>1.85</td>
<td>0.91</td>
<td>0.69</td>
<td>0.21</td>
<td>0.41</td>
</tr>
<tr>
<td>Ngandu Females</td>
<td>3.4</td>
<td>0.85</td>
<td>0.91</td>
<td>0.63</td>
<td>0.26</td>
<td>0.54</td>
</tr>
<tr>
<td>Males</td>
<td>2.7</td>
<td>1.84</td>
<td>0.88</td>
<td>0.64</td>
<td>0.14</td>
<td>0.30</td>
</tr>
<tr>
<td><strong>Playing Work</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aka Females</td>
<td>3.0</td>
<td>1.20</td>
<td>0.66</td>
<td>0.93</td>
<td>0.53</td>
<td>0.12</td>
</tr>
<tr>
<td>Males</td>
<td>3.9</td>
<td>1.90</td>
<td>0.79</td>
<td>0.87</td>
<td>0.36</td>
<td>0.31</td>
</tr>
<tr>
<td>Ngandu Females</td>
<td>3.3</td>
<td>1.20</td>
<td>0.62</td>
<td>0.89</td>
<td>0.37</td>
<td>0.28</td>
</tr>
<tr>
<td>Males</td>
<td>2.8</td>
<td>1.80</td>
<td>0.93</td>
<td>0.55</td>
<td>0.26</td>
<td>0.04</td>
</tr>
</tbody>
</table>

ample opportunity for cultural transmission from other males while performing work and play work activities. However, because of the nature of the focal follow method, I was not able to also capture the exact activities of all members a child’s group while observing the focal child. Productive work activities were normally interspersed with leisure and play, for example. However, I recorded the identities of all individuals the focal children observed performing work. These data are illustrated in Figure 4.3. As can be seen, the Aka children varied little in the relative time boys and girls spent watching same-sex versus other-sex models, and both observed females about twice as frequently as males. In contrast, Ngandu males observed other males working far more often than they observed females working and, similarly, Ngandu girls observed women a greater proportion of the time.

While not a strong test, this evidence does support Hypothesis 1c, indicating that the Aka boys, who were observed performing the least about of work, also observed self-similar (i.e. male) models performing work proportionally less frequently than did any of
Figure 4.3 Proportion of children’s observations of work in which they watched females versus males working. Aka boys performed the least amount of work and observed male models working proportionally less frequently than Ngandu boys.

the other groups. Furthermore, there is a substantial contrast between the cultures in the degree of same-sex cultural transmission of work behavior. This supports developmental models of the sexual division of labor that argue socialization is important (Whiting & Edwards, 1973), but favors a view that, in contexts in which children’s autonomy is respected over the need for children’s contributions to labor, adaptive cultural transmission biases inform children’s learning to work.
That Aka boys rarely observed men working can at least in part be attributed to the
nature of hunting as men’s work. Much of the hunting that men performed during my
fieldwork was performed individually. For example, often hunters were hired by Ngandu
merchants visiting camp to hunt with a shotgun. This activity is conducted alone and at
night, such that boys would have no opportunity to observe men doing this. What,
therefore, is likely, is that Aka boys must learn to do men’s work much later than girls are
able to women’s work. For them, the tradeoff between social learning and individual
learning occurs on a different developmental trajectory. On this point, it is notable that the
Ngandu boys, who observed work relatively infrequently overall, watched only two
categories of work performed: childcare and commerce. While childcare is surprising,
commerce is a highly salient feature of materialist Ngandu society and is seen as the key to
success by the younger generations. It is also a very public and, to a large extent, male-
dominated activity. While much more investigation is needed, these results point to new
avenues for understanding gender egalitarianism in foraging societies and the
development of the sexual division of labor across cultures from an adaptive social learning
perspective.

To summarize, in this section I found strong support for two hypotheses and some
modest support for the third. Children increased the frequency in which they performed
work and spent less time observing work with age, independent of sex and culture
(Hypothesis 1a). Additionally, as has been noted in previous studies of children’s work, the
Ngandu farmer children worked more overall and girls in both cultures worked more than
did boys. Children also spent less time playing work with age (*Hypothesis 1b*), however this relationship was tempered for males, who decreased their time spent in play at a slower rate throughout childhood. Finally, I found that, while there were no major differences in children’s group compositions while working, Ngandu boys, who worked more than Aka boys, also observed males working proportionally much more than females working (*Hypothesis 1c*). Aka boys and girls observed females working about twice as often as males.

**SOCIAL PLAY: CHILD-TO-CHILD TRANSMISSION**

Social play is considered an important platform for early social learning of skills and knowledge, as well as values and beliefs through child-to-child cultural transmission. It is hypothesized that the foundational schema of children’s cultural context, represented in child-rearing practices and parental beliefs, influence the quantity and content of play. Table 4.4 presents the foundational schema of the two cultures (Hewlett et al., 2011) and the hypothesized effects on children’s play. The results are discussed in terms of the relationship between culture learning and children’s play.

<table>
<thead>
<tr>
<th>Culture</th>
<th>Foundational Schema</th>
<th>Hypothesized Cultural Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aka</td>
<td>Egalitarianism</td>
<td>More play overall</td>
</tr>
<tr>
<td></td>
<td>Sharing</td>
<td>More cooperative play</td>
</tr>
<tr>
<td></td>
<td>Autonomy</td>
<td>Little play with defined rules</td>
</tr>
<tr>
<td></td>
<td>Intimacy with the forest</td>
<td>More play engaging surrounding ecology</td>
</tr>
<tr>
<td>Ngandu</td>
<td>Hierarchy (age and gender)</td>
<td>More work overall</td>
</tr>
<tr>
<td></td>
<td>Competition</td>
<td>More competitive play</td>
</tr>
<tr>
<td></td>
<td>Obedience</td>
<td>More play with defined rules</td>
</tr>
<tr>
<td></td>
<td>Materialism</td>
<td>More play reflecting materialism/commerce</td>
</tr>
</tbody>
</table>
Hypothesis 2a: Given greater autonomy, Aka children should play more frequently than Ngandu children (Konner, 2005).

It can be seen in the children’s time budgets presented in the last section (Figure 4.1) that play was one of the two most common activities in each culture, however the Ngandu played more frequently overall. This difference is statistically significant (z=-2.9, p<.01, Wilcoxon Rank-sum test), contrary to Konner’s hunter-gatherer childhood model. As can be seen in Table 4.5, Aka and Ngandu children’s groups were similarly composed across observations and adults were able to observe, and potentially influence, Ngandu children more frequently than Aka children. These data indicate the mixed-age nature of forager children’s groups is not necessarily unique, nor is autonomy necessarily a reason to expect more play—Ngandu play more even though they are in visual range of authoritarian Ngandu adults more often.

<table>
<thead>
<tr>
<th></th>
<th>% of observations different individuals were included among those within 6 meters of Focal Child</th>
<th>% of observations Focal Child was in visual range of Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Older child</td>
<td>Same-age child</td>
</tr>
<tr>
<td>Aka</td>
<td>33</td>
<td>82</td>
</tr>
<tr>
<td>Ngandu</td>
<td>35</td>
<td>76</td>
</tr>
</tbody>
</table>

Hypothesis 2b: Aka should exhibit less competitive play with defined rules, and less aggressive (rough-and-tumble) play than the Ngandu.

Table 4.6 shows the variation in the different types of play that were observed in the
two cultures. As predicted, the Ngandu were observed to play competitive games some six times more frequently than the Aka (z=-4.44, p<.0001, Mann-Whitney test). These games included soccer, “toy soccer” (“babine,” in Songo), and other physical or strategy games with 1) rules, 2) turn-taking, and 3) a scoring system. Some of these games are learned in school, though many are also traditional, passed on by children to other children. The energetic girls’ game of *gbagba* is illustrative of how hierarchy and competition are emphasized in these games, and how child-oblique transmission (from older children to younger children) works to reinforce these values. In *gbagba*, two girls stand opposite each other, one of whom is “it”, and they begin singing and clapping. At the end of each repeated verse of the song, each girl must kick one foot. If the girls kick the same foot they continue. If they kick the opposite foot the girl who is “it” gets a point, and they repeat until there is a champion. Score is kept by drawing a grid of squares on the ground and moving a marker into the next square after earning a point. Often, younger children not skilled enough to effectively compete are recruited to stand in the grid as the score markers.

Rough-and-tumble play was also seen more frequently among the Ngandu (z=2.1, p<.05). The roughness of Ngandu children’s play is quite apparent and does not simply consist of spontaneous roughhousing, but is sometimes an overtly chosen play activity called *ngia ti combat*, or “fighting play” (*jeu de combat* in French). This activity does not exist among the Aka, whose occasional rough-and-tumble is spontaneous and non-aggressive. Often, Ngandu roughhousing escalates until someone is hit too hard and becomes truly aggressive. I never saw play escalate to conflict among the Aka.
**Hypothesis 2c:** Given the value of trust and necessity of knowledge of the forest, Aka social play should involve greater engagement with the natural environment, whereas Ngandu play should reflect foundational schema of materialism which forms the basis of social relationships and cultural success.

