Innovation, Processes of Social Learning, and Modes of Cultural Transmission Among the Chabu Adolescent Forager-Farmers of Ethiopia

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Abstract

Based upon an earlier study of innovation and the transmission and acquisition of innovative skills and knowledge among Aka forager adolescents of central Africa, this study examines the same topic among Chabu adolescents of southwestern Ethiopia, a forager-farming society. Research with the Aka foragers questioned several evolutionary predictions about who should innovate and how innovations should be transmitted (i.e., adolescents, males in particular, should be more innovative than children and adults, innovations should spread by horizontal transmission, and adolescents should pay particular attention to prestigious, "successful" peers). In-depth and structured interviews, informal observations, and systematic ranking and sorting techniques with 14 Chabu adolescents and seven adults were utilized in this study. Major results in terms of the processes and modes of social learning suggest that: (1) oblique modes of transmission were exhibited with greater frequency than horizontal, while prestige bias was indirectly important and linked to reproductive efforts and (2) direct teaching was very important but not exclusively utilized as a means of transmitting social knowledge and reflective of the complexity of skills being taught. Additional results indicate that as with the Aka data, (3) cultural terms specific to innovation existed, (4) innovations and innovators were easily identified by adolescents, (5) innovators were actively sought out individuals who exhibited pro-social qualities and were "good teachers," and (6) adults were more often identified by the adolescents to be innovators. One result was inconsistent with the Aka study: Chabu adult females were more likely to be identified as innovators than were adult males. As the Chabu women produce highly valued and desired pottery with innovative designs, which sell well at the local market, these data suggest that innovative gender bias is domain dependent.

Keywords

Adolescence · Hunter-gatherers · Social learning · Innovation · Cultural transmission · Africa

17.1 Introduction

Innovative behavior has been suggested to have a key influence on cultural evolution and adaptability, occurring in both stable environments and in response to challenging social and/or natural environments (Kummer and Goodall 1985; Laland and Reader 1999). However, what motivates

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particular individuals to innovate, and cooperatively teach, and others to seek out and learn the new behavior remains inadequately understood (Thornton and Samson 2012). Recent work by cognitive psychologists suggest that teaching is innate and a relatively unique trait of human cognition (Csibra and Gergely 2011; Hewlett et al. 2011). These uniquely human social cognitive processes (e.g., teaching, verbal instruction, demonstration, imitation) enable the accurate transmission of cultural traits, providing opportunities for culture to develop and be maintained overtime (Lewis and Laland 2012; Tomasello et al. 1993, Tomasello 1994; Tennie et al. 2009; Henrich 2004). High-fidelity information transmission increases not only the longevity of cultural traits but in turn the number and chances for innovation (i.e., especially through modification or combination) of traits within a population (Enquist et al. 2011, 2010; see also Creanza et al. 2013; Fogarty et al. 2011; Tomasello 1994; Lewis and Laland 2012; Lehmann et al. 2011; Boyd and Richerson 1985; Reader and Laland 2003; Lefebvre et al. 2004). It has been further suggested that the successful replacement of early hominids by modern humans was facilitated by these unique cultural processes, i.e., cooperation, innovation, and the rapid spread of innovations through high-fidelity learning mechanisms (Creanza et al. 2013).

This study explores innovation among Chabu adolescents in southwestern Ethiopia, a farming-foraging society, and is based upon the abovementioned 2013 study of the same topic conducted among Aka forest foragers of central Africa (see Hewlett 2013). Both studies are framed around economic, organizational, and ideological factors influencing the creation, adoption, and transmission of an innovative behavior, artifact, and/or technology. Indigenous terms and understandings (i.e., cultural models) of innovation, motivations for teaching and learning, characteristics of innovators, processes of social learning, and modes of cultural transmission are considered. Additionally, this study also tests the hypothesis that adult males will innovate more than adolescents and adult females, as they are more willing to take risks, travel greater distances, and come into contact with greater numbers of people, thus exposing them to new ideas and technologies.

17.2 Innovation

Innovation and social learning are often described as responsible for playing significant roles in the evolution of cultural systems (Hewlett et al. 2011; Hewlett 2013; Aoki 2013). Arguments are often structured around the transmission and diffusion of novel information, behaviors, and/or artifacts, the receptivity of a society to inventions, and the role of innovation as an adaptive response to highly variable climatic or social conditions, providing solutions to new problems and reducing uncertainty and risk (for definitions of innovation and invention see O'Brien and Shennan 2010, p. vi–18; Henrich 2010, p. 99; Kameda and Nakanishi 2002; Barton et al. 2011). However, as noted, innovations may not necessarily arise in response to socioenvironmental adversity and instability nor be developed to meet specific needs (Henrich 2010; Diamond 1999, p. 246). Innovative behavior is not unique to humans, and as with social learning, often occurs in a variety of ways and ecologies (Nishida 1987; Galef 1992; Tomasello et al. 1993; Boesch 1995, 2003; Kameda and Nakanishi 2002; Lalande and Reader 2010, p. 37–52).

