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LOCAL ECOLOGICAL KNOWLEDGE AMONG BAKA CHILDREN: A CASE OF "CHILDREN'S CULTURE" ?

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Childhood is an extensive life period specific to the human species and a key stage for development. Considering the importance of childhood for cultural transmission, we test the existence of a "children's culture," or child-specific knowledge and practices not necessarily shared with adults, among the Baka in Southeast Cameroon. Using structured questionnaires, we collected data among 69 children and 175 adults to assess the ability to name, identify, and conceptualize animals and wild edibles. We found that some of the ecological knowledge related to little mammals and birds reported by Baka children was not reported by adults. We also found similarities between children's and adults' knowledge, both regarding the content of knowledge and how knowledge is distributed. Thus, children in middle childhood hold similar knowledge to adults, especially related to wild edibles. Moreover, as children age, they start shedding child-specific knowledge and holding more adult-specific knowledge. Echoing the gendered knowledge distribution present in adulthood, from middle childhood, there are differences in the knowledge held by boys and girls. We discuss our results highlighting the existence of specific ecological knowledge held by Baka children, the overlap between children's and adults' knowledge, and the changes in children's ecological knowledge as they move into adulthood.

Keywords: *Cameroon, cultural transmission, ethnoecology, hunter-gatherer, peer culture*

Introduction

> If the goal is to understand how children contribute to making culture, a more appropriate focus would be the arena in which children do most of their culture making: namely, in their lives with other children, what is sometimes called "children's culture." (Hirschfeld 2002:614)

During childhood, individuals learn, use, modify, and create games, artifacts, routines, and specific activities that are not necessarily shared with adults. Children also share exclusively with other children certain values, concerns, knowledge, and skills. The body of knowledge and practices produced by children for themselves or for their peers apart from the adult world are known as children's culture (Corsaro 2012; Johanson 2010).

Children's behaviors, development, and place in their society have been the focus of a growing number of anthropological research projects since the pioneer child-focused work of Margaret Mead in the 1930s (Mead [1930] 2001; Montgomery 2008b). Whether taking a psychological, a developmental, or an evolutionary approach, most of the research modeling Mead's has tried to assess

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both universal patterns and cultural-specific traits of children's behavior and development (Bird-David 2005; Hewlett 2014; Konner 2016; Lancy 2008; Whiting 1980; Whiting and Whiting 1975). In this line, several studies have been carried out among children living in small-scale societies. In such societies, despite variations between foragers, pastoralists, and agriculturalists (Konner 2016; Lancy 2008), children participate in domestic chores, childcare, subsistence activities, and food procurement (Bird-David 2005; Hewlett 2014; Konner 2016; Kramer 2005b; Meehan and Crittenden 2016; Sear and Mace 2008). Such activities affect their nutrition and health (Bird and Bliege Bird 2002; Konner 2016; Little and Gray 1990), but also adults' subsistence, mobility, and fertility (Blurton Jones et al. 1994; Kramer 2005a). But despite the importance of children's involvement in subsistence activities both for themselves and for their households, there is still little research on how children's work and food procurement might be related to children's specific knowledge.

The existence of a children's culture is not only significant for understanding child development and how this articulates with the adult world, but it might also provide insights into the study of cultural transmission in at least three ways (Ahn 2010). First, the existence of a children's culture implies that there is a body of knowledge of intrinsic value to children but not necessarily to adults (see also Bird-David 2005; Hirschfeld 2002). Is this knowledge created by and transmitted among children only? How does the knowledge fit with children's development? Why is this body of knowledge not maintained as children age? Answering these questions would improve our understanding of how cultural knowledge is created and transmitted at different stages of the life cycle.

Second, as children's culture overlaps at least partially with adults' culture, understanding children's culture provides insights "into how children 'do' culture: how they reproduce and reformulate it" (Johanson 2010:389). In other words, understanding children's culture is important because children's culture might play an important role in contributing to cultural production and change, especially in situations where children actively reproduce "adult's society through their activities in their own peer cultures" (Corsaro 2003:14).

