Title: How do hunter-gatherer children learn subsistence skills? A meta-ethnographic review

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Abstract:

Purpose: Hunting and gathering is the defining subsistence strategy of our species, and accordingly, studying how foragers learn these skills is essential to the understanding of the evolution key human traits such as life history, cognition, and social behaviour.

Though foragers live in a wide variety of ecosystems, and have different cultures, most studies of knowledge transmission are conducted on individual societies. However, cross-cultural studies are needed to extrapolate forager-wide trends in how, when, and from whom hunter-gatherer children learn.

Method: We perform a meta-ethnography, which allowed us to systematically extract, summarize and compare both quantitative and qualitative literature.

Results: Learning subsistence skills begins early in infancy, when parents take children on foraging expeditions and give children toy versions of tools. In early and middle childhood, children transition into the multi-age playgroup, where they learn skills through play, observation, and participation. By the end of middle childhood, most children are proficient food collectors. However, it is not until adolescence that adults, not necessarily parents, begin directly teaching complex skills like hunting and complex tool manufacture. Innovations are not usually generated by children and adolescents.

Conclusion: These findings support the claims made by predictive models that social learning occurs before individual learning. Furthermore, these results show that teaching does indeed exist in hunter-gatherer societies. And, finally, though children are competent foragers by late childhood, learning to extract more complex resources, such as hunting large game, does take a lifetime to perfect.

Key words: learning, forager, life history, meta-ethnography

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We would like to take this opportunity to clarify the authors' roles in creating this study. Lew-Levy sorted through the titles and abstracts to initially evaluate the studies using the inclusion criteria. Lew-Levy, Reckin, Lavi and Cristóbal-Azkarate made the final decisions on inclusion, and read and coded the studies. Lew-Levy, Reckin and Lavi decided upon the major themes, and drafted the manuscript, with Lew-Levy providing figures, and Cristóbal-Azkarate and Ellis-Davis contributed to manuscript revisions. Ellis-Davies has served in a supervisory role throughout the process of preparing this paper.

1. Introduction

Humans have an exceptionally long pre-reproductive lifespan than expected for our body size (Bogin 2006). Humans are also unique in our ability to transmit vast quantities of cultural knowledge from one generation to the next. This transmission of knowledge and the accumulation of culture allows us to update our technologies and environmental knowledge in response to changing surroundings (Laland 2004; Boyd et al. 2011). Some have argued that the human propensity for learning has shaped our especially long childhoods (Kaplan and Robson 2002). Since hunting and gathering was our sole subsistence strategy for more than 90% of our evolutionary history, studying how hunter-gatherer (or forager) children learn the various subsistence skills can help us uncover how knowledge has been transmitted through our evolutionary history, and influenced our life history strategy (Marlowe 2005). Unfortunately, of the few studies which exist on the topic of learning subsistence skills among foragers, only a handful employ a cross-cultural approach (e.g. MacDonald 2007). This is surprising, since foragers are diverse in ecologies, cultures, and historical relationships with neighbors, all factors which might influence learning. Furthermore, sociocultural perspectives support this imperative to consider learning cross-culturally, in recognition of the interdependence of social and individual processes in the co-construction of knowledge (John-Steiner and Mahn 1996; Nielsen and Haun 2016). Of these cross-cultural studies, focus is usually on a particular skill, such as hunting, and thus fails to recognize the ways in which learning is similar or different across various skill domains.

In order to address this gap, the present paper adopts a meta-ethnographic approach in order to understand how hunter-gatherer children from around the world learn subsistence skills. Our goal is to answer three main questions: first, how do hunter-gatherer children learn those subsistence skills necessary to survival? Second, how long does it take to learn those various skills? Finally, from whom do children learn subsistence skills? Our approach is novel; the meta-ethnographic method has never been applied to these questions, though it is an ideal method to distill patterns from broad data. By searching for learning behaviors in both quantitative and qualitative literature, a meta-ethnographic review process can help uncover trends which apply to foragers cross-culturally, as well as behaviors that stand out as culture-specific (Blurton Jones et al. 1994; Harkness and Super 1983). Findings could then, cautiously, be extended into humanity's foraging past. Before we describe our methods and results, we offer some background on human life history patterns, and outline features of social and individual learning in humans.

2. Background

Primates in general, and chimpanzees, bonobos and humans in particular, have adopted a long and slow life history strategy known as *K*-selection (MacArthur and Wilson 1967; Smith 1989). Like other *K*-selected species, we have relatively large bodies, and invest heavily in a small number of offspring that take a long time to mature. Though humans are similar in size to chimpanzees, some of our life history traits do not fit the expected pattern for our clade. We have longer pre-reproductive lifespans, higher fertility and shorter interbirth intervals than expected for our body size, even when considering the variability in human birth spacing and fertility (Chisholm 1993; Lancaster et al. 2000; Leigh 2001; Robson and Kaplan 2003). Most primates have a

period of infancy, from birth throughout the process of weaning. This is directly followed by juvenility, where individuals are independent from direct provisioning from parents but are not sexually mature. However, Bogin (2006) suggests that humans have inserted another life history stage between these: early childhood, defined as a period where, though weaned, children still rely on adults for direct care (Bogin 1997).

Why do humans have this extended childhood? Kaplan and Robson (2002) argue that it is an adaptation for learning complex extractive subsistence skills, especially hunting. Kaplan et al. (2003) point to the fact that, during early childhood, children's bodies grow relatively little, whereas their brains reach 95% of adult size by the time they transition into juvenility around age six (Bogin 1997; Bogin 2006; Konner 2010). Since humans make use of resources that require complex skill and knowledge to extract, investment in a large brain in early childhood sets the groundwork for complex learning later in life, and thus increases future performance (Kaplan and Robson 2002; Kaplan et al. 2003). This investment in embodied capital, according to Kaplan et al. (2000), is a driving factor in the evolution of human ontogeny.

So by what mechanisms do children learn? Teaching springs first to a western mind. Sociocultural anthropologist Lancy (2010 nf.1) defines teaching as "the active and systematic intervention of a teacher whose goal is to change the behaviour of a learner." This definition closely resembles classroom teaching in a western setting, and Lancy ultimately concludes that this kind of teaching does not exist in small-scale societies. Using this definition, MacDonald's (2007) review on learning to hunt also argued that teaching rarely occurs. And yet Kline (2015) demonstrates that teaching has been variously defined depending on the research field in question. A more functional definition derived from ethological studies defines teaching as the process an individual uses to modify their behaviour for the benefit of facilitating another's learning (Kline 2015). Therefore, importantly, teaching comes at a cost to the teacher (Caro and Hauser 1992). Under this definition, certain behaviours such as chore assignment, commands, and positive and negative feedback would be considered teaching, while these would not be considered teaching in Lancy's definition.

Children also learn most prominently through play, participation, observation and imitation. Play, specifically, is an important tool through which children learn community-wide social norms and practice their "chore curriculum" (Lancy, 2015; Lancy 1996; Elias and Berk 2002; Göncü et al. 2006; Chick 2009) and also serves as a key venue for developing skills like harvesting and hunting (Bock 2002; Bock and Johnson 2004; Bock 2005). Also, participating in adult activities alongside either adults or other children, like gathering water or firewood, allows a child to develop the necessary competencies to complete these tasks independently (Gaskins 2000; Rogoff et al. 2003; Lancy 2012). Finally, in small-scale societies where adult activities are not segregated from those of children, children have ample opportunities to observe adults and to imitate their behaviours (Odden and Rochat 2004; Gaskins and Paradise 2009).

Not only are children active imitators, they are also overimitators, defined here as the imitation of a model's relevant and irrelevant actions (Lyons et al. 2007). It is argued that over-imitation allows children to learn technologies and cultural practices whose meaning is opaque, allowing for fidelity of transmission across generations (Over and Carpenter 2012). Some also consider imitation and innovation the dual engines of

cultural learning (Legare & Nielsen, 2015). This observation and imitation-based learning allows children to pick up skills with minimal direct interventions by adults.

Though the learning processes described here are social, children also learn individually, through trial-and-error. Individual learning is especially adaptive when an environment is in flux, and when new, novel innovations must be generated to better adapt to ecological changes (Enquist et al. 2007; Boyd et al. 2011; Aoki et al. 2012). However, individual learning is costly, in that many attempts must be made before a useful innovation is developed (Boyd et al. 2011; Kline et al. 2013). Predictive models suggest that, in order to learn adaptively, social learning should occur early in life, and trial-and-error learning should occur later, once baseline competencies have been reached (Aoki et al. 2012). These innovative behaviours are then diffused throughout the social group.

Finally, children learn their subsistence skills from a wide variety of individuals, including parents, other adults, and, importantly, other children. Vertical or parent to child transmission (Cavalli-Sforza et al. 1982; Hewlett et al. 2011) seems to be less conducive to innovation, meaning it is more common in stable environments where information need not change rapidly. Various studies have also noted that most vertical transmission is sex-segregated, meaning that mothers teach their daughters, and men teach their sons (Chen et al. 1982; Hewlett and Cavalli-Sforza 1986). Oblique transmission takes place when non-parental adults from the parent generation teach children. Oblique transmission is common for learning ceremonial practices, for example, where many members of a cultural group share the same information. Horizontal transmission occurs within members of the same generation, in this case children to children, and allows for the rapid diffusion of information. Thus, some theorists have suggested that horizontal transmission would be favoured in a rapidly changing environment (Cavalli-Sforza et al. 1982). More specifically, child oblique transmission is when older children teach younger ones.

Of those studies focused on the association between the human life history strategy and learning, few have employed a cross-cultural approach, which would allow us to draw broader trends throughout the literature available. For example, Bliege Bird and Bird (2002), studying Meriam foraging, found that children made optimal foraging decisions based on their size, and thus, size and not learning could explain their differing foraging returns. On the other hand, Walker et al. (2002) found that it takes Ache men over more than 35 years to become proficient hunters, despite the fact that peak strength and size is reached in their 20s. Is methodology, environment, or culture the cause for these differences? Without a cross-cultural, comparative approach, it is difficult to say. Furthermore, hunting is not the only skill which is complex; tool making, for example, can also take a lifetime to master (e.g. Jordan 2014). And yet, no studies approach this skill using a life history framework. Thus, a broader approach to studying skill acquisition in general, as oppose to particular skills, is warranted. The present study aims to address both these gaps.

3. Methods

Meta-ethnographies are primarily used to synthesize qualitative data for medical research, but have important applications across various fields (Britten et al. 2002; Campbell et al. 2003; MacEachen et al. 2006). Like a systematic literature review, meta-

ethnographies allow researchers to extract common themes and findings from studies from a variety of fields. However, unlike a systematic literature review, a meta-ethnography allows for the inclusion of both qualitative and quantitative studies, allowing us to include a broader, more interdisciplinary, range of publications.