As can be seen, I separated two types of play, *ezambi* and *ndanga* that are specific to Aka children. This does not mean that the Aka played a wider variety of games than the Ngandu. In fact, the Ngandu played a much wider variety of games, all of which were competitive. The *ezambi* forest liana swing and *ndanga* ball game involve cultural symbolism revealing of their nature as social learning activities exclusive to Aka children's culture. The *ezambi* is only used by children, and it takes bravery as well as trust in one's playmates and the forest to enjoy it. Two types of *ezambi* were seen during my fieldwork.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Aka Mean</th>
<th>Aka SD</th>
<th>Ngandu Mean</th>
<th>Ngandu SD</th>
<th>Wilcoxon rank-sum test</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Social Play</td>
<td>84.7</td>
<td>67.6</td>
<td>153.9</td>
<td>126.7</td>
<td>( z = -2.9^{**} )</td>
</tr>
<tr>
<td>Object</td>
<td>8.3</td>
<td>16</td>
<td>6.5</td>
<td>11.4</td>
<td>( z = 0.09 )</td>
</tr>
<tr>
<td>Pretense</td>
<td>3.0</td>
<td>7.4</td>
<td>8.0</td>
<td>27</td>
<td>( z = 1.1 )</td>
</tr>
<tr>
<td><em>ezambi</em></td>
<td>6.3</td>
<td>15.5</td>
<td>NA</td>
<td>NA</td>
<td>-</td>
</tr>
<tr>
<td><em>ndanga</em></td>
<td>3.9</td>
<td>17.8</td>
<td>NA</td>
<td>NA</td>
<td>-</td>
</tr>
<tr>
<td>Competitive</td>
<td>12.7</td>
<td>30.2</td>
<td>80.9</td>
<td>110.9</td>
<td>( z = -4.4^{***} )</td>
</tr>
<tr>
<td>Rough and Tumble</td>
<td>4.0</td>
<td>7.7</td>
<td>11.7</td>
<td>22.8</td>
<td>( z = -2.1^{*} )</td>
</tr>
<tr>
<td>Chase</td>
<td>1.6</td>
<td>3.6</td>
<td>1.9</td>
<td>5.9</td>
<td>( z = 0.4 )</td>
</tr>
<tr>
<td>Tree Climbing</td>
<td>3.6</td>
<td>10.4</td>
<td>2.3</td>
<td>7.7</td>
<td>( z = 0.4 )</td>
</tr>
<tr>
<td>Exploratory</td>
<td>13.5</td>
<td>18.1</td>
<td>9.6</td>
<td>12.8</td>
<td>( z = 0.7 )</td>
</tr>
<tr>
<td>Intimate</td>
<td>2.2</td>
<td>13.2</td>
<td>0.08</td>
<td>0.6</td>
<td>( z = 1.6^{^\wedge} )</td>
</tr>
<tr>
<td>Idiosyncratic</td>
<td>23.6</td>
<td>26.9</td>
<td>30.5</td>
<td>36.0</td>
<td>( z = -0.4 )</td>
</tr>
</tbody>
</table>

\(^{^\wedge}p \leq .10, \,*p \leq .05, \,**p \leq .01, \,***p \leq .001\)
One is usually made close to camp and consists of a liana, cut on both ends, and tied up between two trees. Some versions of this type that I saw were very long, tied high up on a tree by a boy of 10 to 15 years old, which allowed the children to swing very high above the forest floor, though they would not have to climb to get on the swing. The other type was made from lianas naturally anchored at the top of trees found along the trail, not necessarily close to camp. These were cut at the bottom end and tied into a loop. This type takes much skill and bravery to enjoy, as the child must mount the swing, and repeatedly repel off of the trunk of the tree to swing around it, often a few meters from the forest floor, and possibly in synchrony with another child on a nearby liana.

_Ndanga_ is a cooperative ball game in which two teams of players pass a small, natural rubber ball (made of rubber from _Desplatsia_ spp., _Tiliacée_; Thomas et al., 2004) between team members, attempting to keep possession of the ball. If a player from the other team catches the ball, that team then passes the ball to each other. While these two teams compete for control of the ball, there is no winner in the game and there is no score kept. Within the context of the game, many hunting metaphors are used and the phrases used by team members in calling for and receiving the ball are often references to food sharing (e.g. “Busa, dja bima”: “take it, eat food”, in reference to the ball).

**Exploratory Analysis of Pretense Play**

Although there was no quantitative difference in pretense play between the two groups of children, there were distinct qualitative variations. Pretense play included all role-playing or fantasy play that was not imitation of subsistence activities or taking on a
role in the context of a ball or ruled game. Among the Aka, this included pretending to be animals, Ngandu farmers, or forest spirits. Specifically, the dance of Ezengi, or Dzengi, was a popular theme of Aka pretense play. The children would spin and dance like the spirit themselves, or, when the fruit of Moraceae Treculia africana (Takeuchi personal communication, 2011), or depussa, was found and brought to camp, the children would make a toy representation of Ezengi (Figure 4.4a and 4.4b).

Ngandu children’s pretense play had some commonalities, including role-playing of animals, but was distinct in its references to materialist and commercial themes. Ngandu pretense play often included ingenious replication of modern technology, such as guns and logging trucks or other commercial vehicles. Notably, their toys incorporated the greater amount of material culture available to the Ngandu (e.g. rubber bands, sardine cans, discarded sandals), but also used materials from wild plants that are available to Aka children but not used in toy manufacture (Figure 4.5a and Figure 4.5b). For example, the toy in Figure 4.5b is made from whittled pieces of bambou palm (species unknown). Ngandu prefer the leaves of the bambou palm for roofing material if they cannot afford sheet metal. Men sometimes travel deep into the forest, at least two days walk from Bagandou, to extract the leaves, and the heavy bundles must then be brought back on foot. The pith is occasionally recovered as well, and given to the children. The difference may be that Aka do not use bambou for roofing, since their short-term settlements do not make the fabrication time worth the effort. Perhaps if the adults did extract the leaves, the children might use the pith. Currently, I cannot be sure if Aka would make trucks if the materials were available.
Figure 4.4 Children play with a toy Ezengi made from the fruit of Moraceae Treculia africana (a). When spun on a stick, the toy is made to dance like the real Ezengi (b), whose costume is made from immature raffia palm fronds.
Figure 4.5 Toy cars characteristic of Ngandu children’s culture: sardine can “camions” (a), and a logging truck made from bambou palm pith (b). I was given this truck after it had lost its wheels made from discarded flip-flops.
To summarize the results presented in this section, contrary to Konner’s (2005) hypothesis, I find that Aka forager children play less frequently overall than do Ngandu farmer children. Additionally, a *post-hoc* analysis reveals that, while females play less than males overall, there is only a moderately significant sex difference between overall play frequency of Ngandu boys and girls, but Aka boys play more than Aka girls ($z=-2.9, p=.004$, Wilcoxon Rank-sum test; Figure 4.6). This is puzzling but further analysis is necessary. At this point I would speculate that the ease with which Aka children can perform their own independent work activities may lead them to choose productive work instead of play. Additionally, since competition is a pathway to success in Ngandu culture, there may be an functional advantage to engaging in lots of competitive play in the Ngandu village context. Competition is discouraged in Aka culture, thus the aka children spend more time in leisure or performing productive labor activities (Figure 4.1). The gender difference in play among the Aka is also puzzling, given the greater gender egalitarianism of Aka culture, however, the analysis of observations and imitation of work reported in the previous section would suggest boys play more because they work less than females, having fewer opportunities to socially learn men’s work.

In terms of the other hypothesized differences, I found that, as predicted, Aka played competitive, rule-based games and rough-and-tumble play significantly less frequently than the Ngandu children, and they also played a unique cooperative game, *ndanga*, which the Ngandu do not play. Also, the Aka played on the *ezambi* liana swing than did Ngandu children, suggesting more of a closeness and interest in their surrounding ecology, as was hypothesized. Ngandu children have plenty of trees available upon which they might make
affix swings, but they do not, even when in the forest. This would fit their contrasting foundational schema of responsibility and obedience. It also is not a competitive game and does not seem to hold their interest for long, even when they encounter the *ezambi* in the forest during caterpillar season (see Chapter 2).

Lastly, qualitative variation in pretense play was representative of the differences in foundational schema between the Aka and the Ngandu. The Aka evoked the spirit of the forest, *Ezengi*, who demands sharing, and asks for song and dance from the community to give back to the forest in return for the food it provides them. The Ngandu play with cars and guns, emulating the commercial activities seen as pathways to success in their

4.6 Sex differences in frequencies of social play in the two groups. Overall, girls played significantly less than did boys, but the sex difference is more pronounced among the Aka.
community, and the cultural heroes from foreign movies they have seen or heard about (mostly American or Nigerian action films).