Studies with nonhuman primates, meerkats, birds, and fish have provided some insight into the drive behind innovative behavior, assessing which individuals are innovating (by age, rank, and sex) and what relationship might exist between innovation and competitive ability. For example, low ranking individuals in some species (e.g., meerkats, fish, birds and some nonhuman primates) unable to physically outcompete higher-ranking individuals, show innovative propensities or engagement in risk-taking, innovative behavior (Thornton and Samson 2012; Reader and Laland 2001, 2003; Laland and Reader 1999; Katzir 1982; Biondi et al. 2010; Morand-Ferron et al. 2011; Cole and Quinn 2012). Species such as Pan troglodytes (Goodall 1986) achieve higher social rank by displaying innovative behavior (e.g., within foraging and/or sexual and courtship behaviors). Additionally, Reader and Laland (2001, p. 802) found in their extensive survey of the literature on primate behavior that greater incidences of innovation occurred in adult male primates rather than subadults and females and suggest that adults may innovate more than young individuals "because innovation frequently builds on other skills, and requires a degree of experience…that is more common in adults than in younger primates." Further, the authors suggest that adult males may innovate more due to lowered risk aversion driven by sexual selection (Reader and Laland 2001; Hewlett 2013; Dean et al. 2011). Van Bergen (2004) likewise found greater innovation in male primates particularly in association with sexual, courtship behavior and aggression (van Bergen 2004, 2011, p. 46).

Among humans, adult males from contemporary foraging societies tend to travel greater distances than females and adolescents and take greater risks (see for example MacDonald and Hewlett 1999). Exploration not only increases mating chances but also increases exposure to new innovations offering opportunities to observe and learn new traits and behaviors by increasing exposure to greater numbers of individuals and broader social-economic networks (Hewlett 2013). It has also been suggested that male-biased innovations may be less costly than females and have a greater "fitness payoff" than for females

(MacDonald and Hewlett 1999; Hewlett et al. 1986; Reader and Laland 2001). Indeed, in the 2013 study of innovation, adult Aka males were more often identified as innovators than were adult females. Exploratory and risk-taking behavior are important features in the discussion of social learning, innovation, and cumulative culture as these behaviors "facilitate cumulative knowledge" by increasing the population of others one will come into contact with (Lewis and Laland 2012, p. 2175; Reader and Laland 2001).

17.2.1 Social Learning

Although humans share a biological heritage with other animals, humans have characteristics that are somewhat unique (such as natural pedagogy see Csibra and Gergely 2009) which enhance the ability to rapidly acquire novel innovative behaviors and knowledge (Hewlett 2013; Hewlett et al. 2011). How innovations are acquired, from whom, and the way in which novel knowledge and skills are transmitted are directly linked to modes and processes of social learning. Modes of transmission such as learning from parents (vertical transmission), peers (horizontal transmission), leaders or teachers (one-many transmission, prestige bias), or from all of those around an individual (conformist transmission) can be an efficient way to learn innovative skills and knowledge (Hewlett and Cavalli-Sforza 1986; Creanza et al. 2013). Different high-fidelity learning processes, such as teaching, observation and imitation, and participation and practice, enable the "student" to more quickly learn skills and knowledge, as it would be too costly to learn by trial and error (Hewlett et al. 2011).

While natural pedagogy is innate and a relatively unique trait of human cognition, the Aka data support the argument that not only does pedagogy exist in foragers but suggests as well that cooperative, directed teaching enhances the "faithful transmission" of innovative traits between individuals (Hewlett 2013; Hewlett et al. 2011; Csibra and Gergely 2011).

17.2.2 Results from Aka Hunter-Gatherer Study

The 2013 research of innovation among Aka hunter-gatherers included in-depth and structured interviews, informal observations, videotaping, and systematic ranking and sorting techniques with 20 Aka adolescents of Central African Republic and ten Aka adult individuals, with five identified as being "innovators" and evaluated existing developmental and evolutionary theories. The study predicted the following: older adolescents should be more innovative than children and adults, older adolescent males should be more likely to seek out innovations, innovations should spread by horizontal transmission, and adolescents should pay attention to prestigious (i.e., "successful") peers (Nasir 2005; Tamnes et al. 2010; Kleibeuker et al. 2013; see also Laland and Reader 2010).

As predicted, Aka adult males were more often listed as innovators than adult females. Adolescents of both sexes were more likely to seek out, and pay for, new behaviors, innovations, and new technologies than were adults or children. Both males and females are frequently listed being seen as more attractive to the opposite sex as the main reason for acquiring new behaviors and/or technologies.

Contrary to expectations, creation of innovative technologies adopted by others occurred more frequently by Aka adults than adolescents, and both male and female adolescents sought out new innovations from adults rather than peers. Indeed, Aka adolescents were adept at identifying, and sought out, knowledgeable, innovative adults (the most skilled) to learn from (oblique transmission and model-biased learning Chudek et al. 2012). In every case but one, these tended to be adults other than the adolescent's parents. Aka adolescents not only identified the innovators but chose what to learn. Thus, learning was self-directed. Modeling studies suggest that cumulative culture will not occur in low population densities with limited migratory activity of subpopulations unless the offspring selects to learn from more knowledgeable adults other than parents (Powell et al. 2012, p. 143). Additionally, adolescents listed character qualities of the innovators, which could be described as pro-social, and specifically sought out those individuals who exhibited those qualities as well as those who were "good teachers" (Hewlett 2013). Most Aka adults utilized teaching methods producing high-fidelity cultural transmission of the innovative trait (e.g., directed instruction, hand-to-hand instruction).