3.1. Search strategy

The electronic databases used for this search included PsycInfo, JStor, Springer, Wiley, and ScienceDirect. We identified books and book chapters using the above search engines as well as Google Books and the Cambridge University library search system, which has referenced every book published in the U.K. We found unpublished theses and dissertations using ProQuest. Our search terms paired the words "forager" OR "hunter-gatherer" with "child" and with "learn", OR "transmission" OR "socialization" OR "skill acquisition."

In an effort to identify and include older anthropological publications on learning, we also surveyed the electronic Human Relation Area Files (eHRAF) *World Cultures* (ehrafworldcultures.yale.edu) online as of January 2016. We limited our search to those societies HRAF staff codes as hunter-gatherers and primarily hunter-gatherers. Then we searched for ethnographic passages coded by eHRAF staff as "socialization" (OCM code 860), "infancy" and "childhood" (OCM code 850), "learning behaviour" (modification of behaviour-OCM code 153) and "learning process" (ethnopsychology-OCM code 828) from the *Outline of Cultural Materials* (Murdock et al. 2008). eHRAF provided us with a list of papers which mentioned learning. We investigated each to determine if they contained at least a section on hunter-gatherer learning in childhood.

We designed the final steps of our search in in hopes of finding studies that we may otherwise have missed. First, we searched the references of relevant articles and book chapters. Second, we searched the references of qualitative literature reviews on learning in hunter-gatherer children. Third, we searched the publication lists of first authors of relevant publications. Fourth, we contacted the first authors of relevant publications. We provided them with our publication list, to ensure that we were not missing key texts, doctoral dissertations, or unpublished manuscripts. We also contacted all authors who contributed to the Cambridge Encyclopedia of Hunters and Gatherers (Lee and Daly 1999) for any published or unpublished manuscripts on learning in their study communities. Finally, we sorted the studies into two overall groups: studies on learning social skills and gendered behaviours (Lew-Levy et al. forthcoming), and studies on learning subsistence skills. This paper focuses on the latter topic.

3.2. Eligibility criteria and study selection

Our inclusion of studies rested on three criteria. First, that the societies in question be hunter-gatherers. Second, that the studies had at least a section whose primary focus is learning. Third, that the studies considered the learning of children.

Academic definitions of hunter-gatherers have swung broadly over the years, with some focusing on a social definition of small-scale, egalitarian societies, others on a pure economy of foraging, and others still on the importance of mobility. For each of the various definitions of hunter-gatherers, the diversity of foragers across the world means there is always a group that will not fit (Kelly 1995). We chose to focus on socially-defined small-scale, relatively egalitarian and traditionally foraging societies. There are

no foragers today who do not accept economic input from domesticated plants and animals. Thus, we did not hesitate to include groups like the Penan, who sometimes participate in rice swidden agriculture, or the Aka, who trade with farming neighbors. Because of our focus on a social definition of small-scale foragers, we also excluded some groups who, economically, are purely foragers, but whose societies are highly stratified. For example, we excluded North America's Pacific Northwestern Kwakiutl, Nootka or Makah, who subsisted entirely on wild foods, including plentiful salmon runs, but also held slaves. In considering the inclusion of studies on native North Americans and Australians more broadly, we exercised our judgment. Many of these cultures are, of course, foundationally foraging ones, though they have been forcibly removed from that lifeway. For this reason we included studies of Indigenous socialization or mid-century ethnographies of Native Americans that discuss children's learning. We specifically excluded any studies about mission schools, however. Many foraging groups are not represented in this study, and that may well be because there are not relevant studies about that group, not because we do not consider them foragers.

In this review, we only included studies that devote at least an entire section to learning subsistence skills, or the processes associated with subsistence skills. In older publications retrieved from eHRAF, mostly early- to mid- 20th century ethnographies, sections entitled 'childhood' sometimes included detailed descriptions of socialization practices. We included these as well. Finally, we included studies that the author(s) in question define(s) as focused on childhood. We also expected those studies we selected for inclusion to have at least some original data. These include studies that use various qualitative ethnographic methods (interviews, participant observation, etc.), experimental designs, quantitative behavioural observations, and quantitative interview techniques. We excluded studies that rely entirely on secondary data we could access elsewhere. However, we used the references from these studies to find their primary sources wherever possible. We excluded conference proceedings, as well publications in a language other than English.

3.3. Data extraction and synthesis

We extracted three types of data for each study included in this survey. (1) Descriptive data: the hunter-gatherer group(s) surveyed, the age group(s) surveyed, and the year in which the paper was published. (2) Methodological data: the objective of the study, and the study design (interview, participant observation, behavioural observation, etc.). (3) The findings of the study in relation to the three questions of interest: i.e. how do hunter-gatherer children learn subsistence skills? How long does it take to learn these various skills? From whom do children learn these skills? As in all meta-ethnographies, in order to synthesize our findings, we organized the results according to themes, which appear common in the literature.

4. Results

4.1. Descriptive statistics

The initial search using keywords, and after eliminating duplicates, yielded a total number of 1202 potential studies (Figure 1). We discarded 966 of these after screening the titles, publication type and abstracts, and selected 236 studies for full text reading.

From those studies meeting our criteria, we searched their references for relevant publications, and contacted 60 first authors (we could not locate 4 email addresses) half of whom responded. We also contacted 37 contributors from the Cambridge Encyclopedia of Hunters and Gatherers (we could not locate 14 email addresses), of whom nine responded. We also examined the references from six reviews on the topic (Bugarin 2008; Eickelkamp 2010; Herzog 1974; B.S. Hewlett 2014; Keith 2005; MacDonald 2007). This yielded another 340 publications for full text reading. 55 publications provided information addressing our three questions on learning subsistence skills. These were included in the present study.

Of the 55 five publications that we selected for the study, seven papers (13%) use experimental data to answer their questions, five papers (9%) use narrative accounts of learning, 27 papers (49%) use quantitative data and 33 papers (60%) use qualitative data[1]. The earliest publication in our list was from 1939, with the great majority (36 vs. 19) being produced after the year 2000 and particularly in the last 5 years (23 papers) (Figure 2). Our list includes studies on 33 different cultures - plus two studies in non-specified Australian Aboriginals-- from every continent besides Europe (Table 1).

Our team identified five themes around which we have centered our results. These are learning methods, learning to harvest and hunt & trap small game, learning to hunt big game, learning to make material culture, and the impact of strength and skill on the age of skill acquisition. First, 14 studies (25%) were explicitly focused on the learning methods of teaching (7 studies) overimitation (4 studies) and innovation (3 studies). 35 studies (64%) focused on children learning to gather and hunt & trap small game. We noticed that same-sex vertical transmission (7 studies), observation (14 studies), play (13 studies) and participation (20 studies) were noted as especially common ways to learn these skills, and thus we outline each of these separately. 10 studies (18%) discussed learning to hunt big game. Finally, 5 studies (9%) focused on determining if strength, skill and experience were factors in the age of skill acquisition.

Table 1. Contributing authors and number of studies included in the review by culture and continent.

Country	**Culture (n of studies)**	**First Author**
	Africa	
Botswana/South Africa	San (9)[a]	Draper, Imamura, Shostak, Nielsen
Cameroon	Baka (3)	Gallois, Sonoda
CAR	Aka (8)	Neuwelt-Trunzer, B.S. Hewlett, Boyette, B.L. Hewlett, Berl
DRC	Efe (1)	Morelli
Ethiopia	Chabu (2)	B.L. Hewlett, Dira
Madagascar	Mikea (1)	Tucker
Republic of Congo	Mbendjele (1)	Lewis
Tanzania	Hadza (2)	Blurton Jones, Crittenden
	Asia	
India	Jenu Keruba (1)	Demps
India	Nayaka (1)	Naveh
India	Ongee (1)	Pandya
Malaysia	Batek (1)	Lye

[1] Some papers used more than one method. For this reason, the total will be greater than 100%.

Malaysia/Borneo	Penan Benalui (2)	Puri
Sibera	Khanty (1)	Jordan
Siberia	Yukaghir (1)	Willerslev
	Australia and Oceania	
Australia	Aboriginal (not specified) (2)[a]	Nielsen
Australia	Kaytetye (1)	Thompson
Australia	Mardudjara (1)	Tonkinson
Australia	Martu (1)	Bird
Australia	Meriam (2)	Bird, Bliege Bird
Australia	Pitjantjatjara (1)	Ilyatjari
Australia	Yolngu (1)	Harris
Papua New Guinea	Gidra (3)	Kawabe, Ohtsuka, Nishiaki
	North America	
Canada	Chippewayan (1)	VanStone
Canada	Cree (1)	Ohmagari
Canada	Montagnais (1)	Burgesse
Canada	Dene (1)	Gardner
U.S.A.	Comanche (1)	Wallace
U.S.A.	Gros Ventre (1)	Flannery
U.S.A.	Sioux (1)	Erikson
	South America	
Paraguay	Ache (1)	Walker
Peru	Matsigenka (1)	Johnson

a. One study by Nielsen was cross-cultural, and included both the San and Aboriginal Australians. It is counted twice in this table.