Much more work needs to be done, but these preliminary results are suggestive of the important role of children’s play in social learning through child-child cultural transmission. In terms of interpreting and producing culture, the content of pretense play, especially, may be indicative of culture change, as children incorporate new themes they observe. For example, in some Aka camps, there was more commercial foot-traffic by villagers from Bagandou and other nearby villages than in many others. In these communities, adult Aka males, who would engage in trade with these visitors, spoke Songo, CAR’s national language, more often than in other camps with less visitation. In these same camps, children were seen to play commercial games and to play with toy trucks (though they did not build them, as discussed above). Kamei’s (2005) work with Baka children of Cameroon also found such incorporation of modern themes. The Baka are more sedentary and have had a longer history of access to market economies than have the Aka in the Bagandou region.
TEACHING: INSTRUCTION, FEEDBACK, AND COMMANDS

There is an active debate regarding the relative importance of teaching in children’s culture learning across human societies. In this analysis, I contribute to the debate by presenting the first systematic, observational account of teaching in small-scale societies outside of institutionalized educational contexts. During my first set of observations among the Aka, I recorded teaching in its broadest, observable sense: costly information transfer (Caro & Hauser, 1992). However, as I improved my language skills and gained greater knowledge of cultural patterns through participant observation, I was able to identify at two distinctive styles of contingent social behavior previously described in the literature as social learning processes. These were operationalized in my second set of observations, which included comparative data collection among Ngandu farmer children. These styles, or what I describe as forms of teaching, included 1) direct instruction, 2) disapproval or approval through social feedback, and 3) use of directives, or commands, to initiate competency building experiences through assigning tasks.

All Teaching

Teaching was relatively rare, observed during about two percent of all minutes of observation in both 2008 and 2010. Bouts of teaching were short, on average only lasting 1.04 minutes, though slightly longer for the Aka in 2008, lasting a mean of 1.17 minutes. There was no significant difference between frequency of teaching observed among the Aka between the sampling years (Wilcoxon rank-sum test, z=.98, p=.32), and there was no statistically significant difference in teaching overall between the two cultures (Wilcoxon
rank-sum test, \( z=0.12, p=0.90 \); Table 4.7).

<table>
<thead>
<tr>
<th></th>
<th>Aka</th>
<th></th>
<th></th>
<th>Ngandu</th>
<th></th>
<th></th>
<th>Results of Wilcoxon rank-sum test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Bouts</td>
<td>Mean Bouts/Day</td>
<td>SD</td>
<td>Total Bouts</td>
<td>Mean Bouts/Day</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Instruction</td>
<td>15</td>
<td>1.0</td>
<td>2.0</td>
<td>39</td>
<td>2.8</td>
<td>4.4</td>
<td>( z=-3.1^{**} )</td>
</tr>
<tr>
<td>Commands</td>
<td>156</td>
<td>9.3</td>
<td>7.6</td>
<td>128</td>
<td>8.4</td>
<td>7.9</td>
<td>( z=0.8 )</td>
</tr>
<tr>
<td>Feedback</td>
<td>32</td>
<td>1.9</td>
<td>4.0</td>
<td>19</td>
<td>1.2</td>
<td>2.1</td>
<td>( z=0.1 )</td>
</tr>
<tr>
<td>All Teaching (2010) (^2)</td>
<td>203</td>
<td>12.2</td>
<td>10.2</td>
<td>186</td>
<td>12.4</td>
<td>11.3</td>
<td>( z=0.12 )</td>
</tr>
<tr>
<td>Teaching (2008) (^2)</td>
<td>178</td>
<td>13.7</td>
<td>17.1</td>
<td></td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) \((\text{total bouts per child/total minutes child was observed}) \times 720 \text{ mins/day}\)

\(^2\) Aka did not have significantly different rates between years (Wilcoxon rank-sum test, \( z=-0.98, p=0.32 \))

\(^{**}p < 0.01\)

**Hypothesis 3a:** All forms of teaching (direct instruction, feedback, and commands) should decrease in frequency with age, as social learning is traded-off with individual learning.

Theoretical models indicate that social learning should decrease in frequency with age as individuals increase investment in individual learning. Negative binomial regression modeling was used to investigate the relationship between age and frequency of teaching. This method is preferred for count data that are overdispersed with high variance (Cohen et al., 2003). The natural log of the total minutes each child was observed was included in the models to account for variation in observation counts (Long & Freese, 2006).\(^4\) To control for potential culture-dependent age effects, *culture* was included as a dummy variable and an *Age*\(^*\)Culture interaction term was included in the models and removed if non-significant at the .05 level. Table 4.8 presents the results of the statistical modeling.

\(^4\) P-values for all negative binomial regression models below are based on robust standard errors estimated using the Huber-White Sandwich method to correct for heteroscedasticity (Long & Freese, 2006).
Overall, rates of teaching decreased with age as measured in both 2008 and 2010, and the effect is independent of culture. Figure 4.7 shows the pattern graphically.

Four children were included in the sample both years and their change in frequency of teaching received is plotted in Figure 4.8. While a small sample, data from these children show striking consistency with the overall pattern, suggesting it holds true for individuals across development as well. The youngest child showed an increase across the transition from early to middle childhood. A similar peak in middle-childhood is also visible in the full sample data shown in Figure 4.7, however this may be due to the greater variance during early childhood.

Table 4.8 Negative binomial regression modeling results of age in years and culture (Aká=0, Ngandu=1) on count of teaching bouts.

<table>
<thead>
<tr>
<th>DV</th>
<th>IV</th>
<th>coef</th>
<th>Robust SE</th>
<th>z</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching 2008</td>
<td>Age</td>
<td>-.11</td>
<td>.03</td>
<td>-3.16**</td>
<td>[-.18, -.04]</td>
</tr>
<tr>
<td>Wald $\chi^2$=9.97**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching 2010</td>
<td>Age</td>
<td>-.08</td>
<td>.02</td>
<td>-4.04***</td>
<td>[-.12, -.04]</td>
</tr>
<tr>
<td>Wald $\chi^2$=16.55***</td>
<td>Culture</td>
<td>-.05</td>
<td>.15</td>
<td>-.37</td>
<td>[-.34, .23]</td>
</tr>
</tbody>
</table>

Hypothesis 3b: Children learn from their parents first (vertical) and learn proportionally more from other kin and non-kin with age (oblique).

Theory and some empirical data suggest that parents and close relatives in the household are important as teachers early in life and other more distant kin and non-kin contribute later in life. Negative binomial regression was also used to model the relationship between focal child’s age as the independent variable and category of relatedness of teachers to the child across all teaching bouts as the dependent variable.
Figure 4.7 Frequency of teaching by age. Vertical bars are 95% confidence intervals. Dashed line is Aka data from 2008.

Figure 4.8 Change in frequency of teaching received over the course of two years for the four Aka children included in the sample in 2008 and 2010.
Results of this analysis are presented in Table 4.9. Controlling for culture, there is no clear evidence from this analysis that parents change their frequency of teaching across the ages examined here. Similarly, there was no relationship between age and frequency of teaching by non-kin. However, according to model results, as children got older other kin were teachers significantly less frequently independent of culture. Therefore, the overall decrease in teaching with age can be attributed to a proportional decrease in teaching by children’s siblings and other kin, but not parents or non-kin.

Table 4.9 Negative binomial regression modeling results of age in years and culture (Aka=0, Ngandu=1) on minutes of teaching received from parents, other kin and non-kin.