17.3 Methods

This research conducted with the Chabu forager-farmers of southwestern Ethiopia replicates the 2013 study of the nature, indigenous understanding, social learning, and cultural transmission among Aka hunter-gatherer adolescents of Central Africa (Hewlett 2013). Since little is known about this topic in foragers and forager-farmers, most of this research is primarily inductive and descriptive. Additionally, as this is one of the first times for the Chabu society to be studied ethnographically, basic demographic data needed to be collected prior to the research. As with the Aka study, the sample size is small. Data were collected from in-depth informal and semi-structured interviews regarding indigenous concepts and terms relating to innovation,

informal interviews detailing how adolescents learned a specific set of skills and tasks (e.g., how to make pottery, how to make a spear, how to hunt), identification of behavioral and technological innovations, exploration of whom individuals chose to learn from and why, how they were taught, importance of new knowledge, free listing and ranking of persons thought to be innovators, and free listing and ranking of character qualities of innovative people. The sample of "village living" Chabu included six females and six males between the ages of 12–20 years, four adult females (three identified as innovators) 28–70+ years of age and three adult males, (one identified as innovator), 30–80+ years of age. Adolescents were identified by the use of indigenous terms and understandings designating a life-stage beginning with puberty and ending with marriage. Adulthood begins when adolescents show evidence of "adult knowledge" and the ability to hunt or keep a house and have and care for children, "When you are married and have a baby you are an adult… but being an adult is (also) about character, when you have a good behavior" (19 year-old Chabu male).

17.3.1 Setting and Social Organization

The Chabu are forest foragers-horticulturalists located in the highland forest areas of three administrative states of southwestern Ethiopia (Oromo, Southern Nations, Nationalities and Peoples Region [SNNPR], and Gambela) with an approximate population of >2,500 people. Genetic and linguistic work suggests that the Chabu are genetically distinct from their nearest neighbors and are linguistic isolates (Gordan 2005; Schnoebelen 2009; Tischkoff 2013 personal communication). The Chabu are not officially recognized as a distinct ethnic group at the national governmental level. However, the Chabu say three factors differentiate them from those around them, including their cultivating Majang neighbors: music, language, and their acknowledgment as the first inhabitants of the area.

Today the Chabu live in more than ten settlements or camps in the forest of the Majang zone of Gambela and Sheka zone of SNNPR. Several settlements are near coffee plantations. Demographic data collected from 51 households in two villages (with a total of 127 persons, 68 male and 49 females) suggests that fertility is high and infertility infrequent. The total fertility rate is estimated to be 5.3 live births per woman (Hewlett et al. 2013 unpublished data). Women generally are married by 18–20 and have their first child 2 years after marriage. Men marry 2–4 years later than women. Polygyny is practiced, and divorce is reported to be fairly common and, as has been found with other hunter-gatherer groups, typically occurs early in the marriage before children are born (see for example, Hewlett 1992).

The social unit includes the family, the settlement or village, and regional community. The conjugal family is the most significant social unit of production and reproduction. In the villages, each nuclear family has a home where the mother and young children live together. There is variability in terms of whether the father lives with the nuclear family or in a nearby small house of his own. A few older men mentioned belonging to a clan and described clan obligations and hierarchy, but few women seemed to know about or mention clan links. More research is needed to further understand the nature of Chabu social units, particularly in terms of clan ties, and larger regional community ranges.

While little is known about Chabu history and culture, the Chabu recount that traditionally they were hunter-gatherers and beekeepers, and a small population of Chabu still live some distance from the settled villages in nuclear family groups, subsisting primarily by hunting and gathering from the surrounding forests. While these are activities many Chabu pursue in the villages today, during the last 16–20 years most of the Chabu have shifted from a primarily hunting-gathering way of life to foraging-farming, with an increased involvement in the local economy, selling and trading honey, pottery, meat, and land for salt, clothes, pots, spear points, and some foods. There is a division of labor among the men and women. Chabu men fish, and hunt in the forest, often daily, for wild pigs, duikers, and antelope, as well as maintaining traps and a large number of beehives (some men may own up to 200 beehives). The Chabu women tend small fields of maize and coffee, as well as growing taro, bananas, squash, some enset, and other vegetables in gardens close to their homes and fields. The women also regularly gather forest foods, depending upon the availability of produce from their gardens and the season. Summer, for example, is considered a "hungry season" and women may go daily into the forest to gather (Dira 2014 personal communica- tion). Many of the women and adolescent females also make pottery to sell at the local markets, while only a few men, known to be "specialists," construct spears or baskets to sell or trade.

17.3.2 Chabu Children

Terms designating the life cycle begin with the sesele or newborn, cho for a crawling baby, and sara for a toddler. At this toddling stage, the young boys and girls begin learning and practicing specific, gendered tasks from their mothers

and fathers. As Kaneko describes of the Ari people in southwestern Ethiopia, "children grow up in their mother's (and for little Chabu boys, father's) work place" (2014).