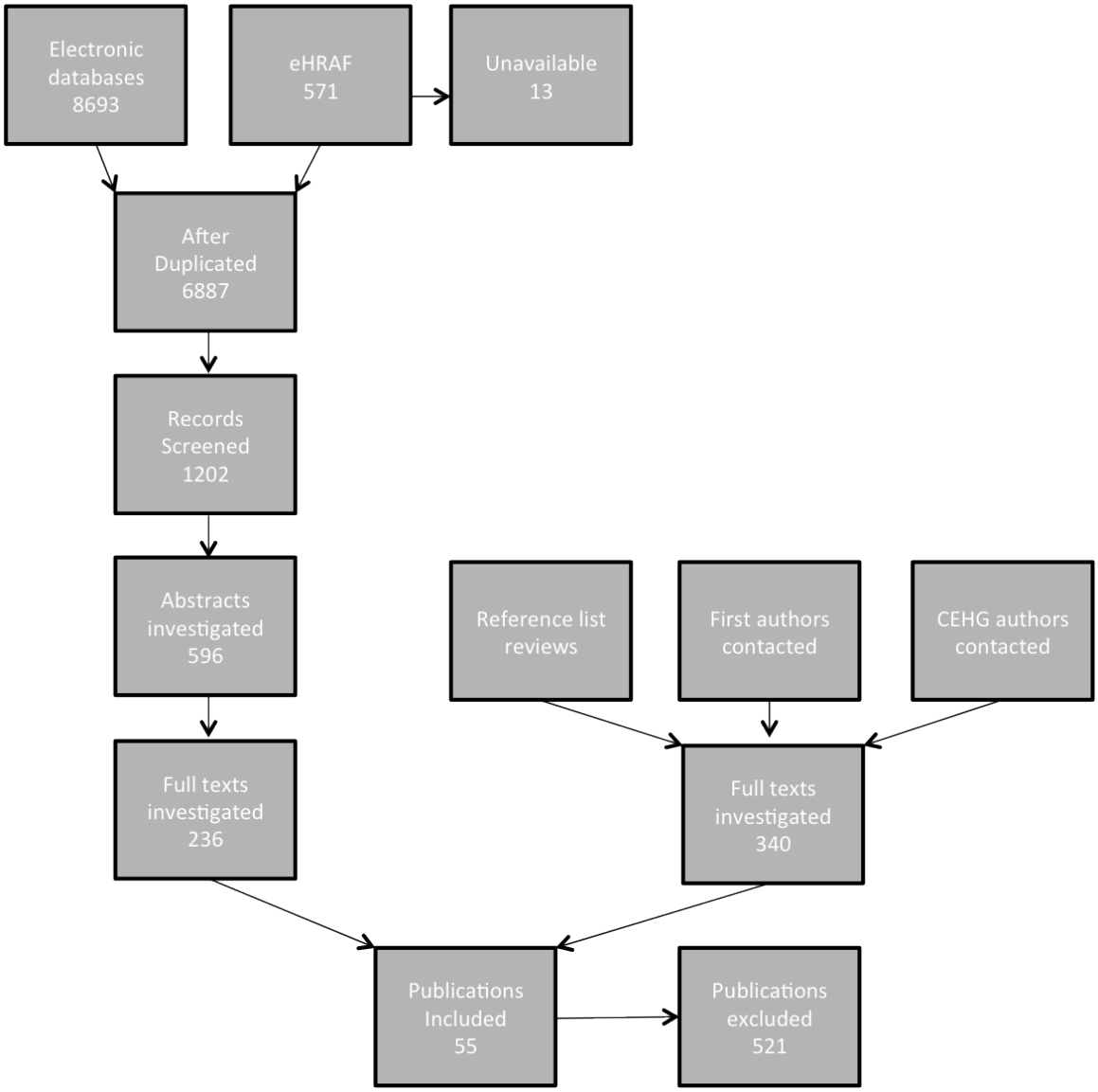

Fig 1 Flow chart of the publication retrieval procedure.

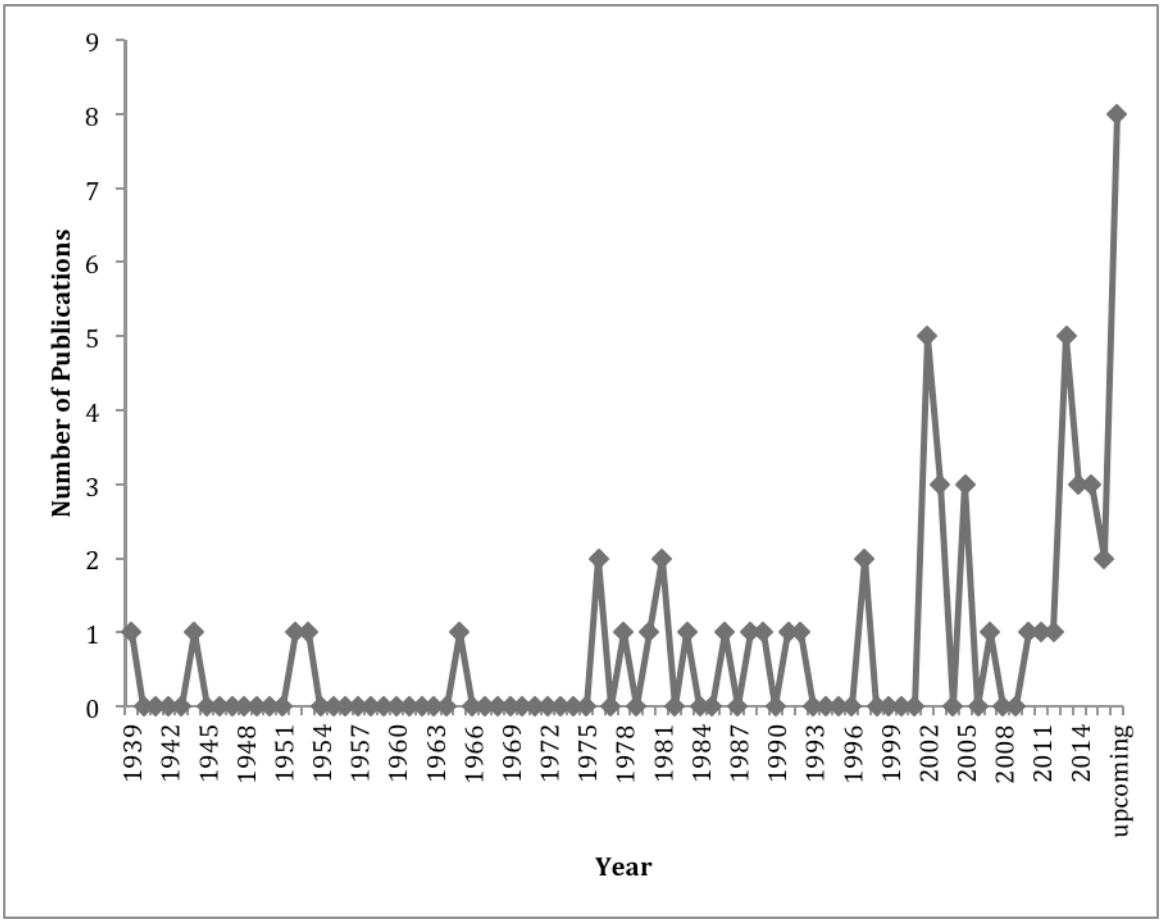

Fig 2 Number of publications per year, based on those publications included in the present review.

4.2. Learning processes

Though the process of learning is, of course, widely discussed in the papers we included, some works are more specifically focused on learning processes like teaching, imitation, and innovation. We address those specialized papers here.

Teaching. When teaching is defined not necessarily as western-style direct instruction, but as demonstration, positive and negative feedback, and commands, many authors have found that teaching does play a role in forager children's learning. In fact, a series of three studies based on systematic behavioural observations of the Aka found, unsurprisingly, that the Aka style of teaching is qualitatively different from teaching in WEIRD —Western, Educated, Industrial, Rich and Developed (Henrich et al. 2010)— societies (B.S. Hewlett et al. 2011; Boyette 2013; B.S. Hewlett and Roulette 2016, see also B.S. Hewlett et al. in press). In addition, these authors found that, amongst the Aka, teachers are more likely to be biologically related to the learner in question, and are most often their parents. Specifically, Boyette's (2013) cross-cultural study of teaching among

Aka foragers and Ngandu farmers found that direct instruction does occur among both groups, but it is significantly more common among the Ngandu. Boyette also found that commands are the most frequent form of teaching for both groups, though the Ngandu tend to be commanded specifically to perform work tasks, while Aka children are commanded to perform behaviours across various skill domains. Negative feedback is the next most common form of teaching for the Aka, and is usually in response to breaches of social norms, especially sharing (Boyette 2013).

On the other hand, a broad theme across many ethnographic papers is the importance placed on children's autonomy in their own learning process, meaning that adults prefer to allow children to observe and experiment with minimal interference. Among people as broadly-ranging as the San (Draper and Cashdan 1988) Nayaka (Naveh 2014), Batek (Lye 1997), Matsigenka (Johnson 2003) and the Yukaghir (Willerslev 2007), adults actively refrain from instructing, directing, explaining or correcting, valuing first-hand knowledge gained by the child through personal experience over any kind of second-hand knowledge. Learning is therefore characterized by processes of trial and error, and is embedded in the context of living in close quarters, and having the opportunity to observe others through everyday tasks and conduct (Naveh 2014). Among the Dene, children are actively provided with opportunities to watch an especially careful but silent version of a task (Gardner, forthcoming). And while the Dene consider paying attention critical to learning, at no point do they insist that the learner pay attention. Similarly, Draper (1976) described a scene where an adult is stretching a hide. Next to him, a child watches his actions intently, but the man does not change his behaviour to accommodate this watching child. Children in these contexts initiate their own learning, experiment with objects, bodies and feelings, and adjust their behaviour according to the results of their actions. Gardner (forthcoming) and Naveh (2014) both argued that such learning leads to diverse understandings, with no attempt to form a systematic and unified standard form of either social or practical knowledge. Similarly, Lye (1997) highlighted that among the Batek, though instruction does occur, personal experience of moving in the forest, monitoring one's own skills, and training one's body is considered the best way of acquiring knowledge.

Overimitation. Though imitation is a common form of children's learning across the world, overimitation has recently become a topic of interest as researchers attempt to understand how culture influences the frequency of overmitation. Using experimental designs, many studies have found overimitation to be common in WEIRD children, but amongst hunter-gatherer children the results are more mixed. Four studies exist that are specifically on foragers, and all use puzzle boxes in their experimental design (see also B.S. Hewlett et al. in press). Nielsen and colleagues (Nielsen et al. in press; Nielsen and Tomaselli 2010; Nielsen et al. 2014a) have conducted four studies on overimitation comparing Brisbane preschoolers, San hunter-gatherers from Botswana and South Africa, and/or Australian Aboriginal children all ranging in age from two to six. They found that, across the board, hunter-gatherer children overimitated at the same frequency as Brisbane children. In contrast with these findings, Berl and B.S. Hewlett (2015) found that though all participants were more likely to perform the irrelevant actions than not, Aka children ranging in age from four to seven engaged in overimitation far less than Ngandu farmer children of the same age, and less than Aka adults.

Innovation. Three studies specifically on children's forager's ability to innovate suggest that innovative these behaviours do not fully emerge until adulthood, but and that these innovations are then transmitted primarily to adolescents. Nielsen et al. (2014b) used an experimental design to determine if South African San and Brisbane preschoolers children between the ages of three and five could innovate new tools to fetch a toy from a bucket. The children had access to a multitude of tools, including a pipe cleaner, which could be bent to retrieve the toy. The results indicate that few children chose the pipe cleaner as their first tool. Half of the children were unable to innovate a tool to retrieve the toy. However, once these children were shown how to produce the tool, e.g. shape the pipe cleaner into a hook, nearly all were capable of retrieving producing and using them. Thus, Nielsen argued that innovative behaviours are not yet fully developed in early childhood, irrespective of culture. B.L. Hewlett has also conducted a study of innovation among Chabu (in press) and Aka (2013) adolescents, and found that, in both groups, adults were the key innovators. Adolescents sought prestigious innovators who could teach well, irrespective of how far away they lived. Furthermore, adolescents affirmed that they sought innovations to find a mate, and also to provide for their families. According to B.L. Hewlett, adolescents are more likely to seek out innovative teachers than children or other adults, and these teachers are usually not their parents.