<table>
<thead>
<tr>
<th>DV</th>
<th>IV</th>
<th>coef</th>
<th>Robust SE</th>
<th>z</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parents</td>
<td>Age</td>
<td>-.007</td>
<td>.04</td>
<td>.87</td>
<td>[.08, .07]</td>
</tr>
<tr>
<td>Wald χ²=.84</td>
<td>Culture</td>
<td>.23</td>
<td>.26</td>
<td>.91</td>
<td>[.27, .73]</td>
</tr>
<tr>
<td>Other-Kin</td>
<td>Age</td>
<td>-.14</td>
<td>.03</td>
<td>-4.39***</td>
<td>[-.20, -.08]</td>
</tr>
<tr>
<td>Wald χ²=20.74***</td>
<td>Culture</td>
<td>-.33</td>
<td>.24</td>
<td>-1.38</td>
<td>[-.81, .14]</td>
</tr>
<tr>
<td>Non-Kin</td>
<td>Age</td>
<td>-.03</td>
<td>.03</td>
<td>-9</td>
<td>[-.09, .03]</td>
</tr>
<tr>
<td>Wald χ²=1.37</td>
<td>Culture</td>
<td>.20</td>
<td>.26</td>
<td>.74</td>
<td>[-.32, .71]</td>
</tr>
</tbody>
</table>

***p<.001

**Instruction**

*Hypothesis 3b: Independent of age, the Aka should receive less direct instruction than should the Ngandu.*

Direct instruction was a significantly more common teaching process among the Ngandu, with children receiving approximately three times as much explicit instruction on a daily basis (Table 4.7). Among the Aka children, 76 percent of the sample never received any instruction, whereas 48 percent of the Ngandu sample never did.
Negative binomial regression modeling was used as above to investigate the relationship between age and frequency of direct instruction. Table 4.10 presents the model results. Instruction is inversely correlated with age independent of culture, but the relationship is just shy conventional statistical significance. The significant and positive culture term in the model confirms that instruction is more common among the Ngandu independent of age. The interaction term was not significant.

| Table 4.10 Negative binomial regression modeling results of age in years and culture (Aka=0, Ngandu=1) on minutes of teaching received. |
|---|---|---|---|---|
| | IV | coef | Robust SE | z | 95% CI |
| Instruction | Age | -.08 | .04 | -1.86^ | [.16, .004] |
| Wald χ²=15.72*** | Culture | 1.0 | .35 | 2.95*** | [.34, 1.7] |
| Commands | Age | -.03 | .03 | -1.12 | [.09, .02] |
| Wald χ²=20.30*** | Culture | .60 | .39 | 1.57 | [.15, 1.4] |
| | Age X Culture | -.09 | .04 | -2.29* | [-.17, -.01] |
| Feedback | Age | -.14 | .05 | -2.65** | [-.25, -.04] |
| Wald χ²=8.17* | Culture | -.48 | .37 | -1.30 | [-1.2, .24] |

^p<.10, *p≤.05, **p≤.01, ***p≤.001

Table 4.11 defines the domains in which teaching was observed and provides examples of each, and Table 4.12 presents the distribution of teaching bouts by domain. For both groups of children, the majority of instruction was directed at some element of the food quest (67% and 49% for the Aka and Ngandu, respectively). For the Ngandu, 33 percent of instruction involved children’s play, whereas only one instance of instruction regarding play was directed at an Aka focal child. Outside of work, most instruction among the Aka children was in relation to health and safety, broadly construed. On the other hand, the Ngandu were instructed in a broader array of idiosyncratic (“Other”) domains.
Table 4.11 Definition and examples of domains in which teaching was observed.

<table>
<thead>
<tr>
<th>Domain</th>
<th>Definition</th>
<th>Teacher (s)</th>
<th>Learner</th>
<th>Teaching Type</th>
<th>Examples (field notes are in quotes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>Involving knowledge or skills associated with subsistence labor or household maintenance.</td>
<td>Aka adult male</td>
<td>Aka 8 y.o. boy</td>
<td>Direct instruction</td>
<td>“Ndami points up in a tree, refers to the bees (banjuee)” [indicating potential source of honey] – 3/29/10, 9:11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ngandu adult female</td>
<td>Ngandu 11 y.o. girl</td>
<td>Direct instruction</td>
<td>&quot;Ok, one more splash of water in the pot, that's enough.&quot; – 7/15/10, 17:01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aka adult female</td>
<td>Aka 7 y.o. girl</td>
<td>Command</td>
<td>“Put an igname on the fire.” – 3/24/10, 9:32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ngandu adult female</td>
<td>Ngandu 14 y.o. girl</td>
<td>Feedback</td>
<td>“She said to her while she was checking the simmering mushrooms, 'There's no fire.' Syntiche (focal child) then stoked the fire.” – 6/15/10, 7:32</td>
</tr>
<tr>
<td>Play</td>
<td>Related to play activities, those not directly productive, even if involving knowledge or skills directly applicable to subsistence or maintenance (e.g. pretending to cook)</td>
<td>Aka 14 y.o. boy</td>
<td>Aka 6 y.o. girl</td>
<td>Direct instruction</td>
<td>&quot;What to do in play net hunt.&quot; – 4/21/10, 7:31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 Ngandu MCH girls</td>
<td>Ngandu 8 y.o. girl</td>
<td>Direct instruction</td>
<td>&quot;Gbogba [girls “patty-cake” game]- how song goes&quot; – 6/4/10, 14:21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aka 7 y.o. boy</td>
<td>Aka ECH boy</td>
<td>Command</td>
<td>“Ya’ [come] = come behind me in this game” – 4/10/10, 7:16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ngandu MCH boy</td>
<td>Ngandu 7 y.o. girl</td>
<td>Feedback</td>
<td>“about a wrong game move.” – 6/15/10, 10:28</td>
</tr>
<tr>
<td>Social Norms</td>
<td>Ways of behaving associated with proper social behavior in general, not associated with other domains.</td>
<td>Aka adult female</td>
<td>Aka 6 y.o. girl</td>
<td>Command</td>
<td>“Turn around, your shirt’s dirty.” – 2/24/10, 12:37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aka adult female</td>
<td>Aka 6 y.o. boy</td>
<td>Feedback</td>
<td>“She taps him and gives him verbal disapproval for climbing on things near her [in the house].” – 8/24/10, 11:42</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ngandu adult male</td>
<td>Ngandu 16 y.o. boy</td>
<td>Feedback</td>
<td>“Oh, Idongu! [boy's name], for climbing above him and knocking some leaves down.” – 6/30/10, 13:28</td>
</tr>
</tbody>
</table>

Note: ECH, MCH, LCH indicate Early, Middle, and Late Childhood, respectively.
Table 4.11 continued

<table>
<thead>
<tr>
<th>Sharing</th>
<th>Involving the rights to a resource or its distribution.</th>
<th>Aka adult male</th>
<th>Aka 7 y.o. girl</th>
<th>Command</th>
<th>&quot;Share some of the eseya' [wild yam]&quot; – 3/24/10, 12:33</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Aka adult female</td>
<td>Aka 7 y.o. boy</td>
<td>Feedback</td>
<td>&quot;For being greedy with P distributed some fish to the younger kids who haven’t eaten. – 5/10/10, 16:30.</td>
</tr>
<tr>
<td>Safety/ Health</td>
<td>Directed toward increasing knowledge related to physical safety, health, or general hygiene.</td>
<td>Aka adolescent boy</td>
<td>Aka 4 y.o. boy</td>
<td>Direct Instruction</td>
<td>&quot;Go in the house, it's raining.&quot; – 8/19/10, 15:32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aka adult female</td>
<td>Aka 5 y.o. girl</td>
<td>Direct Instruction</td>
<td>&quot;where to [defecate]&quot; – 4/23/10, 6:26</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aka adult female</td>
<td>Aka 5 y.o. girl</td>
<td>Command</td>
<td>&quot;Mom took away her ndosi [caterpillar] prep kit, told her to get away from the fire.&quot; – 8/20/10, 16:25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ngandu adult female</td>
<td>Aka 9 y.o. female</td>
<td>Command</td>
<td>&quot;Come wash your hands to eat.&quot; – 7/13/10, 17:05</td>
</tr>
<tr>
<td>Childcare</td>
<td>Involving care of children.</td>
<td>Aka adult male</td>
<td>Aka 7 y.o. female</td>
<td>Command</td>
<td>&quot;Give me the koko [forest leaves to prepare for meal] so you can take care of your little sister.&quot; – 3/24/10, 12:28</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ngandu LCH, MCH boys</td>
<td>Ngandu 7 y.o. boy</td>
<td>Direct Instruction</td>
<td>&quot;What '66' was: 'It's soixant six, not trent six.'&quot; – 6/5/10, 8:01</td>
</tr>
<tr>
<td>Other</td>
<td>Any other domain which does not fit other criteria.</td>
<td>Ngandu adult male</td>
<td>Ngandu 6 y.o. boy</td>
<td>Direct Instruction</td>
<td>&quot;Fix your cloths, you see your pants [fly] are open', points&quot; – 9/5/10, 6:35</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aka adult male</td>
<td>Aka 5 y.o. female</td>
<td>Command</td>
<td>&quot;Asked to put an item of clothing in house.&quot; – 8/20/10, 16:20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ngandu adult female</td>
<td>Ngandu 7 y.o. female</td>
<td>Command</td>
<td>&quot;Put on that dress.&quot; – 7/15/10, 8:28</td>
</tr>
</tbody>
</table>

Note: ECH, MCH, LCH indicate Early, Middle, and Late Childhood, respectively.
The relative investment by parents versus other kin in instruction contrasted dramatically between cultures (Table 4.13). While parents were teachers in 33 percent of all bouts among the Ngandu, parents were teachers in only seven percent of bouts among the Aka. Accounting for differences in observation times per child and extrapolating to all daylight hours, parents provide instruction a mean of roughly two times per day among the Ngandu compared to 0.3 times per day among the Aka, a statistically significant difference in rates (Wilcoxon rank-sum test, z=-1.9, p=.05). Moreover, other kin, including siblings, accounted for the majority (60%) of direct instruction bouts among the Aka and less than a third (27%) of the bouts among the Ngandu. Despite the greater frequency of direct instruction among the Ngandu, there is not a statistically significant difference in projected daily rates for siblings (Wilcoxon rank-sum, z=.66) or other kin (Wilcoxon rank-sum z=1.23) between cultures. However, the Ngandu received direct instruction from non-kin more frequently on a daily basis (Wilcoxon rank-sum, z=-2.1, p=.03).