Middle childhood is designated by the term oofa. At around 6 years of age, young boys are taught to hunt and check traps with their fathers and will start to make little "practice" beehives, traps, and houses (see Fig. 17.1). At this time they may use a small spear, without a metal tip, to practice killing rodents and birds. At around 10, with help from older brothers and/or their fathers, they are able to build and begin to sleep in their own small dhipo (house). They generally have at least one beehive they have built and maintained and by the time they have reached puberty may own up to ten beehives.

In middle childhood, young girls are mainly helping their mothers, learning and practicing domestic chores, cooking, planting corn, fetching water, washing clothes, caring for younger siblings, and gathering wild forest plants (yams, mushrooms, leaves). They also may begin to make pottery, both to furnish their own future dhipos and to sell at the local market. For both the boys and girls, they learn many skills when they are very young, practicing and perfecting them as they mature. It takes years of practice to become good at complex tasks and skills.

Fig. 17.1 Young boy practicing trap building

17.3.3 Chabu Adolescents

Once children reach puberty, young adolescent boys (attines) are often with their fathers hunting, checking traps and beehives, or clearing the fields and forest. By this age as noted, they may own up to eight to ten beehives and are setting up their own traps. At around 15, adolescent males will also have their first iron-tip adult spear to use when hunting with their father or group of friends. The adolescent males will have already built their own small house, "the family insists we build our own homes so we will learn to be responsible for our own lives," where they will live alone, although they continue to eat with their family and/or friends (see Fig. 17.2). Chabu girls, or kota (adolescent females), have a little house constructed for them by their older brothers or father and will live in these homes when menstruating or when a visitor comes. It is rare that they live alone, as they generally choose to live in their family home or with a friend in their small homes when menstruating. The young girls "work to learn" and practice "keeping house and cooking" at their dhipos, demonstrating to potential mates their "wife capacity," or readiness and desirability as a mate. If interested, a young man will send lotions, perfume, clothes, and perhaps food to the young woman and her family. If his gifts are accepted, the couple will be considered "engaged." The young man then begins building a marriage house in his natal village and collecting the brideswealth payment. Upon marriage, the young couple lives in the newly built home and establishes a garden in the man's "ancestral" village, where they will live with their future children.

Married men are known as utare, and a married woman is tegon, until old age when both men and women are called jetti, an old person.

Fig. 17.2 Adolescent boy outside of his dhipo

17.4 Results

17.4.1 Cultural Models: Understanding Innovation

The Chabu have several terms relating to innovation. Achak, for example, is the verb "to create," kina achak translates as creating a thing or matter (which may or may not be an "innovation"), while kina amb refers to a new matter or thing. However, the term that most Chabu use when referring to "innovation" is agadhatta, which is variously described as "creating a new feature on an old thing," or "a person who works hard," and "a person who creates new

things." Chabu adolescents, and adults as well, use the term to refer to a "person who works hard and becomes agadhatta because that person brings out something new." As an elderly Chabu man explains:

> Agadhatta is everywhere, it is in all things. It is waytsine ambe ezagen. This means to do all things. It means to finalize the hard work. It is doing your hard work and observing and thinking about this hard work, and doing it very well. It is all hard work to think of change, to think of new things, but the new thoughts come from hard work. Agadhatta has existed for long years, since our ancestors.

The term encompasses more than innovation, or the creation of something new, as it refers as well to the time and effort, the "hard work" from which creative ideas, designs, and technologies emerge. Interestingly, this work ethic/effort is evidenced in innovative people when they are young, as an adolescent girl explained, "my mother is the sister of S. (most frequently mentioned female innovator) and she said when S. was young, she was very strong in learning and worked hard, and that is why she is better, why she is an agadhatta person." Innovation seemingly arises from long-term engagement (hard work) and mastery of a particular skill.

17.4.2 Descriptions of Innovation

The Chabu are very specific in what they perceive as innovations – a behavior, design, or technology that is different and "new." Examples of innovative processes, as among the Aka, tend to be modifications, i.e., the enhancement of a trait that currently exists, such as a pottery design, basket, or spear, made with a new feature or produced in a different way (for a discussion of modification, combination, and novel invention, see Lewis and Laland 2012). An adolescent male mentioned a basket maker whose "baskets are different than others," and another young man spoke of a slightly older man as being an innovator because "…his works are good and strong. His knives and spears are stronger and better than other peoples" (see Fig. 17.3). From the examples given by the Chabu, it appears that features considered to be innovative are not only "new" but also those favored by many – enhanced designs or technologies or other modifications to artifacts that become highly sought after by others. As a young woman explained, "she (innovator S. named by most people) is a specialist in this new design, not everyone knows these designs (gacha). We learned how to make these pots from our ancestors, but she created this new design. Many people come from other villages to learn from her this new design." When asked about "failed" innovations, a female identified as a highly skilled pottery maker and innovator explained that, "I have never made a design (gauche) that has failed, that others do not want to learn" (see Fig. 17.4).