4.3. Learning to forage, and hunt & trap small game

For hunter-gatherers, learning subsistence skills begins early in life. In infancy, children accompany parents, especially mothers, on foraging expeditions, where they have ample opportunity to watch subsistence activities (Lye 1997; B.S. Hewlett et al. 2011). Children in infancy and early childhood also play with their parents' tools, including potentially dangerous ones like machetes (Lye 1997; Lewis 2002; B.S. Hewlett et al. 2011). Authors describe parents making toy versions of tools like fishing lines, baskets, digging sticks, spears, and bows and arrows for children across cultures including the Gidra (Nishiaki 2013) Batek (Lye 1997), the Kaytetye (Thompson 2003), the Chabu (Dira and B.S. Hewlett), the Aka (Neuwelt-Truntzer 1981; B.S. Hewlett et al. 2011), the Comanche (Wallace and Hoebel 1952) Hadza (Crittenden in press) and the San (Imamura in press). Among the Batek, by two years of age, children are already learning ecological taxonomies (Lye 1997). By the age of six, Meriam, San, Batek, Chabu, and Pitjantjatjara children have an understanding of environmental hazards (Dira and B.S. Hewlett in press; Ilyatjari 1991; Lye 1997; Bliege Bird and Bird 2002; Imamura and Akiyama 2016). These are learned from parents (Bird and Bliege Bird 2002) and through stories (Dira and B.S. Hewlett in press). By adolescence, at the latest, various authors note that children are already competent food collectors, though they may refine more complex skills, such as hunting, throughout their adult life (Crittenden in press; Dira and B.S. Hewlett in press; B.S. Hewlett and Cavalli-Sforza 1986; Lye 1997; Gallois et al. 2015). The major ways in which children learn these skills includes same-sex vertical transmission, observation, play, and participation. We address the results for each of these learning mechanisms in turn.

Same-sex vertical transmission. B.S. Hewlett and Cavalli-Sforza (1986), Thompson (2003), Ilyatjari (1991), Flannery (1953) and Burgesse (1944) argue that children learn many foraging skills through vertical transmission from same-sex parents. For example, among the Gros Ventre, formal training for skills necessary to women's work, such as collecting berries and digging roots comes from female relatives, while among the Sioux, mothers are the primary transmitters of food preparation knowledge, shelter building, and hide work to their daughters (Erikson 1939; Flannery 1953). Among the Aka, parents are the primary transmitters of food acquisition skills, with fathers generally transmitting skills to their sons, and mothers to their daughters (B.S. Hewlett and Cavalli-Sforza 1986; B.L. Hewlett 2012). For example, Aka men know more than women about hunting, and therefore fathers contribute more to the acquisition of these skills. Demps et al. (2012) argues that Jenu Keruba fathers are also particularly important in transmitting knowledge about honey collecting—an activity typically performed by men, to sons between the ages of six and nine.

Observation. Observation appears to be central to how forager children establish competency in so many foraging tasks so young (Burgesse 1944; Flannery 1953; Vanstone 1965; Draper 1976; Tonkinson 1978; Harris 1980; Ohmagari and Berkes 1997; Boyette 2013; Imamura and Akiyama 2016). For example, Morelli et al. (2003) noted that Efe children between the ages of two and three spend a quarter of the authors' scan observations observing work. Indeed, Neuwelt-Trunzer (1981) argued more generally that Aka children spend much of their time simply watching all adult activities. Children are, after all, almost constantly in view of adults, particularly when they are very young (Draper 1976; B.S. Hewlett et al. 2011; Lye 1997). Naveh (2014) noted that, among the Nayaka, children watch adults set traps and then simply practice trap setting themselves. Jenu Kuruba adolescent boys learn to make smoky torches and cut honeycombs by observing older kin as they collect honey from locations too dangerous or difficult for the children to actually participate in the process (Demps et al. 2012).

Play. The authors we include emphasize play as a crucial way children learn foraging skills. According to Morelli et al. (2003), Efe children spend significantly more time emulating adult activities in play than American children. Both Boyette (2013) and Gallois et al. (2015) found that, as children got older, they played less and worked more, suggesting that play helped them learn subsistence behaviours. Parental beliefs may contribute to the importance of play; Neuwelt-Truntzer (1981) argues that Aka parents believe that if children do not play, they will fail to learn. Among a vast cross-cultural sample including the Mbendjele, Hadza, San, Katetye, Aka, Mardudjara, Pitjantjatjara, Chippewayans, and the Gros Ventre, children build small huts and hearths (Crittenden in press; Flannery 1953; Vanstone 1965; Shostak 1976; Tonkinson 1978; Neuwelt-Truntzer 1981; Ilyatjari 1991; Lewis 2002; Thompson 2003). Near these huts, children pretend to dig yams, to hunt, and pretend to be animals. Through these kinds of games, children also learn human-animal relationships. Naveh (2014) suggests that children who play hunted animals in such games vocalize the animal's feelings, fears and emotions. Through this activity, children learn to sympathize with animals and to see animals as sentient persons sharing the forest world with them.

Participation. Children do not just observe their parents' subsistence activities, however – they also participate. In fact, among the Aka, Neuwelt-Truntzer (1981) noted that children may be included in any adult activity. B.L. Hewlett also noted that Aka girls learned to forage by walking in the forest with their parents. Sonoda (in press a; in press b) described adults acknowledging Baka children when they enter situations where hunting and gathering is taking place, and giving the children access to resources. Both adolescents and adults help children learn through participation by providing them with verbal instruction and other subtle forms of teaching. According to Dira and B.S. Hewlett (in press), Chabu adults also allow children and adolescents to participate in the killing of animals. VanStone (1965) mentioned that Chippewayan children learn adult skills and attitudes by participating directly in the household economy. From early childhood onward, Baka children are also expected to participate in household chores, such as fetching water and firewood (Gallois et al. 2015). Among the Cree, women report hands-on experience as the primary way they learn a variety of skills as children and adolescents, including fur preparation, food preparation, bush camp-related skills, hunting, fishing and trapping (Ohmagari and Berkes 1997). That being said, Draper and Cashdan (1988) found that the little work that San parents engage in is more efficiently done by adults, and the nature of this work makes it difficult for children to participate in.

At times, however, children participate in adult activities without adults present, shifting the locus of learning to child-to-child knowledge transmission. Neuwelt-Truntzer (1981) noted that in middle childhood, children participate in work groups where they display self-reliant behaviours such as food harvesting. Indeed, Crittenden (in press) highlighted the importance of 'learning by doing' that occurs within children's playgroups. Crittenden (in press), Lewis (2002) and Gallois et al. (2015) described children collecting wild foods and roasting them on their own hearths. In fact, Crittenden (in press) argued that children are the only Hadza who harvest weaverbirds, a skill primarily transmitted within the playgroup. Among the Meriam and Martu, details and strategies for foraging are learned through other children, and children make decisions to optimize their foraging returns based on their size and strength (Bliege Bird and Bird 2002; Bird and Bliege Bird 2002; Bird and Bliege Bird 2005). Similarly, Tucker and Young (2005) note that though Mikea children allocate as much time to foraging as do adolescents. Thus foraging emerges as an extension of play. For example, they describe children harvesting tubers (work), and then having a food fight (play) with those same tubers. Gallois et al. (2015) also highlight that though children are not expected to participate in economic activities, they do so out of enjoyment. Jenu Kuruba children learn to climb trees to collect honey through games played with their peer groups (Demps et al. 2012). Through these playgroups, older children also transmit early hunting skills (Crittenden in press; Imamura in press; Thompson 2003; B.S. Hewlett et al. 2011; Imamura and Akiyama 2016). It is through older children than San children learn how to bait traps, for example (Imamura in press; Imamura and Akiyama 2016). Through peer group participation, Baka children learn to identify edible wild plants, navigate the landscape, and use increasingly complex tools (Gallois et al. 2015).

4.4. Learning big-game hunting

Hunting is one of the most difficult skills that children, primarily boys, learn. Though small game hunting is early in life, big game hunting may require a lifetime to

master. At first, much of this learning process takes the form of translating observed adult activities into organized games played with peer groups. A hide-and-seek game played by the Ongee, for example, helps children develop the skillset to find animals hiding in the bush (Pandya 1992). Among the Chabu, children play collaborative role-playing games of hunter and hunted (Dira and B.S. Hewlett in press). Similarly, Nisa, a San woman, described playing at hunting during her childhood (Shostak 1976; Shostak 1981). Nisa and her friends followed tracks, and when they spotted prey, they shot make-believe arrows at them. Then, they took leaves and put them on a stick, pretended it was meat, and carried it back to the village. Among the Mbendjele, Pitjantjatjara and Kaytetye, spear-throwing games, and other projectile target practice, such as boomerang competitions, are important for developing accuracy (Ilyatjari 1991; Lewis 2002; Thompson 2003). Similarly, according to Wallace and Hoebel (1952), peer group learning is central to Comanche children's development of shooting accuracy.

Yet hunting seems also to be one of the most prominent exceptions to the general lack of direct instruction among hunter-gatherers. Likely this is due to the complexity of hunting. And, in several cases, this direct instruction begins in early childhood. Around the ages of six or seven, Chabu children listen to hunting stories by their fathers (Dira and B.S. Hewlett in press). These stories transmit important information regarding animal sign and behaviour, as well as dangers associated with hunting. Batek children learn to imitate animal sounds by age six, and regularly practice dart hunting by nine (Lye 1997). Before adolescence, Batek children are already proficient at hunting birds and squirrels.

During adolescence, children in many cultures receive prominent direct instruction in hunting skills. Among the Chabu, Dira and B.S. Hewlett (in press) recorded observation, demonstration, verbal instruction, pointing and teasing as important teaching processes when adolescents are learning to hunt with their mentors. For the Penan, for whom extensive speaking in the forest is taboo, teachers help children learn to hunt by pointing and describing actions, by providing children with opportunities to watch hunting, and by imitating bird and animal calls (Puri 2005). Among both the Chabu and the Batek, boys choose their hunting teachers (Dira and B.S. Hewlett in press; Lye 1997). They trail these hunters, and receive tutoring from them. Chabu adolescents choose teachers based on their hunting ability, skill as teachers, or knowledge of ecology. Chabu adolescents primarily learn to spear hunt from non-parental adults and peers, beginning between the ages of nine and twelve. For Penan boys (and sometimes girls), fathers, uncles and other elders are the primary teachers of hunting skills between the ages of four and fourteen, while between fourteen and twenty, boys learn hunting with peers (Puri 2005). Wallace and Hoebel (1952) argued that Comanche grandfathers specifically are heavily involved in teaching their grandsons to ride horses, shoot, and hunt.