<table>
<thead>
<tr>
<th>Table 4.12 Distribution of teaching bouts by domain for each culture. Percentages are in parentheses, rounded to nearest integer.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aka</strong></td>
</tr>
<tr>
<td><strong>Work</strong></td>
</tr>
<tr>
<td>Work</td>
</tr>
<tr>
<td>Play</td>
</tr>
<tr>
<td>Social Norms</td>
</tr>
<tr>
<td>Sharing</td>
</tr>
<tr>
<td>Safety/Health</td>
</tr>
<tr>
<td>Childcare</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>
Commands

Commands were the most common form of teaching observed. Aka and Ngandu children received approximately nine and eight commands per day, respectively (Table 4.7). Regression modeling reveals a significant interaction between age and culture in predicting frequencies of commands received by children, indicating that only among Ngandu children did children receive fewer commands with age (Table 4.10). Additionally, the majority of commands direct to Ngandu children (71%) were associated with work tasks, whereas the Aka received commands to perform behaviors across all major domains observed and 17% of the commands were associated with other infrequently observed domains. For both groups, commands during play were the second most frequent, with similar proportions observed in each (15% for the Aka, 16% for the Ngandu). Children received commands from parents, other kin, and non-kin at all ages.

<table>
<thead>
<tr>
<th></th>
<th>Aka</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Instruction</td>
<td>Commands</td>
<td>Feedback</td>
<td></td>
</tr>
<tr>
<td>Parents</td>
<td>1 (7)</td>
<td>46 (29)</td>
<td>5 (16)</td>
<td></td>
</tr>
<tr>
<td>Other Kin</td>
<td>9 (60)*</td>
<td>66 (42)</td>
<td>14 (44)</td>
<td></td>
</tr>
<tr>
<td>Non-Kin</td>
<td>2 (13)</td>
<td>33 (21)</td>
<td>12 (38)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>13 (33)*</td>
<td>48 (37)</td>
<td>4 (21)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 (26)</td>
<td>51 (40)</td>
<td>7 (37)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16 (41)*</td>
<td>28 (22)</td>
<td>4 (21)</td>
<td></td>
</tr>
</tbody>
</table>

* Values correspond to significantly greater mean daily rates of teaching by that category of individual in that culture compared to the other (Wilcoxon rank-sum test, p<.05).

Feedback

Feedback was observed less frequently than commands in both cultures, but more frequently than instruction among the Aka and less frequently than instruction among the
Ngandu (Table 4.7). However, the difference in daily rates of receiving feedback did not significantly differ between the groups. In both cases, it was almost completely negative feedback, with only one case of arguably positive feedback. Usually, feedback was nearly always a brief vocalization meant to shame or guilt the child (e.g. “Eh!”, “Oh!”), or the use of the child’s name with a shaming or surprised tone. Rough joking or making fun in response to improper behavior were also observed and recorded as feedback.

Frequency of feedback received was negatively correlated with age independent of culture, with no interaction between culture and age. Feedback was received in response to behavior across a range of domains in both groups, but most frequently in response to what was categorized broadly as breaches of social norms (those not related to the other categories; Table 4.11 presents examples). Notably, 16% of feedback received by Aka children was in response to failures to share resources, especially food, whereas no feedback was observed regarding sharing among the Ngandu (see the next section). Among the Aka, feedback mostly came from non-parental kin and non-kin, but parents provided 16% of feedback. Other kin provided almost twice as much feedback as parents or non-kin among the Ngandu.

In summary, I found clear support for two of the proposed hypotheses and some support for the third. Teaching, as defined herein, was relatively rare but reliably observed, and decreased in frequency across children’s development (Hypothesis 3a). Kin other than children’s parents decreased their investment in teaching as children got older, but parents
and non-kin maintained levels of investment. While *Hypothesis 3b* predicted a decreased contribution from parents, what was found was that, among the Aka parents contributed very little in terms of direct instruction already by the time children were 4-years-old. However, among the Ngandu, parents were significantly more involved in the direct instruction of their children throughout childhood. This variation can be attributed to variation in the developmental niches, as discussed below.

Commands were the most frequent form of teaching directed at both Aka foragers and Ngandu farmers. Direct instruction, perhaps the least disputable form of teaching, was more common among the Ngandu farmers than the Aka foragers, in support of *Hypothesis 3c*, and included a considerable amount of teaching by other children in regards to play. Feedback, in the form of expression of disapproval, was most commonly in response to inappropriate social behaviors, but also to a variety of behavior across a number of domains in both cultures.

This section represents the first systematic, comparative, observational research of teaching directed to children during middle childhood in small-scale societies. To review, teaching was defined in its broadest sense as costly information transfer (Caro & Hauser, 1992), and three qualitatively distinct behavioral interactions were defined as potentially meeting this definition: direct instruction, commands using directive language, and social feedback. Major results confirm expectations based on previous research but provide novel insights into the role of culture, and the nature of teaching as manifested in culturally normative social learning processes.

First, teaching was found to be rare, as has been previously argued (Lancy & Grove,
2011; Lancy, 2010; Rogoff et al., 2003). Indeed, findings of the current study are remarkably consistent with previous measurements. Rogoff’s figure of .35% for observations of direct instruction of nine-year-old Mayan farmer children is almost exactly the frequency of direct instruction received by Ngandu farmer children in their middle childhood years, .39% of all observations. Additionally, Draper (1976) counted 1.5 “adult interruptions” per hour among !Kung San forager children, and here Aka forager children received teaching as I defined it just over 1 time per hour during both years of observation—though this figure reduces to .6 times per hour if we include only adult teachers. Therefore, while rare, costly information transfer has been reliably measured in disparate cultural settings and among both foragers and farmers despite independently derived definitions of teaching, in support of the argument that it is universal. This is consistent with the predictions of evolutionary theory, in that, even if rare, the advantages of high fidelity cultural transmission of information with high-fitness value would support the evolution of psychological mechanisms associated with attending to and providing teaching, and the evolution of cumulative culture.

Theoretically, the risk of too great a dependency on social learning processes like teaching throughout the life course is the potential that individuals will fail to innovate solutions to novel environmental challenges that occur over time through trial-and-error individual learning (Rogers, 1988). One way to overcome this dilemma is to favor social learning early in life and increasingly use individual learning later in life to refine what is already learned and possibly innovate (Aoki et al., 2012; Borenstein et al., 2008; Fogarty et al., 2011). This study confirms the first component of this prediction: age was significantly
negatively correlated with teaching independent of culture. The second component of the prediction is tested among these same children in a forthcoming report.

Another set of theory predicts a two-stage model of cultural transmission in which children update easily acquired knowledge or skills learned from parents early in life as they get to know experts or others with alternative knowledge or skills (Henrich & Broesch, 2011; Henrich & Henrich, 2010). Kline and colleagues (N.d.) found that, in Fiji, teaching by parents (vertical transmission) is reported to decrease with age and other older kin and non-kin perform more teaching (oblique transmission). Additionally, they found that more difficult skill domains were also learned later, and probability of oblique transmission increased with skill difficulty. Results of the current study do not support the two-stage model. The only age-dependent change in relative frequency of teaching found was a significant decrease in contributions by kin other than parents. One explanation for why I did not find support for the two-stage model is that difficult to acquire skills one would learn from an expert outside the close family might be learned later in life, after early adolescence. For the Fijian case, the point at which the probability of being taught a task obliquely becomes greater than the probability of vertical teaching is the late teens. Among the Aka, some traditional medicines are not learned by every individual and were not reported as known by any children in one study (Hewlett & Cavalli-Sforza, 1986). Lewis (2002) also reports that, among the Mbendjele, a southern Aka-speaking population, only initiated men can learn certain kinds of ritual knowledge which they are taught by experts from other regions.

Alternatively, the two-stage model of cultural transmission might not
comprehensively apply to all types of observable social learning processes. What the current observational account demonstrates is that parents and others invest in providing children with opportunities to learn generalizable information—the functional definition of teaching—in relatively similar proportions across childhood, but that overall teaching approaches a frequency of nearly zero by adolescence. Future research will need to further disentangle etic and emic views of exactly what constitutes teaching, and investigate the extent of observational learning that does not fit the functional definition of teaching. The results of this study suggest that teaching, from the etic perspective, is characterized by different interactional styles within different cultural contexts. If this is the case, how teaching is conducted—the nature of the social interaction, especially the possible dynamics of power and authority—is a component of what is learned. Without a doubt, a child must only learn skills, knowledge, and beliefs, but more subtle ways of behaving as well.