Third, the analysis of children's culture might also provide insights into the study of knowledge transmission pathways. For example, some researchers have found knowledge can be transmitted without the help or intervention of adults during children's playtime activities. Games and songs transmitted in this manner have shown an impressive persistence (Morin 2010). For example, using a selection of Gargantua's play, Morin (2010) shows that knowledge transmitted during leisure activities performed only by adults persisted, on average, for ten generations of adults, whereas knowledge transmitted during playtime by children persisted for 55 generations of children, despite the more limited duration of children's generations. Such findings are important because they challenge the supposed low stability of knowledge transmitted horizontally (Hewlett and Cavalli-Sforza 1986). However, and despite the theoretical importance of children's culture in the transmission of cultural knowledge, research on how the transmission of cultural knowledge is shaped during childhood continues to be limited (Ahn 2010). Furthermore, most research addressing the issue has focused on the leisure activities—i.e., games and play—

of children living in what anthropologists refer to as WEIRD (Western, Educated, Industrialized, Rich, and Democratic) societies (Henrich et al. 2010). Little research has analyzed whether children's culture also exists in relation to productive activities or in non-WEIRD societies (for exceptions, see Zarger 2002; Zarger and Stepp 2004).

In this article, we contribute to this under-explored field by presenting empirical data analyzing the existence of children's culture and its overlap with adults' culture. Specifically, we analyze children's culture in relation to the Local Ecological Knowledge (LEK) of children of a small-scale society of foragers, the Baka in Southeast Cameroon. We specifically worked with children aged between five and 16 years old, grouped into three development stages: middle childhood ($>$ 5 to $\leq$ 9 years); pre-adolescence ($>$ 9 to $\leq$ 13 years); and adolescence ($>$ 13 to $\leq$ 16 years) (Flavell et al. 1993). For the purpose of this research, we define LEK as the corpus of knowledge, practices, and beliefs held by a society about their surrounding environment. We explore both the content and the structure of children's and adults' LEK first by comparing children's and adults' knowledge and then by examining the similarities and differences of LEK among children according to their sex and age-category hand; as in small-scale societies like the one studied here, knowledge related to the local environment guides subsistence activities (Reyes-García et al. 2016c). Previous research in such settings suggests that childhood is a critical period for the acquisition of LEK (Demps et al. 2012; Gurven et al. 2006; Reyes-García et al. 2009; Ruiz-Mallén et al. 2013; Zarger and Stepp 2004). In that sense, studying children's culture in relation to LEK could enable us to understand how, in reproducing aspects of adults' knowledge, children might acquire or re-create cultural knowledge.

The Baka

This study took place among the Baka, a hunter-gatherer group of about 30,000 individuals living in Cameroon, Gabon, Republic of Congo, and Central African Republic (Joiris 2003). Detailed ethnographic information of the Baka can be found in Leclerc (2012) and Joiris (1998). Data were collected in two Baka communities settled in the Haut-Nyong region, specifically in the districts of Lomié and Messok, Southeast Cameroon.

Until recently, the Baka lived in small, semi-nomadic groups, depending both on forest and agricultural products, obtaining the latter through bartering with sedentary Bantu-speaking farmers. For the last 50 years, the Baka living in Cameroon have faced several changes mostly driven by the deforestation and defaunation of the forest where they live and by the national government's extensive settlement program (Leclerc 2012). As a result, most Baka now live in villages located along logging roads, practice agriculture, and engage in wage labor (Leclerc 2012). Compared to only three decades ago, Baka mobility is largely reduced and nowadays their forest incursions are generally organized around the agricultural seasons and the gathering of commercial wild edibles.

Similar to children in other hunter-gatherer societies (Hewlett 2014), Baka children are very autonomous and independent from an early age. They engage in subsistence activities, including hunting small mammals and birds and gathering wild edibles, often without adult presence (Gallois et al. 2015). Moreover, due to adults' prolonged absences during the day, identifying, catching, or gathering game and plants are essential skills for Baka children, as this forms part of their daily diet.

Methodology

Methods of Data Collection

Field work lasted 18 months, from February 2012 to April 2014. The studied villages had a population of 119 and 187 adults (defined here as people above 16 years of age, as this is the age at which Baka typically create new households) and 145 and 206 children (31 and 86 under 5 years of age), respectively.

We firstly obtained free, prior, and informed consent in both villages and with every individual participating in this study. For children, we asked for parental consent. This study adheres to the Code of Ethics of the International Society of Ethnobiology and received the approval of the ethics committee of the Universitat Autònoma de Barcelona (CEEAH-04102010).

During all the fieldwork period, Sandrine Gallois and Romain Duda lived in the Baka villages. For the first six months of fieldwork, they learned the basics of the Baka language and the local socio-cultural norms (e.g., on sharing), which helped them to be accepted in village life. They also collected ethnographic information using spontaneous conversations, semi-structured interviews, and participant observation in daily activities (e.g., joining fishing or hunting trips, participating in honey collection expeditions, or working on agricultural plots). Two trained local assistants and interpreters helped with data collection. During this period, researchers also collected demographic (i.e., sex and level of schooling) and genealogical data (i.e., kinship charts) through a census. As the Baka do not have birth cards, we estimated participants' ages using kinship information.