4.5. Learning to make material culture

Studies on how children learn to produce material culture seem to demonstrate that such skills are transmitted mostly vertically, from parents to offspring, and also commonly from older children. Additionally, as one might expect, in many cases children begin to learn craft skills by making small-scaled versions of items including bows and arrows and sledges. In a study to determine how Baka children spend the majority of their time, Gallois et al. (2015) determined that they participate in subsistence and leisure activities more frequently than handicrafts. This trend seems to generally hold true

amongst the papers included here; that is to say, hunter-gatherer groups do not seem to strongly emphasize structured instruction on the creation of material culture amongst their younger children, especially.

Between the ages of four and five, Batek (Lye 1997), San (Imamura in press; Imamura and Akiyama 2016), and Kaytetye (Thompson 2003), children begin making their own tools. In these cases, parents gift children with bows and arrows while they are still too young to use the tools, let alone to produce them. Among the Batek (Lye 1997), parents correct children's mistakes on tool construction, while among the San (Imamura in press; Imamura and Akiyama 2016) and Kaytetye (Thompson 2003), younger children imitate older children in order to learn to construct these tools, and are also corrected by other children. By four and five, San and Batek children have constructed the bows and arrows they will use to hunt birds and lizards until adolescence (Imamura in press; Lye 1997). Nishiaki (2013) argued that Gidra parents intend their gifts to be a form of education. Rather than directly teaching children how to produce bows and arrows, parents gift them with well-made scale models from which they are expected to reverse engineer their own tools. This may also be true among the Aka, where fragments of nets are made available to children to examine (Neuwelt-Truntzer 1981). Gidra children do not skillfully produce bows and arrows until approximately 14 years old. On the other hand, Imamura and Akiyama (2016) argued that, after mothers first gift their sons with bows and arrows between two and three years old, they then refine their skills in bowmaking and in the hunting of small game largely with the help of older boys. Imamura (in press) emphasized the role of older San boys, as well, stating that older children will take over and complete toys for younger children when they are struggling with the skill.

Direct instruction from adult to child in the production of material culture seems to be clustered later in childhood and in early adolescence, when children begin producing more complex material culture. Other handicraft skills, including basketry (Puri 2013), hidework (Erikson 1939; Ohmagari and Berkes 1997), and the production of skis, sledges and canoes (Jordan 2014), seem to be taught using vertical and oblique transmission in late childhood to early adolescence. Amongst the Penan, Puri (2013) found that women report beginning to learn basket making at 14 on average, while males begin somewhat later at 17. However, he acknowledged that amongst some families, where basket making is especially important, children begin to learn as early as eight. Because men and women make and use different baskets, boys tend to learn from men and girls from women, usually family members but not necessarily parents. Cree women report learning hide working skills between the ages of 11-16, mostly from hands-on experience and family instruction (Ohmagari and Berkes 1997). Sioux hide work is learned early on, primarily from mothers (Erikson 1939). Jordan (2014) argued the Khanty transmit skills such as ski, sledge, and canoe production vertically, and that children learn from observation, imitation, and direct instruction. When learning to construct sledges, children in late childhood create exact models of adult sledges.

4.6. Strength, size, skill and experience in foraging proficiency

Though this review is primarily concerned with learning in childhood, we include studies concerning how body size and strength, skill and experience can impact foraging proficiency. Children's learning processes are, after all, framed by their size and their

relative lack of experience. Overall, these studies find that the more complex the activity, like hunting in particular, the more important experience may be. Walker et al. (2002), working with the Ache, conducted an experimental and quantitative observational study on individuals ranging from twelve years of age to over forty. The authors found that prey finding rates peak in the late thirties, as do hunting abilities. However, monkey hunting ability, one of the most difficult prey in the Ache ecosystem, peaks in the forties. Walker et al. (2002) also found that previous lack of experience adversely affects hunting ability. Similarly, Ohtsuka (1989), working with the Gidra, found that, independent of strength and size, individuals between the ages of 35 and 45 have four times the hunting success of teenagers and young adults. These two studies suggest that strength is unimportant in comparison to skill in hunting proficiency. Kawabe (1983) found that Gidra boys hunt a larger variety of animals as they grow older. These expand from small animals, which are easy to hunt, to larger animals, which can be hunted with developed skills. Though older boys vary in success rates, Kawabe suggested that this is related to differences in environmental knowledge, not arrow shooting proficiency. Finally, B.S. Hewlett and Cavalli-Sforza (1986) found that though both Aka girls and boys between the ages of seven and twelve have developed a majority of their foraging skills, boys will continue to increase their skills in net hunting and other hunting techniques through adolescence and adulthood.

On the other hand, individual components of hunting activity like shooting accuracy seem to require less experience to achieve commensurate skill. And some simpler foraging activities, like tuber digging or tree climbing, require a baseline of strength after which increased experience does not significantly improve returns. In an experimental study with the Hadza, Blurton Jones and Marlowe (2002) considered the importance of practice in proficiency at tree-climbing, target shooting with bows and arrows, and tuber digging through an 'Olympic' style competition including children, adolescents, and adults of both sexes. The authors found that women and men were equally proficient at digging tubers, despite the fact that women had significantly more experience doing so. Similarly, the authors found that adolescents who attend boarding school were just as proficient at climbing trees and just as accurate in shooting as their non-schooled peers, despite having practiced these skills less. Kawabe (1983) also found no remarkable difference between schooled and non-schooled Gidra boys in some foraging tasks, possibly because schooled boys take advantage of hunting opportunities when they return to the village during long vacation.

5. Discussion

These results indicate a meta-ethnographic approach has utility for answering the kind of broad ethnographic and evolutionary questions we have posed here, namely, how do children learn subsistence skills, who do they learn them from, and how long does it take to reach proficiency? Our results indicate that, in recent years, a growing number of researchers are interested in the question of how children learn subsistence skills. However, this interest is unevenly distributed, with the San and the Aka receiving the most consistent attention on learning in childhood. This is likely due to the interests of researchers like Patricia Draper and Barry and Bonnie Hewlett, who have contributed immensely to the field of learning in hunter-gatherer childhoods. However, this

represents an African bias in the literature. More studies are needed on learning in childhood among foragers on other continents.

Nonetheless, taken cumulatively, the studies we include demonstrate that social learning occurs before individual learning amongst hunter-gatherers, which aligns with what several authors have predicted to be the most adaptive progression of learning. These studies emphasize the importance observation, participation, and same-sex parental transmission in learning subsistence skills. Especially, the playgroup and of playful learning among hunter-gatherer children allows children to take increasing responsibility for provisioning themselves (though they do not always do so) without seeing those subsistence activities as a burden. Our results clearly show that teaching exists amongst hunter-gatherers in forms like feedback and demonstration. Direct instruction appears to be largely reserved for adolescents, and for complex skills like hunting and multi-component toolmaking. We have found that adolescents are not innovators, but they are the primary acquirers of innovative behaviours. And, finally, our results suggest that while innovation does not explain our extended childhoods, children do spend their entire childhoods learning the complexities of hunting in particular. They do not, however, require an entire extended human adolescence to become proficient foragers of many plants and small game. In order to unpack our results more fully, we address the following points in our discussion; (1) does teaching, overimitation and innovation occur during hunter-gatherer childhood? (2) how and from whom children learn? and (3) does it take 20 years to learn to hunt and gather?

5.1. Teaching, overimitation and innovation

In the debate about teaching amongst hunter-gatherers, our results demonstrate a stark divide between ethnographic studies, which generally argue against the presence of teaching, and quantitative approaches that find it does occur. We would argue this debate is largely the result of a lack of consensus about the definition of teaching itself. We support Kline's (2015) integrative definition of teaching, which includes the following behaviours: teaching by social tolerance, teaching by providing opportunities, teaching by stimulus or local enhancement, teaching by evaluative feedback, and direct, active teaching. Using this broad definition, we argue that each of these teaching styles exist to varying degrees in hunter-gatherer populations. Teaching through local enhancement occurs when children help butcher an animal (e.g. Dira and B.S. Hewlett in press). Teaching through evaluative feedback occurs when parents correct children's tool making (e.g. Jordan 2014). When children actively watch an adult tanning a hide, they are experiencing social tolerance (e.g. Draper 1976). Direct, active teaching also seems to occur, but is rare, and most commonly used in adolescence, to learn skills like hunting and complex tool making (e.g. Dira and B.S. Hewlett in press). However, even where direct, active teaching does occur among hunter-gatherers, it is qualitatively different than classroom teaching. It is specific to context – like being out on a hunt – and depends on the child's willing participation. Because the current teaching debate seems to hinge so heavily on semantics, we hope that researchers will adopt a more holistic definition like Kline's, which would foster interdisciplinary conversation on the topic.

The varying results we report here on overimitation amongst hunter-gatherers, with San and Aboriginal children found to overimitate much more prominently than Aka children, may be the result of compulsory western schooling. The San and Aboriginal

groups Nielsen et al. (2014a) studies have access to classroom-based schools (Berl and B.S. Hewlett 2015). The Aka do not. Children quickly learn to defer to teachers in a school setting, and thus are more likely to imitate adults' relevant and irrelevant actions. Indeed, some studies suggest that children generally are more likely to copy adults than they are to copy other children (Wood et al. 2012; Zmyj and Seehagen 2012). Among hunter-gatherers, though, autonomy and egalitarianism reduces the degree to which any individual defers to another based on age, gender or status (Woodburn 1982; Lewis 2014). Since schooling often acts as a tool to incorporate marginal groups into the dominant culture, it seems likely that not only cultural values, but learning processes also change (Berl and B.S. Hewlett 2015; Mesoudi et al. 2015). Further research into the presence of overimitation in foraging societies with differing access to schools could, therefore, provide important insight into how foraging children's learning processes change.