In support of this argument, a major novel result of this study is that the frequency of direct instruction was significantly less among Aka foragers. This result was predicted based on the argument that egalitarian social norms and an emphasis on autonomy would tend to discourage the use of direct instruction. Fouts (2005) reports that among Central African Bofi farmers invest more in direct training of their children than do Bofi foragers. Studies previously describing teaching among foragers, especially those clearly noting ostensive cues (Guemple, 1988; Konner, 1976; Wiessner, 1982), have tended to show it involving parents and directed at infants. Hewlett’s preliminary analysis of video-samples among Aka infants finds similar results. Here parents invested in direct instruction less frequently than others, and other kin provided the bulk of direct instruction. It may be the
case that parents cease investing in direct instruction after children become more socially independent, by early childhood, and siblings and other kin adopt the teaching burden. From a different perspective, if vertical transmission is to be considered an important source of cultural transmission early in life, then perhaps the absence of direct instruction by Aka parents is an example of modeling normative interactional style and the importance of prestige avoidance after a critical period. At the same time, that Ngandu farmer parents and non-kin continuously invest in direct instruction may reinforce the cultural model of authority vested in hierarchy and structures of status ranking.

Additional supporting evidence comes from a second major novel result of this study: Over one-third of the direct instruction observed among the Ngandu involved children teaching each other the rules to various games. While it may be difficult to argue that children’s game play is a domain of high fitness value in terms of subsistence skills or knowledge, games are often argued to be key venues for social development (Lancy, 1996; Pellegrini & Smith, 1998; Piaget, 1932; Schwartzman, 1978). Ngandu children play ruled, competitive games significantly more often than Aka children (see above), so it may be they simply need to explain the rules more often to novices. Alternatively, it may be normatively discouraged to play games that rank individuals and allow for demonstrations of physical or intellectual dominance. I have seen Aka children play several village games, but they tended to adopt those involving rhythm, song, dance, and cooperation. With the exception of soccer, I have never seen the Aka play village-derived games involving score-keeping or the possibility of winning (i.e. dominance).

Furthermore, the Aka did not receive less teaching overall, only less direct
instruction. In this study I also measured frequencies of two other interactions previously described as teaching by other anthropologists (Mead, 1964; Whiting & Edwards, 1988) and fitting the broadest commonly accepted definition of teaching in biology (Caro & Hauser, 1992; Castro & Toro, 2004): the use of commands to stimulate learning opportunities and giving approval or disapproval of a child’s behavior through social feedback. These other forms of teaching might be expected to be more common in forager societies than direct instruction because they leave autonomy to learn in the hands of the learner. The Aka did receive more commands and more feedback than the Ngandu, though standardized mean daily rates for all ages were not distinguishable statistically. However, the negative binomial regression model results presented in Table 4.10 indicate that, while the Ngandu children received fewer commands as they got older, Aka children continued to receive commands into adolescence. This cultural difference in behavioral frequencies across development maps on well to what has been described among other forager and small-scale farmer populations before. For example, Whiting and Edwards (1988), drawing from the most extensive systematic cross-cultural study of children’s socialization to date (see also Whiting, 1963; Whiting & Whiting, 1975), see the developmental interplay of mother’s commands and children’s cooperation as:

“...the development of a mother-child choreography in which children not only respond to their mothers’ stated requests but also come to anticipate their unstated desires and act with few commands or promptings...Cooperative and obedient behavior thus indicates that the
child helper has internalized a common goal with the adult and has learned to monitor the activities of co-workers in order to cooperate most effectively in the accomplishment of the task.” (149-150)

They go on: “However, this kind of mother/child cooperation is not one that allows the child much opportunity to suggest new strategies or to renegotiate the goal” (150). The children of the subsistence farmer populations in their sample of twelve cultures increased in compliance as they got older, and the greatest compliance was among sub-Saharan African farmers, like the Ngandu. The cultural emphasis is on cooperation in the form of obedience and social learning of not only tasks themselves, but also the manner of coordination in their performance. Among the Ngandu, fewer commands were issued as children learned to comply. Although, as seen in Table 4.8, not only parents but other community members also invest in this process of obedience training.

On the other hand, forager researchers tend to emphasize autonomy, as opposed to obligation, in cooperation (Gardner, 1991). It is the responsibility of individuals to stand for their own interests and to defy others’ attempts at dominance or taking more than an equal share (Wiessner, 2005). Forager children can be active in the food quest and are regularly helpful to others, but authors consistently report children’s cooperation is on their own terms (Draper, 1976; Marlowe, 2010). As Woodburn writes,

“Neither the parent-child nexus, nor the relationship between generations more generally, provide either a model or a training ground for
relationships of authority and dependency; indeed they provide an alternative model for and training in personal decision-making and in the possibilities of self-reliance, in sharing but not dependency on sharing.”

(439)

Thus, the continual issue of commands to children among the Aka across childhood by parents and others, and in reference to a greater diversity of domains, might reflect everyone’s right to demand cooperation from others but inability to coerce them. If this is a reasonable explanation, can we say commanding others is always teaching, as seems to be the case among the Ngandu and other farmers? In the sense that commands represent both opportunity scaffolding of particular behaviors and reinforcement of the core value of autonomy and cooperation, I argue that commands fit the definition.

Among the Aka and Ngandu, what I’ve referred to as feedback, also noted by Gaskins and Paradise (2010) as a form of contingent child socialization, usually consisted of brief verbal expression of disapproval or joking at the expense of the focal child, whose behavior was deemed inappropriate. At times, mild corporal punishment was observed and coded as negative feedback. Most feedback was directed at infraction of various social norms. Is this teaching? In the sense that teachers alter their own behavior to draw attention—in this case negative attention—to the learner’s behavior in a way that may allow for generalization to any similar context, the definition would apply. Additionally, for both Aka and Ngandu children in my samples, feedback received was negatively correlated with age such that we can infer children internalize normative ways of behaving with age and
experience. An alternative explanation would be that others give less feedback to older children, independent of their behavior. However, I see no reason why anyone in either culture would be inhibited from expressing their disapproval, especially if they are older than the child. Rather, feedback seems to be an effective, low cost way of teaching proper comportment. Castro and Toro (2004) argue that the capacity to approve or disapprove of offspring’s behavior could have served as the basis for a cultural inheritance system by constraining the behaviors the young adopted into their repertoires. Notably, feedback was distinct from commands or direct instruction by its emotional valence; it was meant to shame or guilt children, even if mildly, for their behavior. It has been argued that the evolution of prosocial emotions, such as guilt and shame, were key to the evolution of cooperative institutions among humans (Bowles & Gintis, 2005; Tomasello et al., 2012). Therefore, on top of simply understanding that a member of the community disapproves of a behavior, prosocial emotions function to reinforce in the child the notion that a behavior is not only ineffectual but “wrong” or “not what we do.” As such, it is noteworthy that failures to follow sharing norms were a relatively frequent and distinct source of feedback among the Aka but not the Ngandu (see below).

**LEARNING TO SHARE FOOD**

To review, there is reasonable evidence that across cultures children share food, understand locally normative ways food is shared, and enforce food-sharing norms amongst themselves. Adults in at least two modern foraging cultures explicitly train young children in specific sharing institutions. In several other similar cultures, children during
middle childhood participate in intragroup sharing practices as couriers of shared meals and game meat between households, when, according to developmental psychologists, they are old enough to understand the nature of the sharing gesture in the context of the wider network of social relationships in which they are embedded—when they are likely to be aware not only that “we share” but that “we must share, and we do so like this.”

In this analysis, interview and observational data are used to characterize the social learning processes and cultural transmission modes associated with learning to share food. Hypothesis 4a is tested using the interview data. Here I present a concise overview of the interview response describing 1) children’s views about sharing food, and 2) results of the analysis of their stated source of cultural transmission. I then examine the observational data and present results of tests of the second two hypotheses.

Hypothesis 4a. (Replication of Hewlett and Cavalli-Sforza 1986) Aka children should state they learned to share from a same sex parent.

Do you hunt or gather food? What do you do if you get something? Children were unequivocal that sharing was necessary if one had food. Ninety-seven percent of the sample said they hunt and forage a variety of resources, and 100 percent said that, when they have acquired food, they prepare and share it themselves or give it to an older female to do so. It is typical that women prepare food that is brought to Aka and Bofi camps.