Over the following 12 months, several systematic protocols were used to assess individuals' LEK in two domains: game and wild edibles (i.e., plants, mushrooms, insects, and honey). Specifically, we assessed people's abilities to: 1) name game and wild edibles using a free-listing task; 2) identify game and wild edibles using a test of visual and auditory identification; and 3) to conceptualize etho-ecological knowledge through a structured survey[1]. The sample varied among methods of data collection (see below).

Free-listings

We asked informants to enumerate all the game and wild edibles they knew (Puri and Vogl 2005). Ethnographic observations suggested that children and adults engage differently in activities related to the two domains of knowledge selected and, consequently, conducted a set of eight free-listings to cover both

children's and adults' expertise. To capture the knowledge held about game species, informants were asked to list the names of game they knew using the following groupings: a) game (without further specification) and then b) mice, c) birds, and d) fish. Similarly, informants were asked to list all the wild edibles they knew according to the following groups: a) wild edibles (without further specification) and then b) fruits, c) caterpillars, and d) mushrooms.

For each free-list, we obtained data for about 45 individuals, including adults and children. A total of 54 adults (16 women and 38 men) and 30 children (13 girls and 17 boys) were interviewed, meaning that most informants responded to more than one free-listing (Table 1). All the entries in our lists were reviewed by one of our research assistants, a Baka man. Additionally, once free-listing was completed, adult informants were asked to review children's lists, identifying any item unknown to them. Items reported by at least two informants in the "game" and "wild edibles" free-listings were used to elaborate the other tests.

Common Identification Test

We used the Smith's Saliency Index derived from free-listing (Puri and Vogl 2005) to categorize items listed as "game" and "wild edibles" into three groups: high, medium, and low saliency (see Supplementary Table 1). Five items were then randomly selected in each group, from which nine game and eight wild edibles were kept after testing. The common identification test consisted of a series of stimuli, including pictures and recordings (i.e., a monkey's call) for the selected game; and dry specimens, pictures, and plant parts (i.e., barks) for the selected wild edibles. Stimuli were shown to respondents and they were asked to provide the vernacular name of the species featured.

Common Structured Questionnaire

To assess theoretical knowledge on game and wild edibles—referred to as etho-ecological knowledge—questions were selected regarding the behavior of three game species and the ecology of three wild edible species, one game and one wild edible species from each saliency group.

A total of 244 individuals (175 adults and 69 children) answered both the common identification test and the common structured questionnaire.

Children's Identification Test

As our second goal was to analyze children's LEK, additional data was collected among children. Specifically, children were presented with visual stimuli for 11 additional game species. Thus, children were asked to identify a total of 20 species of animals and eight species of wild edibles. The additional species included in the children's identification test were also distributed across different saliency levels: ten had a high saliency in children's free-listing, five a medium saliency, nine a low saliency, and four were not reported by children.

Variable Construction

Data collected from the common identification test, the children's identification test, and the common structured questionnaire were used to construct

Table 1. Items listed during free-listing (30 children, 54 adults).

	Children					Adults						Items reported only by children	
	N					N							
	Girls	Boys	Total	Average	Standard deviation	Women	Men	Total	Average	Standard deviation	Common items	Freq	%
Game	12	14	43	8.7	2.8	4	21	83	15.5	4.3	35	8	19
Mice	10	14	26	4.3	2.1	7	11	25	5.6	2.9	13	13	50
Birds	11	13	36	4.75	2.6	8	15	62	8.6	5.4	21	15	42
Fishes	12	12	22	6.2	2.0	13	12	30	8.2	2.8	13	13	50
Wild edibles	12	15	52	5.4	3.0	6	21	103	13.2	6.5	30	22	42
Fruits	10	14	32	3.5	1.8	7	11	39	6.6	2.4	17	15	47
Caterpillars	11	15	15	3.5	1.3	7	10	14	4.6	2.0	7	8	53
Mushrooms	11	15	28	4.5	1.6	8	11	32	7.1	3.6	20	8	29