Fig. 17.3 Example of larger and innovative "lighter" designed spear

Fig. 17.4 New "gache" or design on a cup

17.4.3 Characteristics of Innovators

Adolescent free listing data indicate that overall goodness, generosity, peacefulness (being a non-conflictual person), being a hard worker, and having "love" for others are attributes of innovative people (see Table 17.1). A "good" person is described as being one who encompasses these highly valued qualities. Innovators are said to be people who care more deeply about others' welfare, who share their time and knowledge so that other people may benefit. Adolescents provided the following descriptions of innovators:

> She is a very good person. She is known. She is kind and generous and shares whatever materials she has. She is more active then other people and works hard for others. There is no one else like her here in this village. Her willingness, she gives whatever she has to others. People go to her for her love. She is a person who loves more than others [teng-uti].
>
> He is a good person. He gives what he has to others, and does not create conflict with others. He does not ask for anything to teach.

Table 17.1 Adolescent salience analysis of freelisting data

Attributes	Attributes ∑	Composite salience ∑/n (n ¼ 18)
Good	6.67	0.74
Generous (with time and knowledge)	4.09	0.45
Peaceful	2.49	0.27
Shares (food, etc.)	2.42	0.26
Hard worker	1.92	0.21
Loves people	1.58	0.17
Kind	1.00	0.11
Friendly	0.25	0.02

Innovators are described as people who work hard, and like Aka innovators, are "different from others." Likewise, as noted, innovative people are more likely said to be concerned about others' well-being and are willing to teach others in order to help them. Such was exemplified by a 35+ year-old female Chabu innovator, who explained: "People come from other villages to learn and I do not charge for teaching people. . . I only want to teach them, to help them because they do not know how to make this new design."

Much like the descriptions of Aka innovators, Chabu innovator characteristics could be understood as features of a pro-social individual. However, among the Aka not all innovators could be said to be acting altruistically (i.e., pro-socially), as some would charge a "fee" (e.g., money, necklaces, an ax, or pot) for their "knowledge" (see Hewlett 2013; Lewis 2015). Although Chabu adolescents expressed a willingness to compensate their teachers, those they regard as the "best" at creating (e.g., a new pottery design or a new way of making knives, baskets, spears, or craft technologies), and identify the innovators as "owners" of the new technology or idea, they are not, like the Aka, asked to pay for this knowledge or time spent in teaching a particular skill. Interestingly, like the Aka innovators, Chabu individuals identified as innovators and sought out by the adolescents, are also the most likely to be described as "good teachers," as an adolescent female explained: "She is a good teacher, those who want to learn go to her home, watch and she shows them. They ask and she tells them how. People watch when she is making pots. There is no payment, people are grateful. She is a specialist."

17.4.4 Innovators Motivations to Teach

Innovators, as noted above, are seemingly motivated to teach a new skill simply to help others. As one 28+ year-old female said, "people come and seek my support and I give to them so they can become good in their life for the future. I never tell people 'no.' Whoever comes, it is my responsibility to teach." Informal interviews with the four innovators suggest that along with the reputation of being an innovator, that is, being agadhatta, comes a sense of responsibility for others:

> I am known for agadhatta, when I see mistakes I teach and correct. If they make a mistake when they hunt, they will not get the animal, so I tell them. I do this. I teach people. I tell them the stories of the fathers. I teach people how to make the new light spear and I do this so they can take care of themselves in the future. This is knowledge from God, from Chaa. Agadhatta people love more than others, they have more love, this is why I teach. – 70+ year-old male

The Chabu innovators did not express the desire for any type of reward, e.g., monetary gain or gifts, attracting a mate, or the enhancement of their reputation and status, as a reason for their willingness to teach others their knowledge or innovative skill.

17.4.5 Adolescent Choice and Strategies of Learning

All of the six adolescent females stated that they sought out and learned from adult female innovators other than their mothers. Six of the adolescent males listed seeking out and learning from adult males other than fathers, and two also mentioned learning from older adolescent males. Adolescents' choices of individuals from whom to learn innovations, as noted previously, are based upon the types and complexity of skills being taught, the innovativeness of the person, and their teaching ability. As noted, all were adults, (save the two older adolescent males, these two particular males were in their early twenties and still considered adolescents as they were unmarried) and many were innovators. Chabu innovators are also generally said to be good at teaching. The adolescents describe a "good teacher" as a person who is patient, explains carefully, corrects mistakes, or demonstrates a task until the "student" can proficiently perform the skill. Innovators known as being good at teaching are highly sought after by the adolescents, as are those who exhibit pro-social characteristics (e.g., kindness, generosity, empathy), paralleling the attributes of good teachers mentioned by the Aka adolescents. As a young Chabu adolescent girl explained about an innovator "She is a good teacher, she is not angry if I make a mistake. She is danka ufa[a good person]. She is patient. I heard from others she is a good, patient teacher so I went to her to learn." As with the Aka, both adolescent males and females chose skillful others, almost always adults, to learn from. Likewise, learning from others, as well as choosing from whom to learn, is self-directed. A Chabu adolescent related that he chose "K because he is a specialist in making knives and spears, his are stronger than others. He knows how to make them well, he knows better than others." Not surprisingly,

given the sexual division of labor, adolescent males choose adult males to learn from "the best teacher is a brave one, one who teaches everything he knows, the new things. Adult men are the best teachers." Likewise, adolescent females choose specific adult females to study: "I go to learn from her (adult female innovator). I learned from my mother, but some things she did not teach me, so I went to her (the innovator) to learn the best way. To make sure my mother taught me the best and correct way."