Who taught you to share food? How did they teach you? Similar to Hewlett and Cavalli-Sforza (1986), children nominated parents, especially mothers, more often than
others as who taught them to share (Table 4.14). Girls only nominated other females as their teachers, and boys nominated males and females about equally as often. While as many boys nominated their fathers as did their mothers, more boys specified that both parents contributed. However, no boys younger than 7-years-old first nominated their fathers as their teacher. When probed for other teachers, one 5-year-old boy nominated his father.

It was not easy for many of my informants to articulate how they were taught to share food, however 36% described watching someone divide portions and then being asked to distribute them, exactly as was observed previously by Kitanishi (1998) for the Aka and others for different forager groups.

<table>
<thead>
<tr>
<th></th>
<th>Females</th>
<th>Males</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother</td>
<td>16 (89)</td>
<td>4 (20)</td>
</tr>
<tr>
<td>Father</td>
<td>4 (20)</td>
<td></td>
</tr>
<tr>
<td>Parents</td>
<td>7 (35)</td>
<td></td>
</tr>
<tr>
<td>Sister</td>
<td>1 (6)</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Brother</td>
<td>1 (5)</td>
<td></td>
</tr>
<tr>
<td>Other (same sex)</td>
<td>1 (6)</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Other (other sex)</td>
<td></td>
<td>1(5)</td>
</tr>
</tbody>
</table>

Table 4.14 Number of nominations in response to, "Who taught you to share food?" (percent in parentheses)

Observations of Learning to Share

Hypothesis 4b. Children should observe more sharing and receive and give more teaching regarding sharing than should Ngandu children through multiple social learning processes—
observation, direct instruction, task commands, and feedback (punishment for improper sharing).

All together, sharing constituted about 5% of all observed social learning episodes observed among the Aka, and less than 1% among the Ngandu. Only 16 Aka focal children, 32% of the sample, observed sharing or received a form of teaching regarding sharing during the observations. Aka children observed food sharing only 22 times (Table 4.15). Most of the observations (81%) were brief, lasting only one minute at most. For comparison, only 4 Ngandu children (8%) were observed in 5 episodes of observation and observation was the only social learning variable associated with sharing recorded among the Ngandu. However, the Aka also received commands to share a mean of 2.3 times per day and feedback, all negative, a mean of .8 times per day for unacceptable sharing behavior. It should be noted that 80% of the feedback (4 of 5 bouts) was received by one 7-year-old Aka boy who was notably greedy and generally treated unfavorably by the other children in his camp, especially the boys in his age group who provided 40% of the negative feedback.

Table 4.15 also displays the frequencies of social learning initiated by focal children as “teachers.” These episodes were also rare, however they represented a different set of social learning processes in both cultures than were received by the focal children. Aka focal children gave direct instructions to others regarding sharing 1.4 times per day, and gave feedback, all negative, .6 times per day. A single Ngandu adolescent gave feedback to her younger sister for taking food that was meant for others.
Table 4.15 Frequencies of observed social learning bouts regarding sharing.

|                          | Aka                  |                        |                          |                       |                      |                          |                             |                          |                      |
|--------------------------|----------------------|------------------------|--------------------------|-----------------------|----------------------|--------------------------|---------------------------|------------------------|
|                          | Total Bouts n¹       | Mean bouts per day²    | SD                       | Total Bouts n¹       | Mean bouts per day²  | SD                       |                           |                        |
| Observation of sharing   | 22                   | 10                     | 3.0                      | 3.9                   | 5                    | 4                        | 2.6                       | 2.3                    |
| Commanded to share       | 10                   | 8                      | 2.3                      | 4.0                   | 0                    | –                        | –                         | –                      |
| Feedback for not sharing | 5                    | 2                      | .8                       | 3.0                   | 0                    | –                        | –                         | –                      |

|                          |                      | Focal Child as Teacher |                          | Focal Child as Teacher |                      |                          |                           |                        |
| Direct Instruction how to share | 5                    | 4                      | 1.4                      | 3.7                   | 0                    | –                        | –                         | –                      |
| Feedback for not sharing  | 4                    | 4                      | .6                       | 1.2                   | 1                    | 1                        | 2.6                       | –                      |

¹Number of focal children with whom social learning process was observed.
²(Total observed bouts of observation of sharing/total minutes of observation) * 720 minutes/day

Hypothesis 4c. (Alternative to Hewlett and Cavalli-Sforza 1986) Among the Aka, children should learn to share via multiple cultural transmission modes, whereas Ngandu children should learn proportionally more via vertical transmission.

The majority of all observation of sharing involved older children or adults other than the children’s parents (Table 4.16). Most observation of adults was of same-sex individuals, while observation of older children was evenly divided between same- and other-sex models. Parents gave 50% of all commands, equally dived between mothers and fathers, and commands were never issued horizontally, from same-age children. As noted above only two children received feedback. One 5-year-old girl received feedback from her mother, a light slap in the belly, for grabbing at food that was meant for someone else (the 20% of feedback in Table 4.16). The girl cried at the slap, though it was clearly not meant to
harm, and then sat down silently next to her mother. The other, a 7-year-old boy, received feedback twice from same-age boys and twice from adult women. Each instance involved a typical brief verbalization of disapproval (e.g. “Eh!”).

Focal children’s contributions to other’s social learning involved direct instruction evenly to same-age and younger children of both sexes, and feedback primarily to same-age children of the same sex. Feedback by the focal children was similar to what was received (e.g. “Ohhh!”).

Table 4.16 Who teaches Aka children about food sharing (i.e. percentage of social learning bouts observed involving each cultural transmission mode and percentage of transmission by an individual of the same sex for Aka children).

<table>
<thead>
<tr>
<th></th>
<th>Observation</th>
<th>Commands</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total % of Bouts</td>
<td>% Same Sex Cultural Transmission</td>
<td>Total % of Bouts</td>
</tr>
<tr>
<td>Vertical</td>
<td>8</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>Horizontal</td>
<td>12</td>
<td>75</td>
<td>–</td>
</tr>
<tr>
<td>Child Oblique</td>
<td>32</td>
<td>50</td>
<td>10</td>
</tr>
<tr>
<td>Adult Oblique</td>
<td>48</td>
<td>92</td>
<td>40</td>
</tr>
</tbody>
</table>

|               | 100          | 100       | 100       |

Developmental Patterns

While too few instances of social learning regarding sharing were observed to perform statistical analysis of their relationship to children's age, Figure 4.9 portrays the general pattern across the age groups represented as estimated minutes per day. What is apparent is that older children tended to spend less time observing sharing, but they received more commands to share. Additionally, Figure 4.10 presents the overall minutes per day contributed to each age group’s social learning by different modes of transmission.
What is evident is that vertical transmission is most prevalent in adolescence, horizontal transmission in middle childhood, and child-oblique transmission during early childhood, but adults other than a child’s parents play a role throughout development—perhaps more so after early childhood.

To summarize, in this section I have presented the first systematic analysis of children’s descriptions of learning to share and observations of social learning episodes in their daily lives. I have characterized the major social learning processes involved and the cultural transmission modes through which knowledge and enforcement of sharing norms are transmitted. There are several major results and weaknesses of the analysis to discuss.

First, I have replicated the result of Hewlett and Cavalli-Sforza (1986) that children tend to nominate same-sex parents as the transmitters of their knowledge of sharing. However, parents played a minimal role in children’s experiences of learning to share food according to my observations. This is similar to the results of Aunger (2000) that people in his sample from the Eastern Congo evidenced a bias to say they primarily acquired cultural traits vertically. Most importantly, my systematic observations of children’s social learning clearly show the prominent and multi-faceted contributions of other community members to children’s acquisition of sharing behavior. In terms of quantity of time in which children observed food distributions, parents were the least frequently observed (though 100% of children’s observation was of a same-sex parent). Rather, the contribution of parents was primarily in commanding their children to share as couriers during distributions, exactly as 36% of my informants specified and similar to what has been described previously for the
Figure 4.9 Rates of social learning across age groups for Aka children.

Aka and several other groups (Bird-David, 2005; Damas, 1972; Kitanishi, 1998; Wiessner, 2002). In my observations, it was especially those in middle childhood and early adolescence who were asked to participate in the distribution (Figure 4.9), although children of all age groups mentioned being asked to be couriers during the interviews.

The discrepancy, therefore, between what children said and what was observed seems to be a matter of the saliency of parents and, perhaps additively, the process of sharing they orchestrate. Additional evidence in support of the parental salience
hypothesis comes from the fact that, while girls consistently mentioned mothers as their teachers, only boys older than 6-years-old mentioned their fathers or both parents. Women typically organize distributions, at least in camp. In my observations, 60% of all commands to share were from mothers, whereas only 10% were by fathers. Both boys and girls in my sample spent more time with their mothers than their fathers, and boys spent less time with their fathers with age. Therefore, the developmental increase in naming fathers as conveyors of sharing norms may be associated with greater development in gender-identification and increase in saliency of male models, rather than an actual increase in male guidance.