individual knowledge scores. For the common identification test and the children's identification test, a measure of agreement with the group based on the number of times the informant's answer matched the modal response of a question after excluding missing answers was created (D'Andrade 1987; Reyes-García et al. 2016b). The modal answers were established for all the species presented first for the whole sample, then by sex, and finally for adult and children separately. For all the species present in the interviews, we found similar modal answers. In other words, for every species, we found as the modal answer of the whole sample of interviewees was the same as the modal answers of the different subgroups studied (groups composed by women/men separately and groups composed by children/adults separately). Moreover, as the stimuli were from a known origin (i.e., pictures and recordings from the literature), we found that all modal answers corresponded to local names whose scientific correspondence had been identified by previous scholars (Brisson 2010; Dounias 1996; Hattori 2006; Letouzey 1976; Vivien 2012). Thus, we generated knowledge scores by contrasting informants' responses with the modal answer of the whole sample. Specifically, we added a point to the identification score for each coincidence between the respondents' answers and the modal answer. In this sense, individuals' scores might rank from zero (when none of the respondents' answers matched the modal response) to 17 (when all the respondents' answers matched the modal responses) for the common identification test and from zero to 28 for the children's identification test. To evaluate the answers to the common structured questionnaire, a measure of agreement with the group based on the number of times the informant's answer matched the modal response of a question was generated (D'Andrade 1987; Reyes-García et al. 2016b). Since both questionnaires had three questions, the range of individuals' scores was from zero to three. For both questionnaires, two different sets of modal answers were calculated: children's and adults'.

Data Analysis

Children's and Adults' LEK Compared

To assess whether there is child-specific LEK, we first examined the differences and similarities between children's and adults' responses to the three protocols. We analyzed responses to free-listings using ANTHROPAC 4.0 and FLAME (Borgatti 1996; Pennec et al. 2012). Data were first analyzed comparing the full samples (adults vs. children). Since our ethnographic understanding suggested that there were gendered differences in LEK, we also compared free-listing responses, taking into account the sex of the respondents. For each group (women/men and girls/boys), we first compared the total number of items reported and then the actual items listed. Such analysis allowed us to assess particularities in children's responses as well as commonalities with adults' answers.

We compared adults' and children's scores of the common identification test and the common structured questionnaire, first using the full sample and then differentiating by sex. We tested whether differences between adults' and children's scores were statistically significant using a Wilcoxon ranking test.

Finally, we explored the differences and commonalities between children's and adults' scores by looking at the details of their answers.

Similarities and Differences among Children

As the second goal of this work was to analyze variations in LEK during childhood, we further analyzed our data taking into account children's sex and age-categories. Drawing on published references (Brisson 2010; Joiris 1998) and our own interviews with Baka adults, we divided our sample of children into three age-categories: 1) middle childhood (> 5 to ≤ 9 years); 2) pre-adolescence (> 9 to ≤ 13 years); and 3) adolescence (> 13 to ≤ 16 years). We compared the number of items reported and the content of children's free-listing according to the respondent's sex and the age-category. We then used a series of Wilcoxon ranking tests to test whether the number of items reported by boys and girls varied and a series of Kruskal-Wallis tests to test whether the number of items varied from one age-category to another. Finally, we ran a series of Pearson's correlations to test whether children's age and scores in the children's identification test correlated.

Results

Children's and Adults' LEK Compared

Naming Abilities

The number of items reported in free-listings and the specific items listed varied according to the informant's age-category (child or adult) and sex (Table 1). The total number of items reported by children and adults also varied depending on the domain of knowledge (Table 1).

Overall, children reported about half the number of items adults reported, both when comparing the average and the total number of items listed (Table 1). There was a large overlap in the most salient items listed. Thus, eight of the ten most salient game reported by adults were also highly salient in children's free-listing (Supplementary Table 1). Game highly salient for children and adults corresponds to large mammals and includes: 1) the most commonly hunted mammals in the area (i.e., blue duiker [*Cephalophus monticola*] and Gambian pouched rat [*Cricetomys gambianus*]); 2) highly appreciated bushmeat (i.e., *kokòlo,* African white-bellied pangolin [*Phataginus tricuspis*] and *mbòke*, brush-tailed porcupine [*Atherurus africanus*]); and 3) culturally emblematic species (i.e., elephant [*Loxondonta africana*], gorilla [*Gorilla gorilla*], and red river hog [*Potamocherus porcus*]).

Similarly, both the total and the average number of wild edibles listed by children was about half the number of items listed by adults, but unlike game, wild edibles listed by adults and children did not overlap. Thus, when comparing the ten most salient wild edibles in children's and adults' lists, only five items were common. Different types of honey (*pOkì*, *dàndù*, *keke*) predominate the items specific to children's lists, whereas marketable wild

edibles (*p e k è* [*Irvingia gabonensis*], *n g i mb a* [*Afrostyrax lepidophyllus*], *mà B è* [*Baillonella toxisperma*], *k * O k * O* [*Gnetum africanum*], and *p a y o* [*Irvingia excelsa*]) only appeared as salient in adults' lists.