The adolescents typically do not choose their parents to learn the innovative skills from, but rather those who have a reputation as being a good teacher and innovator. Additionally, as the above quote indicates, young children may have already learned from their parents a particular skill, e.g., pottery making, but seek out those known as specialists and innovators to improve upon their knowledge and ability in order to produce a highly valued skill and/or desired artifact, be it a pot, spear, house, or dance.

17.4.6 Motivations for Learning Particular Innovative Skills

While Aka adolescents listed mate attraction as the primary reason to learn innovative skills, Chabu adolescents more often cite independence from others as being the chief motivating factor; a 13 year-old Chabu male indicated "it is important now to learn to be self-sufficient, to be independent without seeking the support of others." Not to say that mate attraction was not on their minds: "I want to be dhiwe ufe, a popular man, to do things well and have lots of girlfriends" – 14 year-old male. The importance of adolescence as being a time of learning is notable among the conversations with males and females, as well as the decision about what to learn, as the following quotes suggest:

> Deciding what is most important to learn is the best quality of an attine. – 13 year-old male
>
> Making pottery is the most important lesson for kota. Girls learn so they can take care of their families and buy things at the market. – 14 year-old female

Chabu adolescents expressed the sentiment that it is important to learn skills in order to contribute to their present family household income and also to learn from those most proficient and innovative in order to gain a skill they can use to support their future families. The adolescents are well aware of the importance of being able to provide for their families by participating in the local market economy.

17.4.7 Who Are Innovators?

In two different villages, with a combined population of approximately 150–200, 12 innovators were identified by 18 of those interviewed. Contrary to prediction, among the Chabu, females 25–40+ years of age were most frequently mentioned as innovators. Specifically, five of the innovators were males (ages 23–70 years) and seven were females (ages 28–45) (see Table 17.2).

Table 17.2 Composite salience of freelisting of innovators

Innovator	Innovator ∑	Composite salience ∑/n (n ¼ 18)
35-year-old female	9.00	0.50
40-year-old female	5.17	0.28
40-year-old male	3.50	0.19
25-year-old male	2.33	0.12
30+-year-old female	2.00	0.11
35-year-old male	1.33	0.07
35+-year-old female	0.75	0.04
70-year-old male	1.00	0.05
25+-year-old female	1.00	0.05
25-year-old male	0.67	0.03
30-year-old female	0.50	0.02
40-year-old female	0.25	0.01

A 28+ year-old female ("S.") in particular was identified by both adults and adolescents much more frequently than all others. Interest in her pottery skill was expressed by women of all ages:

> Because I made the old style they would not accept it at the market. If I made the new design the pot would sell immediately and with a good price. My old pots did not sell, so S. came to me and advised me to make the new style and invited me to her house to watch her make the new design. In this way I learned and can now make more with the new pots. – 50+ year-old female

Innovator identification appears to be domain specific and related to recent integration into a market economy in which "gache" pottery made by the women generates a good income.

17.4.8 Modes of Cultural Transmission of Innovation

Interviews with the 12 adolescents and 7 adults revealed that Chabu adolescents seek out knowledgeable adults (the most skilled) other than parents from whom to learn, suggesting oblique transmission and model- biased learning (cf. Chudek et al. 2012). Only two young adolescent males reported learning a new skill (how to construct a guitar and build a home in a particular style) from another (older) adolescent male. The importance of vertical transmission (parents

teaching children) and horizontal transmission (peer to peer, or intragenerational – a characteristic form of transmission in adolescence) cannot be overemphasized, but given that the innovators are adults other than parents, as with the Aka, most transmission of new knowledge or invention occurs obliquely (for a more detailed analysis of social learning among foragers, see Hewlett 2013; Hewlett et al. 2011; Hewlett and Cavalii-Sforza 1986). Generally, adolescents were seeking to refine skills or techniques they had acquired from their parents as children (e.g., how to make a trap, pot, or build a house), rather than learning an entirely new skill.

17.4.9 Innovation and the Processes of Social Learning

The Chabu language includes very specific words encompassing processes of teaching and social learning: (e.g., temare, to learn; étoté, to teach; yeayeah, to watch; doya, to practice; and yemba, to show). Twelve Chabu adolescents and five of the adults very specifically described processes of social learning that included observation ("I watched her many times before I tried to make the pot gauche by myself") and imitation of technique (e.g., seeing a new pottery design and imitating the trait). Nine of the 12 adolescents specifically mentioned watching as an adult demonstrated a particular skill while giving verbal instruction, such as "Do it like this, ekukum (the correct way)." Adolescents also reported receiving direct instruction from an adult innovator who was directly next to them demonstrating a technique (e.g., house building, applying a new design on pottery) as the adolescent performs the same task and suggests/shows the correct method. This style of directed "side-by-side" (not to be confused with "hand-to-hand" in which the teacher takes the learners hand and directs the movement) teaching with verbal instruction was not as common as observation and imitation, being reported by only three individuals, and in those cases seemed to be used to teach more complex skills:

> My father brought me to the forest to collect materials. He showed me the good wood and the bad wood. We came back to the village and he showed me how to build a good house. I watched my father working and I helped. My father warned me when I built incorrectly, he would take out the bad way and do it correctly and make me do it also. We built my house together. I built alongside my father. – 14 year-old male

Often the adolescent would observe the task multiple times, then practice at home, coming back to show their various attempts to the "teacher" who would make suggestions until it was correctly reproduced, as illustrated by a young man, 19 years old, who was learning an innovative guitar design: "He shows me how to make a guitar. I watch and then I make the guitar in my own house and then show him what I have done. If I make a mistake he corrects me." Adolescents said they sought out the "best" teachers, those who were patient, taught slowly, gave directed instruction, and ensured the student correctly performed the new task: "She invited me to her house to watch her make the new design. When I made a mistake she was watching and she corrected me. She would complete the design if I made a mistake. She teaches very slowly (laquka ezagen). While she is showing us she explains carefully" (13-year-old female). Many times the adolescent had some prior knowledge and skill learned from a parent, but they reported seeking out those who were more skilled, innovative, or knowledgeable in order to refine the skill.

During childhood, less complex skills taught vertically are "practiced" for some time and are then built upon during adolescence. Increasingly complex skills are generally taught obliquely (adults other than parents) and from "the best" persons, those often identified as innovators. Adults interviewed also mentioned how they were taught both as children and when they were older:

> I learned how to make pottery from watching my mother. My mother would have me make a pot while she watched, and she corrected if I made a mistake. I learned this when I was very young. I sold my pots at the market when I was a young kota. After my marriage people began to notice my pots with the new gauche (with design she created) and I became known as a specialist. – S., a 28+ year-old female innovator

> Here, the hunter goes out with a big spear, and you take ten dogs to hunt with you. But six years ago there was a great hunger in the village, there was a drought, and no food for the people and even the (hunting) dogs started to die. T. went and saw this man (A.) who hunted with a lighter spear. So he gave him a pig to learn how to make this spear. A. took us to the forest and showed us the wood, he cut it and prepared it for use. He showed us how to use the spear and took us hunting with him. With a light spear you can take only 5 dogs, or go alone. The lighter spear is more dangerous as it may not kill the animal, but the hunter can go out without the dogs – 30 year-old male

Evidence from qualitative and quantitative data suggests that due to recent integration into a market economy, adolescents are particularly likely to learn from adults other than parents and learn through observation, imitation, and directed teaching.

17.4.10 Discussion and Conclusion

Chabu societies have a local term for innovation, and like the Aka, have very specific ideas of what are considered innovations. Both Aka and Chabu societies (adults and adolescents) are able to quickly identify individuals known as innovators, who are often characterized as being "different" from others. Motivations for teaching listed by innovators are altruistic, a responsibility felt by the innovators to help others. Unlike some among the Aka,

Chabu innovators did not "charge" a fee for their time spent in teaching and sharing of "owned" knowledge of a particular skill, nor did they list monetary support or increased status as a motivation for teaching. Also dissimilar from the Aka, motivations for the Chabu wanting to learn a particular, innovative skill included the desire to be independent of others and being able to provide for their present and future families.

The innovations and personality characteristics of innovators (e.g., goodness, kindness, and generosity) could be understood as features of a pro-social individual, features highly valued among the Chabu and Aka alike. As noted above, knowledge was freely shared among the Chabu (among the Aka, adolescents were at times charged a fee (e.g., money, necklaces, an ax, or pot) to be taught). The investment in and demonstration of pro-social behaviors, such as cooperative teaching by the innovators, suggests strategies related to fitness payoffs (cf. Kaplan and Hill 1985; Inkeles 2000; Hill 2002; Gintis et al. 2003; Henrich et al. 2005) in that it appears from observational data that Chabu learners pay with "prestige deference" and "public praise." However, further research is needed to ascertain whether public praise and deference "payment" to innovators increase their reproductive fitness (e.g., health status of innovator, number and health status of mates and children compared to others).

Chabu innovators are also described as being more hard-working than others. As with the Aka, Chabu begin learning and practicing skills of varying complexity from the time they are small children and are provided an environment in which practice is supported and encouraged by those around them. Thus, innovators have been "working" on particular skills for a long time, practicing from childhood, and as the indigenous Chabu term, agadhatta, suggests, innovation both is and comes from hard work. Practicing tasks and skills from a young age (often manifested through "play") has important implications and benefits in that it not only teaches the "practical techniques of use" but also encourages children and young adults to "become familiar with the cultural, social and emotional contexts of the objects" (Spikins et al. 2014, p. 127). Importantly, it is also a stimulus for creativity and innovation (Nielsen 2012; Nielsen et al. 2012). Indeed it has been suggested that a childhood of preparation, practice, and support is necessary for innovation to occur (Gladwell 2013).