Evolutionary anthropologists have long been preoccupied with the reason for humans' extended juvenility, which some have linked to the potential for children to use their childhood as a period to develop innovative behaviours (Bateson 2014; Carruthers 2002). In fact, some argue that children's play specifically is crucial to the development of the kind of human innovation that allowed anatomically modern humans to inhabit every ecosystem on the globe (Carruthers 2002). Yet our results do not support extended juvenility as time used for innovation. They do, however, potentially support the hypothesis that the skills learned in childhood create a foundation for future innovation during adulthood. Children cross-culturally do not appear to truly innovate, in the sense that they do not generally create new technologies or significantly different foraging methods for themselves (B.L. Hewlett 2013). Instead, our results suggest that children act as problem-solvers - using combinations of all of their knowledge in flexible iterations so that they are prepared to truly innovate in adulthood (e.g. Naveh 2014). For example, children foraging amongst the Meriam make their own decisions about resource choice, decisions that are couched in their background knowledge of the dangers and opportunities of the reef as a whole (Bird and Bird 2002). Indeed, B.L. Hewlett (2013) found that Aka adolescents seek out very skilled innovators to learn from, but do not innovate themselves. Instead, children's propensity for engaging in group social learning earlier in life and in innovation later on allows them to quickly gain a wide base of knowledge, which they can update with their own innovations as adults (Aoki et al. 2012).

5.2. How and from whom do children learn?

Lehmann et al. (2013) argued that vertical transmission is the most adaptive during infancy and early childhood, and that horizontal transmission and innovative, individual learning will occur through the rest of childhood. As the results presented here suggest, in infancy we find that parents, not siblings, are primary caregivers (Draper and Cashdan 1988), and thus vertical transmission is common at this age. Specifically, many studies find same-sex vertical transmission to be especially important. Mothers teach their daughters gendered skills such as hide tanning, while fathers teach their sons to hunt. Parents have also been found to the primary transmitters of social skills, such as sharing (Boyette 2013). In early and middle childhood, both horizontal and child oblique transmission are important. Older children correct the tool manufacture of younger ones,

and show them how to bait traps (Imamura and Akiyama 2016). Play is also an important medium for horizontal transmission (Crittenden in press). In adolescence, both oblique and vertical transmission are important for teaching and demonstrating more complex tasks, such as complex tool manufacture and hunting (Dira and B.S. Hewlett in press). Somewhat contrary to Lehmann et al.'s (2013) expectations, we do not find truly innovative behaviours emerging until after adolescence.

Specifically, our results emphasize the importance of children's playgroups in learning subsistence skills, especially in middle childhood. Hunter-gatherer children are active learners, who participate in learning by choice, and for whom learning is an ongoing, playful activity, not separated from the rest of life. Our results show again and again the prominence of what Gaskins and Paradise (2009) call "open attention," a form of learning found in small-scale societies where children are in such constant contact with adults and older children as they work that learning occurs without the child or the 'teacher' specifically intending it. In these contexts, learning may be an "incidental byproduct of social life" (Gaskins and Paradise 2009, pp.85). This type of learning is exemplified by our findings that, cross-culturally, foraging children continue to participate in foraging activities even when away from adults. This is markedly different from studies of small-scale farmers that emphasize a compulsory chore curriculum (Gaskins and Paradise 2009; Lancy 2012). It would seem that, through play, forager children offset the cost of their burden of care, reducing the need for direct parental teaching.

This finding highlights Crittenden's (in press) and Tucker and Young's (2005) argument that play and work should not be distinguished, since they are not distinguished by forager children themselves. Indeed, it would seem that, at least in the hunter-gatherer context, *both* play and work are a form of participation, and children transition seamlessly between the two. This finding supports arguments about the primacy of play in learning made by Bock and colleagues (Bock 2002; Bock and Johnson 2004; Bock 2005), and the sociocultural approach to learning (John-Steiner & Mahn, 1996; Lancy, 2015).In his work with the Okavango Delta peoples, Bock (2005) found that children trade off play with work, depending on the needs of the household, and the complexity of the task at hand. For example, the play pounding of grain allowed girls to practice this task without wasting grain, while boys' participation in target games diminished as participation in actual hunting increased. These findings are supported by Boyette (2013) and Gallois et al., (2015), who also found that play and work traded off with age. Small game hunting and trapping, which we found to be primary learned in the playgroup, are excellent examples of these types of activities, wherein children can begin to assist in provisioning themselves while also learning important skills for later hunting of larger animals. Others, such as Göncü et al. (2006) suggest that play helps children situate themselves within a cultural world. Our findings that foraging children imitate the entire structure of adult subsistence activities through their play, building small huts and cooking their own foods on their own small hearths, supports Göncü's hypothesis.

5.3. Does it take twenty years to learn to hunt and gather?

Yet another hypothetical driver for humans' extended juvenility has been our need for an extended period of learning (Kaplan and Robson 2002). So does it take

twenty years for a child to learn to hunt and gather? Yes and no. In many ways, children are competent foragers by the end of late childhood, able to make simple tools, to gather plants and to hunt small animals, and even to make optimal foraging decisions about which resources they can most effectively exploit. However the most complex skills of a hunter-gatherer life, like big-game hunting, ecological knowledge or the production of multi-component tools, seem to be learned at the very latest stages of childhood and into adulthood. And these findings do not seem to be restricted to foraging populations; Among the Tsimane, a Bolivian farming culture who fish and hunt extensively, a relevant series of studies on hunting skills (Gurven et al. 2006; Schniter et al. 2015) argued that learning itself, not physical development or body size, seemed to determine hunting success. In fact, while Gurven et al. (2006) found that indirect encounters with game are most frequent in individuals' mid-twenties, overall kill rates across multiple categories of game did not peak until age thirty-nine. Thus, the integration of all of a child's individual skills into his or her maximum foraging potential may not occur until far past his or her transition into adulthood. This finding supports the theory that humans require a long juvenile period to learn to extract complex resources (Kaplan and Robson 2002).

6. Conclusion

In summary, through the years, more and more studies have focused on how foraging children learn subsistence skills. This meta-ethnography has allowed us to draw broad cross-cultural patterns from that positive trend in research. In infancy, children accompany parents on subsistence tasks, and are given small versions of tools such as digging sticks and bows and arrows. During the transition from infancy to early childhood, when children join playgroups, children learn a majority of their subsistence skills, such as harvesting, trapping, small game hunting, and some elements of honey harvesting knowledge, such as tree climbing. Children learn these skills through a variety of mechanisms, including participation in activities with adults and children, through play, and observation. It would seem that most children are proficient at these skills by the end of middle childhood. However, skills like hunting, making complex tools, learning innovative behaviours and cutting honeycomb, skills that are more difficult and potentially more hazardous, continue to be learned into adolescence. These skills are especially learned obliquely, from non-parental expert adults, though parents seem to be prominent in material culture learning. The more complex the skill, the more common teaching seems to be. Finally, our results suggest that learning to hunt continues into adulthood.

A large-scale meta-ethnography like this will necessarily have limitations brought on by the sheer breadth of our sources, both in age and in methods. We did not include studies with general, passing mentions of learning, meaning that there are fragmentary observations in the literature that are missing from this work. Many of the studies we did include only address positive observations without referencing the absence of specific behaviours, potentially introducing further bias. And, the relatively qualitative nature of our results and discussion means that we translated some quantitative results into qualitative findings, potentially misrepresenting their magnitude. However, because we are attempting to address extremely broad trends in hunter-gatherer behaviour, it is our hope that these limitations are counteracted by the sheer quantity of data we included.

Nonetheless, this meta-ethnography has allowed us to draw broad cross-cultural patterns from that positive trend in research. As we consider all of the papers included in this study, several general gaps in research become apparent. First, perhaps unsurprisingly, many papers focus on hunting activities, while plant harvesting activities given much less attention. Specifically, studies on high-complexity foraging activities such as medicinal plant use are lacking, and studies of the methods and timing of broad traditional ecological knowledge transmission are also scarce. This means, generally, that women's subsistence skills and material culture are underrepresented. Similarly, only two studies on learning to harvest honey were extracted. It has recently been hypothesized that eating honey may have had important implications for the evolution of modern humans (Crittenden 2011). Future studies should explore how this important foraging activity is transmitted. The second major gap we note is the lack of studies specifically considering children learning subsistence skills from one another. Furthermore, we would be interested in work addressing how same-sex children teach one another particular skills. Such occurrences are mentioned obliquely in a number of our studies - boys helping one another with bows, for example - but are not developed. Given the emphasis we are seeing on peer group learning and the prevalence of vertical transmission from same-sex parents, we wonder how extensively those two trends converge in the form of same-sex children teaching one another. In addition, Africa is over-represented in studies on learning subsistence skills. We would welcome further studies from places like Asia or South America. Finally, very few studies include a narrative approach where people themselves explain how they learn, which is a valuable method to understand how foragers see their own learning process.

The present research has important implications for many fields. Hunter-gatherer archaeologists find it especially difficult to pinpoint the role of children in the creation of the material record. Collectively, these studies demonstrate the importance of children in producing smaller versions of "adult" material culture, and they also address the complexities of human innovation as a product of entire communities, a topic that always preoccupies archaeologists. For psychologists and anthropologists particularly interested in human evolution and life history, our findings have implications for long-running debates about innovation, learning and the reason for extended human juvenility. Overall, it is our hope that the growing trend in studying the learning processes of foraging children continues.

Reference List

Aoki K., Wakano J. Y., & Lehmann L. (2012). Evolutionarily stable learning schedules and cumulative culture in discrete generation models. Theoretical Population Biology 81, 300–309. doi: 10.1016/j.tpb.2012.01.006

Bateson P. (2014). Play, playfulness, creativity and innovation. Animal Behavior and Cognition, 2(2), 99-112.

Berl R. E. W., & Hewlett B. S. (2015). Cultural variation in the use of overimitation by the Aka and Ngandu of the Congo Basin. PLoS One. 10, e0120180. doi: 10.1371/journal.pone.0120180

Bird D. W., & Bliege Bird R. (2002). Children on the reef: Slow learning or strategic foraging? Human Nature, 13, 269–297. doi: 10.1007/s12110-002-1010-9

Bird D.W., & Bliege Bird R. (2005). Martu children's hunting strategies in the Western Desert, Australia. In B. S. Hewlett, M. E. Lamb (Eds.), Hunter-gatherer childhoods: Evolutionary, developmental and cultural perspectives (pp. 129-148). New Brunswick: Transaction Publishers.

Bliege Bird R., & Bird D. W. (2002). Constraints of knowing or constraints of growing? FIshing and collecting by the children of Mer. Human Nature, 13, 239–267.

Blurton Jones N., Hawkes K., & Draper P. (1994). Differences between Hadza and !Kung children's work: Original affluence or practical reason. In E. S. J. Burch & L. J. Ellanna (Eds.), Key issues in hunter-gatherer research (pp. 189-215). Oxford: Oxford University Press.

Blurton Jones N., & Marlowe F. W. (2002). Selection for delayed maturity: Does it take 20 years to learn to hunt and gather? Human Nature 13, 199–238.