The differences between adults and children vary from one specific game category to another. Thus, children listed about half the number of birds reported by adults. Only two of the ten most salient birds appearing in children's and adults' lists were different. We found few differences in the number of mice and fish that adults and children listed. As for the general category, the five most salient types of mice and fish listed by children overlap with the five most salient items listed by adults (Supplementary Table 1). Interestingly, and despite similitude in the most salient items, 42% of the birds and more than 50% of mice and fish reported by children were not reported by adults.

Overall, children and adults listed about the same number (both in average and in total) of fruit, caterpillars, and mushrooms (Table 1). For the five most salient fruits, only two items overlapped between adults' and children's lists; whereas, for caterpillars and mushrooms, there was an almost complete overlap between the five most salient items listed by adults and children. However, 29% of the mushrooms and more than 50% of the caterpillars and fruit reported by children were not reported by adults.

Identification Abilities

We found differences between children's and adults' ability to identify game but not wild edibles (Table 2). Children recognized about 74% of the species identified by adults in the common identification test for game and children were able to identify as many wild edible species as adults identified (an average of 5 wild edible species identified for both children and adults).

The results of the Wilcoxon ranking tests showed that, among adults, the identification scores varied between men and women, both for game ($z = -5.28$, $p < .001$), and—to a lower extent—for wild edibles ($z = -1.66$, $p < .01$) (not shown in tables). We also found statistically significant differences in game identification scores when comparing the scores of women and girls and men and boys, but we did not find gendered differences in the identification of wild edibles (Table 2).

Etho-ecological Knowledge

Children and adults gave similar answers to ecological questions on the common structured questionnaire on wild edibles but not on the one on game. Specifically, children's modal answers on the two game species differed from adults' modal answers. Not surprisingly, scores for this questionnaire also differed between children and adults, with the average children's score on the game questionnaire being almost half the average of the adults' scores (Table 3). The difference was even larger on the wild edibles questionnaire. The examination of specific answers suggests that children were less accurate than adults in their responses. For example, when asked "Where does *B è mb à* [*Cephalophus sylvicultor*] rest during the day?", most children gave generic answers, such as "in the forest," whereas most adults provided a more specific answer, like the "in swampy forest clearings—*baye*."

Table 2. Identification scores, overall and by sex.

	All sample		Female		Male	
	Children	**Adults**	**Girls**	**Women**	**Boys**	**Men**
Game (8 species)						
N	69	162	32	84	37	78
Mean	**4.29**	**5.78*** **	**3.75**	**5.26*** **	**4.76**	**6.33*** **
SD	1.68	1.35	1.32	1.32	1.83	1.16
Min	0	1	0	1	1	3
Max	8	8	6	8	8	8
Wild edibles (7 species)						
N	69	175	32	96	37	79
Mean	**5.0**	**5.07**	**4.81**	**4.76**	**5.3**	**5.28**
SD	1.62	1.35	1.38	1.78	1.31	1.37
Min	0	2	2	0	2	1
Max	7	7	7	7	7	7

* $p < .1$; ** $p < .05$; *** $p < .01$ to the results of Wilcoxon ranking tests realized between adults and children.

Similarities and Differences among Children

Variation in Children's Naming Abilities

We found variation in boys' and girls' naming abilities for some, but not all, categories. Specifically, we found differences in the number of items boys and girls listed as game, birds, fish, and mushrooms, but not in the number of items listed as wild edibles, mice, caterpillars, and fruit (Table 4a). Boys listed more game, birds, and fish than girls, and girls listed more mushrooms than boys. When listing fish, several girls used the word *si*, a category that includes all water-living beings (i.e., fish, shellfish, and amphibians); boys reported species that are not usually killed during women's fishing expeditions. Girls listed ten more types of mushrooms than boys, who reported three items which are not mushrooms.

Table 3. Etho-ecological knowledge scores, by sex and age-categories.

	Pooled		Female		Male	
	Children	**Adults**	**Children**	**Adults**	**Children**	**Adults**
Game (from 0 to 3)						
N	69	162	32	84	37	78
Mean	**0.65**	**1.22*** **	**0.69**	**1*** **	**0.62**	**1.46** **
SD	0.85	0.84	0.82	0.79	0.89	0.83
Min	0	0	0	0	0	0
Max	3	3	3	3	3	3
Wild edibles (from 0 to 3)						
N	69	175	32	96	37	79
Mean	**0.54**	**1.81*** **	**0.66**	**1.95*** **	**0.43**	**1.63*** **
SD	0.65	1.81	0.70	0.86	0.60	0.92
Min	0	0	0	0	0	0
Max	3	3	3	3	3	3

* $p < .1$; ** $p < .05$; *** $p < .01$ to the results of Wilcoxon ranking tests between adults and children.