Contrary to prediction, and unlike the Aka data, those who were identified and more frequently listed as innovators tended to be adult females. While Reader and Laland (2001) found patterns of male-biased innovation in nonhuman primates under a wide range of conditions and in varying environments, individuals vary in their degree of risk aversion in particular ways, and innovators, both male and female, are simply more tolerant of risk-taking and uncertainty (Henrich 2001, p. 8). Innovative individuals are more willing to adopt a new trait based on limited (uncertain) evidence. Risk-taking tolerance for males and females in particular environments may lead to mating success and establishment of broader social-economic and "innovative" networks (2001). As the Chabu produce highly valued and desired artifacts, such as pottery with gauche or innovative designs, which sells well at the local market, it is perhaps not surprising that women are listed more frequently as innovators. Thus, these data suggest that innovative gender bias is domain dependent.

Adolescents in both Aka and Chabu societies chose to learn from prestigious ("successful") adults rather than peers. Henrich (2010, pp. 99–120) argues "learners ought to be selective in terms of to whom they pay attention for the purposes of cultural learning," preferring those with "greater skill, success, knowledge, health, and prestige" while also " using cues of self-similarity such as gender, size, and ethnicity to help ensure that what they learn is fit for their personal attributes and current or future social roles" (see also Henrich and Gil-White 2001; Henrich et al. 2005; Hewlett 2013). Chabu and Aka adolescents certainly sought out "prestigious others" from among their peers to observe and emulate; however, when learning new innovative traits, they more frequently sought out "prestigious" adults, those who possessed special knowledge and ability that others did not. While the importance of vertical and horizontal transmission cannot be overemphasized, given that the innovators were adults other than parents, most transmission of new knowledge or invention appears to occur obliquely. Another key point is that in both societies, it was the adolescents themselves who identified the innovators and chose from whom, and what, to learn, i.e., learning was self-directed (see Hewlett et al. (2011) and Hewlett (2012), for a further discussion of self-directed learning among adolescents).

Aka and Chabu adolescents, as noted, chose not only from whom to learn but also how to learn. The process of cooperative social learning of an innovative skill should most often be teaching, as it is a more efficient form than observation and imitation alone (Shennan and Steele 1999; Gergely and Csibra 2006; Gergely et al. 2007; Hewlett et al. 2011). Informal observations and qualitative data indicate that observation and imitation of a new trait accompanied by direct instruction (e.g., the adolescent observes and imitates the adult, who gives verbal instruction) occurred in a majority of instances, as with the Aka. Also similar to the Aka data, observational imitation (e.g., observing a pottery design and imitating it without instruction) occurred less frequently. While direct imitation/copying of others is a "powerful" form of learning that allows new skills to be rapidly acquired, of note are studies which emphasize "social motivations" underlying selective and over-imitation among humans (Nielsen et al. 2012;

Dijksterhuis 2005; Nadel et al. 1999). Over and Carpenter (2012, pp. 182–192) argue that choices about what to (over- and/or selectively) imitate tend to be based on the desire to "do as others do." Put another way, imitation is a social process, often done under social pressure, in which individuals copy in particular ways what particular individuals do, those with whom they may have a familial relationship with, or who are known within the social group in general.

Finally, the use of hand-to-hand instruction to transmit an innovation was neither mentioned nor observed among the Chabu, whereas this method was recorded and mentioned frequently among the Aka adolescents (see Hewlett 2013). Various demographic and cultural contexts contribute to the different ways in which social learning occurs. Aka families, who live in groups of 10–30 in small huts circling a central area, are together often throughout the day, know each other exceptionally well, and cooperate in many activities on a regular basis. The Chabu families in this study, on the other hand, live in larger villages, with husbands and adolescent males often living away from the family home. Chabu husbands and wives apparently do not often participate in joint activities and may be inclined to know each other less well (Hewlett 2013). Gender roles and tasks among the Aka are flexible, the capabilities of each are similar, gendered tasks are shared, and gender roles are fluid. Preliminary research seems to indicate that Chabu gender roles and tasks are largely fixed, seldom shared, and tend to be largely inflexible. The close communities of the Aka and Chabu each begin with the family, where the acquisition of cultural skills, socialization, production, and reproduction occur. However, one could suggest that the egalitarian nature of the Aka society promotes high physical closeness, including physical proximity during teaching events (i.e., hand-to-hand instruction). Thus, adolescent's choices concerning from whom, how, and what to learn are not willy-nilly considerations, but ones powerfully informed by social dynamics, motivations, and rewards (cf. Over and Carpenter 2012, pp. 182–192).

Interactions between knowledgeable adults and naïve individuals as described above may help to provide an understanding of how processes of social learning, in concurrence with particular modes of cultural transmission and innovation, are factors in both the conservation and change of culture overtime (DeBoer 1990; Gosselain 1998; Greenfield 1984; Roe 1995). Innovation, as an element of behavioral plasticity, may enhance not only the fitness and survivability of individuals but may overall increase the diversity, longevity, and complexity of cultural traits over time (Shennan 2001). Further work is needed to fully understand these processes, to examine, for example, individual agency and innovation: What prompts certain individuals to create and not others? Why do some cultural traits become highly sought after and maintained overtime and not others? What are examples of innovative failures? How important are play, practice, and the "hard work" of childhood in producing not only innovative individuals but cumulative culture? It is my hope that researchers will continue to engage in multidisciplinary explorations of these and other provocative questions regarding social learning, innovation, and cultural transmission.

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