Bock J. (2002). Learning, life history, and productivity. Human Nature, 13, 161–197. doi: 10.1007/s12110-002-1007-4

Bock J. (2005). Farming, foraging and children's play in the Okavango Delta, Botswana. In A. Pellegrini, & P. K. Smith PK (Eds.), The nature of play: Great apes and humans (pp. 254-285). New York: Guilford Press.

Bock J., & Johnson S. E. (2004). Subsistence ecology and play among the okavango delta peoples of botswana. Human Nature, 15, 63–81.

Bogin B. (2006) Modern human life history: The evolution of human childhood and fertility. In K. Hawkes, & R. R. Paine (Eds.), The evolution of human life history, 2nd edn (pp. 197-230). Santa Fe: School of American Research.

Bogin B. (1997). Evolutionary hypotheses for human childhood. American Journal of Physical Anthropolology, 104, 63–89. doi: 10.1002/(SICI)1096-8644(1997)25+<63::AID-AJPA3>3.0.CO;2-8

Boyd R., Richerson P. J., & Henrich J. (2011). The cultural niche: Why social learning is essential for human adaptation. PNAS, 108, Suppl, 10918–10925. doi: 10.1073/pnas.1100290108

Boyette A. H. (2013). Social learning during middle childhood among Aka foragers and Ngandu farmers of the Central African Republic. PhD Dissertation: Washington State University.

Britten N., Campbell R., Pope C., et al. (2002). Using meta-ethnography to synthesise

qualitative research: A worked example. Journal of Health Services Research & Policy, 7, 209–215. doi: 10.1258/135581902320432732
Bugarin F. T. (2008). Constructing an archeology of children: Studying children and child material clture from the African past. Archeological Papers of the American Anthropological Association, 15, 13-26.
Burgesse J. A. (1944). The woman and the child among the Lac-St-Jean Montagnais. Primit Man, 17, 1–18. doi: 10.2307/3316305
Campbell R., Pound P., Pope C., et al (2003). Evaluating meta-ethnography: A synthesis of qualitative research on lay experiences of diabetes and diabetes care. Social Science & Medecine, 56, 671–684. doi: 10.1016/S0277-9536(02)00064-3
Caro TM, Hauser MD (1992) Is there teaching in nonhuman animals? Q Rev Biol 67:151–174.
Carruthers P. (2002). Human creativity: Its evolution, its cognitive basis, and its connections with childhood pretense. British Journal for the Philosophy of Science, 53, 225–249.
Cavalli-Sforza L. L., Feldman M. W., Chen K. H., Dornsbusch S. M. (1982). Theory and observation in cultural transmission. Science, 80(361), 19–27.
Chen K-H, Cavalli-Sforza LL, Feldman MW (1982) A study of cultural transmission in Taiwan. Hum Ecol 10:365–382.
Chick G. (2009). Work, play and learning. In D. F. Lancy J. Bock, & S. Gaskins (Eds.), The anthropology of learning in childhood. (pp. 119-144). New York: Rowman & Littlefield.
Chisholm J. S. (1993). Death, hope, and sex: Life-history theory and the development of reproductive strategies. Current Anthropology, 34, 1–24.
Crittenden A. N. (in press) Children's foraging and play among the Hadza: The evolutionary significance of "work Play." In C. L. Meehan, & A. N. Crittenden (Eds.), Origins and implications of the evolution of childhood (pp. 156-171). Santa Fe: School of Advanced Research Press.
Crittenden A. N. (2011). The importance of honey consumption in human evolution. Food and Foodways, 19(4), 257-273.
Demps K., Zorondo-Rodríguez F., García C., & Reyes-García V. (2012). Social learning across the life cycle: Cultural knowledge acquisition for honey collection among the Jenu Kuruba, India. Evolution & Human Behavior, 33, 460–470. doi: 10.1016/j.evolhumbehav.2011.12.008
Dira S., & Hewlett B. S. (in press). Learning to spear hunt among Ethiopian Chabu adolescent hunter-gatherers. In A. Takada, & B. S. Hewlett (Eds.), Social learning and innovation in contemporary hunter-gatherers: Evoltionary and ethnographic perspectives. Tokyo: Springer Japan.
Draper P. (1976). Social and economic constraints on child life among the !Kung. In R. B. Lee, & I. Devore (Eds.), Kalahari hunter-gatherers: Studies of the !Kung San and Their Neighbors (pp. 199-217). Cambridge: Harvard University Press.
Draper P., & Cashdan E. (1988). Technological change and child behavior among the !Kung. Ethnology, 27, 339–365.
Eickelkamp U. (2010). Children and youth in Australia: An overview of the literature. Anthropological Forum, 20(2), 147-166.
Elias C. L., & Berk L. E. (2002). Self-regulation in young children: Is there a role for

sociodramatic play? Early Childhood Research, 17(2), 216–238. doi: 10.1016/S0885-2006(02)00146-1

Enquist M., Eriksson K., & Ghirlanda S. (2007). Critical social learning: A solution to Rogers's paradox of nonadaptive culture. American Anthropologist, 109, 727–734. doi: 10.1525/AA.2007.109.4.727.728

Erikson, E. H. (1939) Observations on Sioux education. The Journal of Psychology, 7, 101–156.

Flannery, R. (1953). The Gros Ventres of Montana: Part 1, social life. Washington D.C. : Catholic University of America Press.

Gallois, S., Duda, R., Hewlett, B. S., & Reyes-García, V. (2015). Children's daily activities and knowledge acquisition: A case study among the Baka from southeastern Cameroon. Journal of Ethnobiology and Ethnomedecine, 11, 1–13. doi: 10.1186/s13002-015-0072-9

Gaskins, S. (2000). Children's daily activities in a Mayan village: A culturally grounded description. Cross-Cultural Research, 34, 375–389. doi: 10.1177/106939710003400405

Gaskins, S., & Paradise, R. (2009). Learning through observation in daily life. In D. F. Lancy, J. Bock, & S. Gaskins (Eds.), The anthropology of learning in childhood (pp. 85-118). London: Rowan & Littlefield.

Göncü A., Jain J., & Tuerner U. (2006). Children's play as cultural interpretation. In A. Göncü, & S. Gaskins (Eds.), Play and development: Evolutionary, sociocultural, and functional perspectives (pp. 115-178). Mahwah: Lawrence Erlbaum Associated.

Gurven M., Kaplan H., & Gutierrez M. (2006). How long does it take to become a proficient hunter? Implications for the evolution of extended development and long life span. Journal of Human Evolution, 51, 454–470. doi: http://dx.doi.org/10.1016/j.jhevol.2006.05.003

Harkness S., & Super C. M. (1983). The cultural construction of child development: A framework for the socialization of affect. Ethos, 11, 221–231.

Harris S. (1980). Culture and learning: Tradition and education in Northeast Arnhem Land. Canberra: Australian Institute of Aboriginal Studies.

Henrich J., Heine S. J., & Norenzayan A. (2010). The weirdest people in the world? Behavioral Brain Science, 33, 61–83. doi: 10.1017/S0140525X0999152X

Herzog J. (1974). The socialization of juveniles in primate and foraging societies: Implications for contemporary education. Council on Anthropology and Education Quarterly, V(1), 12-17.

Hewlett B. L. (in press). Innovation and social learning among Chabu adolescent hunter-gatherers of Ethiopia. In H. Terashima, & B. S. Hewlett (Eds.), Social learning and innovation in contemporary hunter-gatherers: Evoltionary and ethnographic perspectives. Tokyo: Springer Japan.

Hewlett B. L. (2012). Listen, here's a story: Ethnographic life narratives from Aka and Ngandu women of the Congo Basin. Oxford: Oxford University Press.

Hewlett B. L. (2013). "Ekeloko" The spirit to create: innovation and social learning among Aka adolescents of the Central African Rainforest. In T. Akazawa, Y. Nishiaki, & K. Aoki (Eds.), Dynamics of learning in Neanderthals and Modern Humans Volume 1: Cultural perspectives (pp. 187-195) Tokyo: Springer Japan.

Hewlett B. S., & Cavalli-Sforza L. L. (1986). Cultural transmission among Aka pygmies.

American Anthropologist, 88, 922–934.
Hewlett B. S., Fouts H. N., Boyette A. H., & Hewlett B. L. (2011). Social learning among Congo Basin hunter-gatherers. Philosophical Transaction Royal Society of London B, Biological Science, 366, 1168–1178. doi: 10.1098/rstb.2010.0373
Hewlett B. S. (2014). Hunter-gatherer childhoods in the Congo Basin. B. S. Hewlett (Ed.), Hunter-gatherers of the Congo Basin: Cultures, histories and biology of African Pygmies (pp. 245-276). New Brunswick: Transaction Publishers.
Hewlett B. S., & Roulette C. J. (2016). Teaching in hunter-gatherer infancy. Royal Society Open Science, 3, 150403.
Ilyatjari N. (1991). Traditional Aboriginal learning: How I learned as a Pitjantjatjara child. Aboriginal Children at School, 19, 6–12.
Imamura K. (in press). Hunting play among the San children: Imitation, learning, and play. In H Terashima, & B.S. Hewlett (Eds.), Social learning and innovation in contemporary hunter-gatherers: Evoltionary and ethnographic perspectives.Tokyo: Springer Japan.
Imamura K., & Akiyama H. (2016). How hunter-gatherers have learned to hunt: Transmission of hunting methods and techniques among the Central Kalahari San. African study Monographs, Suppl(52), 61–76.
Johnson A. (2003). Families of the forest: The Matsigenka Indians of the Peruvian Amazon. Oakland: University of California Press.
John-Steiner, V., & Mahn, H. (1996). Sociocultural approaches to learning and development: A Vygotskian framework. Educational psychologist, 31(3-4), 191-206.
Jordan P. D. (2014). Technology as human social tradition: Cultural transmission among hunter-gatherers. Oakland: Univ of California Press.
Kaplan H., Hill K., Lancaster J., & Hurtado A. M. (2000.) A theory of human life history evolution: Diet, intelligence, and longevity. Evolutionary Anthropology; Issues, News, and Reviews, 9, 156–185.
Kaplan H., & Robson A. J. (2002) The emergence of humans: The coevolution of intelligence and longevity with intergenerational transfers. PNAS, 99, 10221–10226.
Kaplan H. S., Mueller T., Gangestad S., & Lancaster J. B. (2003). Neural capital and life span evolution among primates and humans. In C. E. Finch, J.-M Robine, Y. Christen (Eds.), Brain and longevity (pp. 69-97). Berlin: Springer.
Kawabe T. (1983.) Development of hunting and fishing skill among boys of the Gidra in Lowland Papua New Guinea. Journal Human Ergology, 12, 65–74.
Keith K. (2008). Childhood learning and the distribution of knowledge in foraging societies. Archeological Papers of the American Anthropological Association, 15, 27-40.
Kelly, R. L. (1995). The foraging spectrum: Diversity in hunter-gatherer lifeways. Washington, D.C.: Smithsonian Institution Press.
Kline M. A. (2015). How to learn about teaching: An evolutionary framework for the study of teaching behavior in humans and other animals. Behavior & Brain Science 38, 1–70. doi: 10.1017/S0140525X14000090
Kline M. A., Boyd R., & Henrich J. (2013). Teaching and the life history of cultural transmission in Fijian villages. Human Nature, 24, 351–374. doi: 10.1007/s12110-013-9180-1