Table 4. Results of the free-listing among Baka children, by sex and age-category. a) by sex; b) by age category.

	Girls				Boys					
	Respondents	Items	Average of no. of items	Standard deviation	Respondents	Items	Average of no. of items	Standard deviation	% of items in common (items common/ total items listed)	z (Wilcoxon ranking test)
Animals	12	22	7.1	2.2	14	40	10.1	2.6	47% (20/43)	-2.9***
Mice	10	16	3.8	2.1	14	17	4.6	2.1	23% (6/26)	-1.09
Birds	11	19	3.5	2.1	13	28	5.8	2.6	31% (11/36)	-2.08**
Fishes	12	13	5.3	1.6	14	20	7.0	2.0	50% (11/22)	-2.9***
Wild edibles	12	34	5.6	4.1	15	33	5.3	1.7	34% (18/52)	-1.04
Fruits	10	19	3.2	1.9	14	22	3.6	1.6	28% (9/32)	-0.84
Caterpillars	11	9	3.5	1.6	15	12	3.4	1.1	47% (7/15)	-0.67
Mushrooms	11	23	5.4	1.5	15	18	3.9	1.5	46% (13/28)	1.77*

* $p < .1$; ** $p < .05$; *** $p < .01$ to the Wilcoxon Ranking test.

	Middle childhood			Pre-adolescence			Adolescence			
	Respondents		Items cited	Respondents		Items cited	Respondents		Items cited	Results of Kruskal-Wallis test (chi^2 with ties)
	Girls	Boys		Girls	Boys		Girls	Boys		
Animals	3	4	8.9	6	7	8	4	2	10.2	0.36
Mice	2	4	5	5	7	3.9	4	2	4.2	0.94
Birds	2	3	3.6	5	8	4.7	4	2	5.8	2.23
Fishes	3	4	5.7	6	7	6.2	4	2	6.8	1.09
Wild edibles	2	4	4.8	6	8	4.1	4	2	4.7	1.61
Fruits	2	4	3.5	5	5	2.9	4	1	4.4	2.52
Caterpillars	2	4	3.2	6	7	3.1	3	2	4.6	3.80
Mushrooms	1	4	2.6	6	8	4.6	4	2	6.3	14.46***

* $p < .1$; ** $p < .05$; *** $p < .01$ to the Kruskal-Wallis tests.

Table 5. Children's identification scores, by sex and age-categories.

	Middle childhood		Pre-adolescence		Adolescence	
	Girls	Boys	Girls	Boys	Girls	Boys
Game and wild edibles (28 species)						
N	9	9	13	18	10	10
Mean	14.1	14.78	13.77	16.78	14.3	21.1
SD	3.01	3.31	3.44	3.89	3.89	2.42
Min	11	9	7	7	8	18
Max	20	20	20	22	21	26
Wilcoxon ranking tests results	-0.71		-2.31**		-3.31***	
Wild edibles (8 species)						
Mean	5.44	5.33	5.08	5.44	4.9	6.7
SD	1.13	1.87	1.38	1.54	2.02	1.06
Min	4	3	3	2	2	5
Max	7	8	7	8	8	8
Wilcoxon ranking tests results	0.22		0.69		1.99**	

* $p < .1$; ** $p < .05$; *** $p < .01$ to the Wilcoxon ranking test.

Across the different domains of knowledge, the number of items reported does not change significantly according to children's age-category (Table 4b), but the content of the lists does differ. Specifically, middle childhood respondents gave more generic names than pre-adolescents and adolescents. For example, when listing game, middle childhood children listed categorical names such as *nguma* (fish), or *jo* (food), but such generic categories do not appear in adolescents' lists. Middle childhood respondents also listed more intruders, or items which are not part of the domain of knowledge, than older children. This was specifically the case for the category of wild edibles, for which middle childhood respondents listed game.

Variation in Children's Identification Abilities

Children recognized a little more than half of the 28 species shown during the children's identification test (Table 5). However, scores varied depending on the respondent's sex: overall, girls' identification scores were lower than boys', with larger differences among pre-adolescents and adolescents than among younger children.