That parents are salient is not at all surprising. Aka and Bofi mothers and fathers spend considerable time in close proximity and physical contact with their children from birth (Fouts, 2008; Hewlett, 1992) and are exceptionally responsive to their young children’s needs (Hewlett et al., 2000). Hewlett has recently found that parents actively teach infants a variety of basic skills using demonstration and physical scaffolding, like moving a child’s arm to use a knife correctly (see preliminary results in Hewlett et al., 2011). Anecdotally, I have seen a mother dip a young infant’s hand in honey and put the child’s hand into its mother’s mouth, echoing the deliberate training of hxaro noted by Wiessner (1982) among the Ju/'hoansi. Based on such evidence, it may be that parent’s most intensive contributions in the form of direct instruction are very early in children’s lives and these leave a strong impression. On the other hand, throughout childhood Aka children usually eat major meals at a nuclear family hearth, where the formalized public distribution of plates of cooked stew occurs (Bahuchet, 1990; Kitanishi, 1998). Children
may associate their mothers—and to a lesser extent their fathers—with teaching them through this particular practice.

It is crucial to note that because my observations were across daylight hours and evening meals, during which major distributions occur, are often at night, my observations may not reflect the relative prominence of parents in regards to this sharing practice. However, I do not believe the overall picture captured in these data would change dramatically. The major novel finding here is the extent to which horizontal and oblique modes of transmission contributed on a daily basis to Aka children’s learning to share, especially through demonstrations of regular food sharing and through commanding children to help them share with others. From an early age, parents direct infants outward to the community, and others seek out infants, hold them, and play with them (Hewlett, 1992), such that by the time children are 4-years-old, they are exposed to and involved in normative food sharing at the community level. The contrasting experiences of Ngandu are illustrative how important others are to the transmission of sharing norms in foraging societies. Like other hierarchical subsistence farming societies (e.g. Whiting & Edwards, 1988), food distribution is the responsibility of the mother and it is by her authority that food is shared. Ngandu children were never observed being commanded to share, and they observed food distributions a fifth as frequently as did the Aka. Eighty percent of the sharing Ngandu observed was by their mothers or other adult female kin.

There are some theoretical implications of these results for the study of cultural transmission. Hewlett and Cavalli-Sforza (1986) was the first of several studies to have emphasized the importance of vertical transmission, at least early in life (Demps et al.,
Figure 4.9. Rates of social learning via each cultural transmission mode across age groups for Aka Children.

2012; Henrich & Henrich, 2010; Kline et al., N.d.; Ohmagari & Berkes, 1997; Reyes-García et al., 2009; Shennan & Steele, 1999). Henrich and colleagues (Henrich & Broesch, 2011; Henrich & Henrich, 2010) have proposed that parents may be important early, and others grow in importance as individuals get older and enter the wider community, such that they have opportunities to update what they learned from parents or seek specialized knowledge. According to this “two-step” model, in environments where most others are behaving similar to one’s parents, as is the case with the Aka, it would be theoretically a
waste of energy to copy others’ behavior. My results show that, from an observational perspective, learning to share on a daily basis regularly involves non-vertical modes of transmission from as young as 4-years-old, and children from as young as 5-years-old participate in norm enforcement (providing feedback) to younger children. Therefore, if there are two-steps, the first vertical-dominant step is early among foragers, which is not surprising given the intimacy of the infant-parent relationship among the Aka (Hewlett, 1992; Hewlett et al., 2000). The fact that food sharing among foragers is crucial to reducing risk from individual variance in hunting and gathering returns (Cashdan, 1980; Wiessner, 1982) and the is basis for political, economic, and social relationships (Bird-David, 1990; Woodburn, 1998) it should not be surprising that others beyond parents have a vested interest in children’s learning to share. However, these data also indicate the timing during the life cycle in which vertical transmission may dominate, the domains for which parents are the most suitable models, and the social learning processes used by different potential transmitters all may vary independently.
CHAPTER FIVE

CONCLUSION

This study is the first systematic, comparative, quantitative analysis of children's daily learning experiences throughout middle childhood in two small-scale societies. It is also the first to use behavioral observations to characterize the cultural transmission modes associated with the social learning of skills, norms, and values in distinct cultural contexts. As such, I have made an attempt to integrate the fields of evolutionary anthropology (behavioral ecology and dual inheritance perspectives), evolutionary biology (learning theory, and life history theory), social, developmental and comparative psychology and the anthropology of childhood in order to build and test theoretically grounded and ethnographically informed hypotheses about human social learning and the transmission of culture. This integrative perspective construes children as evolved culture learners embedded in networks of potential teachers from whom they must acquire the means to make sense of their cultural worlds and thrive as members of society. Neither the data collection methods nor the analytical techniques used are without room for improvement, however a number of major conclusions can be drawn from the four sets of analyses herein.

First, among both the Aka foragers and Ngandu farmers, children performed increasing amounts of productive work throughout childhood, but, as is typical of many cultures, girls worked more than boys. Ngandu boys, however, worked more than Aka boys. Ngandu adults demand labor from their children under threat of punishment and
obedience and responsibility are among Ngandu foundational schema, so it is not necessarily surprising that Ngandu boys must work. What requires explanation is why Aka boys do not while girls do, even though Aka adults do not infringe upon children’s autonomy by demanding obedience. I offer evidence that Ngandu boys also spent proportionally more time observing males working than did Aka boys, whereas both Aka boys and girls observed mostly women and at equivalent proportions. This accords with proposals that an adaptive social learning strategy is to act like those who are more similar to the self, since behavioral phenotypes of self-similar models are likely to lead to similar adaptive outcomes. At around 4-years-old, children become cognitively aware of biological sex and its relation to their gender identity. Aka boys in my sample had few opportunities to observationally learn and imitate men’s productive work.

Second, I investigated cultural differences in social play as a social learning process important for child-to-child cultural transmission. I report that Aka children spent less time in social play than did Ngandu children, contrary to Konner’s (2005) Hunter-Gatherer Childhood Model, which argued that, with little responsibility forager children’s time should be occupied with play. I propose that the discrepancy relates to key differences in the types of play engaged in by each group of children and their adaptive value. For example, the other two proposed hypotheses about social play found strong support: Ngandu farmer children, in whose culture competition and controlled aggression are condoned pathways to social power, played competitive games on average six times more frequently than Aka children, and engaged in rough-and-tumble play three times more often. Aka children’s games tended to involve cooperation or engagement with their forest
ecology. Therefore, that Aka children engaged in less play means, compared to the Ngandu, they engaged in less competition. As a social learning process involving child-to-child transmission, Aka social play served to transmit non-aggression, traditional ecological knowledge, cooperation, and trust.

Third, briefly, I describe three social learning processes that fit Caro and Hauser’s (1992) functional definition of teaching. Anthropologists have tended to emphasize observation and imitation as key social learning processes in small-scale, face-to-face societies, but from my observations children also learned from direct instruction (e.g. demonstration, pedagogy), by being commanded to perform helpful or healthful behaviors, and through receiving negative social feedback for improper behavior. Additionally, previous theoretical and empirical research has emphasized the importance of teaching via vertical transmission. However, I predicted this would vary between cultures due to variations in foundational schema, and I found clear support for my hypothesis. Aka parents contribute little by way of direct instruction, whereas Ngandu parents provided their children direct instruction throughout childhood. However, Aka parents commanded their children as often as did Ngandu parents, and Aka children did not evidence the same age-dependent decrease in commands received seen in the Ngandu. I argue this reflects the core value of autonomy in Aka culture. Anyone can command others to cooperate, but no one can coerce another to obey. Therefore, the use of commands directs experiential learning and transmits core values.

Fourth, and finally, I investigated social learning and cultural transmission modes in relation to the specific domain of food sharing. Sharing is a core value among egalitarian
forager cultures and an ecological necessity. As predicted, Aka children observed sharing more frequently than did Ngandu children, and sharing behavior was transmitted through multiple modes, including older children (child oblique) and adults other than parents (oblique). Moreover, the Ngandu never received any teaching regarding sharing, whereas the Aka children in the study were commanded to distribute food by parents and other adults, and also received negative feedback for improper sharing and child-oblique instruction in sharing, albeit rarely. The results of this analysis indicate that egalitarian resource distribution is made a very present and engaging part of daily life for children in foraging societies in ways completely absent among farmers.

Overall, these results clearly illustrate the importance of an integrative evolutionary approach to the study of culture learning. Humans teach and learn using evolved social learning processes, and we possess cognitive mechanisms to direct us to those individuals in our environments most likely to provide us the best information. However, our environments are also constructed by the very culture users we seek to learn from, and our developmental niche informs how social learning processes operate to transmit culture. I hope this research inspires others to further examine the culture learner-culture teacher interface in context and across the human life course.
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