Konner M. (2010). The evolution of childhood: Relationships, emotion, mind. Canbridge: Harvard University Press.
Laland K. N. (2004). Social learning strategies. Animal Learning Behavior, 32, 4–14. doi: 10.3758/BF03196002
Lancaster J. B., Kaplan H. S., Hill K., & Hurtado A. M. (2000). The evolution of life history, intelligence and diet among chimpanzees and human foragers. In F. Tonnea, N. S. Thompson (Eds), Perspectives in ethology: Evolution, culture and behaviour (pp. 47-72). Berlin: Springer.
Lancy D. F. (1996). Playing on the mother-ground: Cultural routines for children's development. New YorkL Guilford Press.
Lancy D. F. (2010). Learning "from nobody": The limited role of teaching in folk models of children's development. Child Past, 3, 79–106.
Lancy D. F. (2012). The chore curriculum. In M. F. C. Bourdillion, & G. Spitter (Eds.), African children at work: Working and learning in growing up for life (pp. 23-56). Berlin: LITV.
Lancy, D. F. (2015). Mapping the landscape of children's play. SSWA Faculty Publications, Paper 572.
Lee R. B., & Daly R. H. (Eds.) (1999). The Cambridge encyclopedia of hunters and gatherers. Cambridge: Cambridge University Press.
Legare, C. H., & Nielsen, M. (2015). Imitation and innovation: The dual engines of cultural learning. Trends in cognitive sciences, 19(11), 688-699.
Lehmann L., Wakano J.Y., & Aoki K. (2013). On optimal learning schedules and the marginal value of cumulative cultural evolution. Evolution, 67, 1435–1445. doi: 10.1111/evo.12040
Leigh, S. R. (2001). Evolution of human growth. Evolutionary Anthropology: Issues, News, & Reviews, 10, 223–236. doi: 10.1002/evan.20002
Lewis J. (2002). Forest hunter-gatherers and their world: A study of Mbendjele Yaka Pygmies of Congo-Brazzaville and their secular and religious activities and representations. PhD Dissertation: London School of Economics and Political Science.
Lewis J. (2014). Egalitarian social organization: The case of the Mbendhele BaYaka. In B. S. Hewlett (Ed.), Hunter-gatherers of the Congo Basin: Cultures, histories, and biology of African Pygmies (pp. 219-244). New Brunswick: Transaction Publishers.
Lye T. P. (1997). Knowledge, forest, and hunter-gatherer movement: The Batek of Pahang, Malaysia. PhD Disseration, University of Hawaii.
Lyons D. E., Young A. G., & Keil F. C. (2007). The hidden structure of overimitation. PNAS, 104, 19751–19756. doi: 10.1073/pnas.0704452104
MacArthur R. H., &Wilson E. O. (1967). The theory of island biogeography. Princeton: Princeton University Press.
MacDonald K. (2007). Cross-cultural comparison of learning in human hunting. Human Nature, 18, 386–402. doi: 10.1007/s12110-007-9019-8
MacEachen E., Clarke J., Franche R. L., et al (2006). Systematic review of the qualitative literature on return to work after injury. Scandinavian Journal Work, Environment & Health, 32, 257–269. doi: 10.5271/sjweh.1009
Marlowe FW (2005) Hunter-gatherers and human evolution. Evol Anthropol Issues, News, Rev 14:54–67. doi: 10.1002/evan.20046

Mesoudi A, Chang L, Murray K, Lu HJ (2015) Higher frequency of social learning in China than in the West shows cultural variation in the dynamics of cultural evolution. Proc R Soc B 282:1–7. doi: 10.1098/rspb.2014.2209

Morelli GA, Rogoff B, Angelillo C (2003) Cultural variation in young children's access to work or involvement in specialised child-focused activities. Int J Behav Dev 27:264–274. doi: 10.1080/01650250244000335

Murdock GP, Ford CS, Hudson AE, et al (2008) Outline of Cultural Materials. 6th revised edition with modifications. Human Relations Area Files, New Haven, CT.

Naveh D (2014) Knowing and learning among Nayaka hunter-gatherers. East Anthropol 67:3–4.

Neuwelt-Truntzer S (1981) Ecological Influences on the Physical, Behavioral, and Cognitive Development of Pygmy Children. University of Chicago

Nielsen, M., & Haun, D. (2016). Why developmental psychology is incomplete without comparative and cross-cultural perspectives. *Phil. Trans. R. Soc. B*, *371*(1686), 20150071.

Nielsen M, Mushin I, Tomaselli K, Whiten A (in press) Imitation, collaboration and their interaction among Western and Indigenous Australian preschool children.

Nielsen M, Mushin I, Tomaselli K, Whiten A (2014a) Where culture takes hold: "overimitation" and its flexible deployment in Western, Aboriginal, and Bushmen children. Child Dev 85:2169–2184. doi: 10.1111/cdev.12265

Nielsen M, Tomaselli K (2010) Overimitation in Kalahari Bushman children and the origins of human cultural cognition. Psychol Sci 21:729–36. doi: 10.1177/0956797610368808

Nielsen M, Tomaselli K, Mushin I, Whiten A (2014b) Exploring tool innovation: A comparison of Western and Bushman children. J Exp Child Psychol 126:384–394. doi: http://dx.doi.org/10.1016/j.jecp.2014.05.008

Nishiaki Y (2013) "Gifting" as a means of cultural transmission: The archeological implications of bow-and-arrow technology in Papua New Guinea. In: Akazawa T (ed) Dynamics of Learning in Neanderthals and Modern Humans, Volume 1: Cultural Perspectives. Springer Japan, Tokyo, pp 173–285

Odden H, Rochat P (2004) Observational learning and enculturation. Educ Child Psychol 21:39–50.

Ohmagari K, Berkes F (1997) Transmission of Indigenous knowledge and bush skills among the Western James Bay Cree women of Subarctic Canada. Hum Ecol 25:6–25.

Ohtsuka R (1989) Hunting activity and aging among the Gidra Papuans: A biobehavioral analysis. Am J Phys Anthropol 80:31–39. doi: 10.1002/ajpa.1330800105

Over, H., & Carpenter, M. (2012). Putting the social into social learning: Explaining both selectivity and fidelity in children's copying behavior. *Journal of Comparative Psychology*, *126*, 182-192.

Pandya V (1992) Gukwelonone: The game of hiding fathers and seeking sons among the Ongee of Little Adaman. In: Hewlett BS (ed) Father-Child Relations: Cultural and Biosocial Contexts. Aldine de Gruyter, Hawthorne, N. Y., pp 263–279

Puri RK (2013) Transmitting Penan basketry knowledge and practice. In: Ellen R, Lycett SJ, Johns SE (eds) Understanding Cultural Transmission in Anthropology: A Critical Synthesis. Berghahn Books, New York, N. Y., pp 266–299

Puri RK (2005) Deadly dances in the Bornean rainforest: Hunting knowledge of the Penan Benalui. KITLV press, Leiden.
Robson AJ, Kaplan HS (2003) The evolution of human life expectancy and intelligence in economies. Am Econ Rev 93:150–169.
Rogoff B, Paradise R, Arauz RM, et al (2003) Firsthand learning through intent participation. Annu Rev Psychol 54:175–203. doi: 10.1146/annurev.psych.54.101601.145118
Schniter E, Gurven M, Kaplan HS, et al (2015) Skill ontogeny among Tsimane forager-horticulturalists. Am J Phys Anthropol 158:3–18. doi: 10.1002/ajpa.22757
Shostak M (1976) A !Kung woman's memories of childhood. In: Lee RB, DeVore I (eds) Kalahari Hunter-Gatherers: Studies of the !Kung San and Their Neighborsnd Their Neighbors. Harvard University Press, Cambridge, MA., pp 246–278
Shostak M (1981) Nisa, the life and Words of a !Kung woman. Vintage Books, New York N.Y.
Smith BH (1989) Dental development as a measure of life history in primates. Evolution 43:683–688. doi: 10.2307/2409073
Sonoda K (in pressa) Constructing social learning interactions among Baka hunter-gatherers. In: Takada A, Hewlett BS (eds) Social Learning and Innovation in Contemporary Hunter-Gatherers: Evoltionary and Ethnographic Perspectives. Springer Japan, Tokyo.
Sonoda K (in pressb) Give me the meat, the child said: Cultural practice among the children of the Baka hunter-gatherers.
Thompson TK (2003) Growing Up Kaytetye: Stories. Jukurrpa Books
Tonkinson R (1978) The Mardudjara}aborigines: living the dream in Australia's desert. Holt, Rinehart and Winston, New York, N. Y.
Tucker B, Young A (2005) Growing up Mikea: Children's time allocaton and tuber foraging in Southwestern Madagascar. In: Hewlett BS, Lamb ME (eds) Hunter-Gatherer Childhoods: Evolutionary, Developmental and Cultural Perspectives. Transaction Publishers, New Brunswick, New Jersey, pp 146–174
Vanstone JW (1965) The changing culture of the Snowdrift Chipewyan. Queen's Printer, Regina, SK.
Walker R, Hill K, Kaplan H, McMillan G (2002) Age-dependency in hunting ability among the Ache of eastern Paraguay. J Hum Evol 42:639–57. doi: 10.1006/jhev.2001.0541
Wallace E, Hoebel EA (1952) The Comanches: Lords of the South Plains. University of Oklahoma Press, Norman, OK.
Willerslev R (2007) Soul hunters: Hunting, animism, and personhood among the Siberian Yukaghirs. University of California Press, Oakland, CA.
Wood LA, Kendal RL, Flynn EG (2012) Context-dependent model-based biases in cultural transmission: Children's imitation is affected by model age over model knowledge state. Evol Hum Behav 33:387–394. doi: 10.1016/j.evolhumbehav.2011.11.010
Woodburn J (1982) Egalitarian societies. Man 17:431–451.
Zmyj N, Seehagen S (2012) The role of a model's age for young children's imitation: A research review. Infant Child Dev 22:622–641.