Scores on children's identification tests were positively correlated with age ($r = .4135$, $p < .001$), suggesting that, as they grow up, children tend to improve their identification abilities (Table 5; Figure 1). Thus, the average identification score increased from 14.4 species identified by children in middle childhood to 17.7 species identified by adolescents (Figure 1). The average identification is also significantly different between age-categories ($chi^2 = 6.94$, $p = 0.03$ to the Kruskal-Wallis tests). The correlation between age and identification scores is significant for boys ($r = .622$, $p < .001$) but not for girls ($r = .152$, $p = .4$).

The previous results seem to be mostly driven by the ability to identify game. Indeed, scores derived from the wild edibles identification test were not

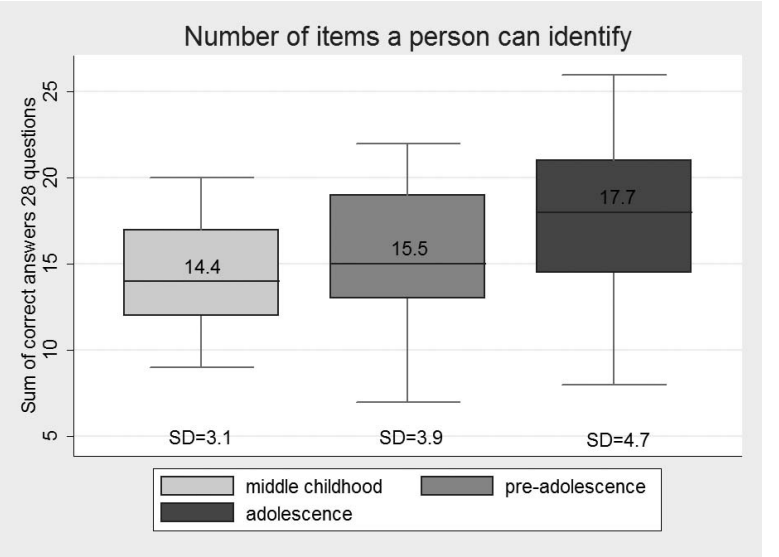

Figure 1. Box and whisker plot of children's mean number of correct identification test responses, by age-category (n = 69 children).

statistically different between boys and girls (Table 5), nor between children from different age-categories (Wilcoxon ranking test $z = 0.1937$, $p = .11$).

Discussion

We start the discussion by acknowledging that our results might be biased. From previous research we know that the intracultural distribution of LEK is partly shaped by factors such as the individual's education (Giovannini et al. 2011; Quinlan and Quinlan 2007; Reyes-García et al. 2010), income (Reyes-García et al. 2007), or household composition (Quinlan et al. 2016), none of which have been included in our analysis. Despite this caveat, we still consider that our work brings insights into the study of children's LEK and specifically related to: 1) the existence of a LEK children's culture; 2) the overlap between children's and adults' LEK; and 3) changes in children's LEK as they move into adulthood.

Is There a Children's LEK?

We started this paper defining children's culture as a set of practices and knowledge produced by children for themselves, separated from the adults' world. The results presented here suggest that some of the Baka children's knowledge and practices related to game and wild edibles are indeed specific to them. Interviews with adults concerning the items children listed provide further support for our interpretation of differences between children's and adults' naming abilities. Thus, in the two domains of knowledge examined, children listed items that were not reported by adults. When asked, adults claimed to be unaware of many of the items the children listed. In the words of an adult

respondent: "Children have their own knowledge about mice. They are always inventing new names!" Specifically, for the categories of mice and birds, adults argued that mice and small birds "are children's hunt." Furthermore, naming differences might indeed reflect the different types of hunting in which children and adults engage. Baka adults' hunting techniques basically consist of capturing large game using spears, shotguns, or snares made of iron wire (Hayashi 2008). Although Baka children use some weapons that mimic those used by adults, such as self-made spears and traps from plant materials (see also Kamei 2005), they also use their specific techniques, such as bows and arrows and slingshots to hunt squirrel, mice, and small birds. Differences in adults' and children's hunting techniques likely result in the catch of different preys, which in turn relates to different knowledge. It is also interesting to notice that adults did not consider children's hunting techniques to be real hunting nor children's catch to be real game. Indeed, adults typically reject using children's hunting techniques, except for teaching purposes or if there is a real meat scarcity known as *mò t E pEnE*, also described as *faim de viande* (Motte-Florac et al. 1996). In sum, our results support the idea that there is a children's culture among the Baka, at least related to some domains of their LEK. Importantly, our data, in contrast to those studies which suggest that children's cultures do not exist in relation to children's play and games, show that such cultures also affect subsistence and productive activities, at least among children in small-scale societies.

It is worth noticing that the implications of the existence of children's LEK go beyond the theoretical realm as the knowledge and practices examined here are intimately related to food procurement. As children in other small-scale societies do (Bird-David 2005; Crittenden et al. 2009; Konner 2016; Tucker and Young 2005), Baka children perform hunting, fishing, and gathering activities mostly without adult supervision with the aim of getting a snack or food (Gallois 2015), which might have an important impact on their nutritional status, development, and health. Food procurement becomes even more important in cases of seasonal changes or changes in food availability (Crittenden et al. 2009; Leonard and Thomas 1989), as well as when a society is facing socio-ecological changes (Little and Gray 1990). In that sense, our first results suggest that a greater focus on "children's LEK" might help in our understanding of factors associated with children's nutrition, health, and overall well-being.

A last important aspect related to the existence of children's culture is that its study might inform us on potential cultural changes. For example, because several of the names reported only by children were unknown by adults, the question arises about the origin of those names. One plausible explanation is that children invent at least some of the names listed, which fits well with insights from previous research emphasizing children's creativity and suggesting that children build their own knowledge by integrating what they are taught by others and what they experience by themselves (Corsaro 2014; Johanson 2010; Kamei 2005; Niskac 2013). Moreover, in our study, some of the terms reported only by children are linguistically close to the Nzime language, in the Bantu-linguistic family, or to French. Baka children in the studied villages are in daily contact with Nzime children, contact that increased since the Baka settled in the village along the logging road. In such a situation, the use of such names might,

indeed, reflect the situation of cultural change that the Baka face nowadays (Sercombe 1996), at least within children's own corpus of knowledge. Acknowledged to be cultural sponges (Mesoudi 2011), children rapidly acquire knowledge from different sources which they might then use to create new knowledge. Such knowledge reflects their past cultural heritage but it can be also used to predict future cultural trends.

The Overlap Between Children's and Adults' LEK

Acknowledging the specificity of some of the knowledge held by children does not preclude overlaps between children's and adults' knowledge, as they are part of the same culture. So, the second important finding of this work relates to the overlap, both in terms of content and structure, between children's and adults' LEK.

Regarding content, important overlaps exist between children's and adults' knowledge of game and wild edibles. This finding is not surprising and has been previously reported by research highlighting the precocious acquisition of ecological knowledge by children from small-scale societies (see for instance Demps et al. 2012; Hewlett 2014; Hewlett et al. 2011; Koster et al. 2016; Quinlan et al. 2016; Reyes-García et al. 2009; Soengas López 2010). Similarly, our findings also show that, from an early age, children acquire knowledge related to the most common or the most commonly used species in the area. Moreover, we found that children in middle childhood are familiar with species uncommon in their daily life, but emblematic for the Baka culture. Thus, even young children reported game or wild edibles which they had rarely seen and most probably never hunted or gathered, such as gorillas, elephants, or rare species of yams. Those species are important for Baka adults' hunting and gathering practices, but they are also symbolically important for children, as they form Baka cultural cosmology (Fitzgerald 2011). A similar finding has been recently reported by Quinlan et al. (2016), who described how children from Caribbean villages first learn the most eaten and used, but also the most culturally important, plant species. As children cannot acquire this knowledge through personal experience, our results suggest that children's LEK acquisition not only occurs through children's involvement with their close natural environment (Zarger 2010), but also through imaginary or real oral stories that allow children to access adult culture (Sugiyama 2011).

Children's LEK also relates to adults' LEK in its patterned distribution and specifically in the gendered intracultural division of knowledge. Thus, like Baka adults' LEK, children's LEK is clearly marked by the knowledge holder's gender; boys and girls tend to have similar levels of knowledge related to wild edibles, but boys tend to have a higher score on animal identification tests than girls (see Demps et al. [2012] for similar results). The result is not surprising as, from an early age, children's daily life is clearly marked by their sex, echoing the sexual division of labor shown among adults (Gallois et al. 2015). For example, although children from both sexes spend time looking for food, there are gendered differences, with hunting being a clearly more boy-oriented activity. Thus, the gendered differentiation in children's knowledge is part of the construction of the gender identity across the lifespan (Best 2004; Lancy 2010) and the gendered structure of activities and LEK mimics the adults' structure of LEK. A similar early gendered differentiation of activities and knowledge has also been reported

among children in other small-scale societies (Quinlan et al. 2016; Ruiz-Mallén et al. 2013; Setalaphruk and Price 2007; Shukla and Sinclair 2009; Tian 2016), which suggests the existence of a quite common pattern.

The Dynamic Nature of Children's Culture

Our third finding relates to the dynamic nature of children's culture and specifically to the increasing convergence between children's and adults' knowledge as children grow up. Indeed, our data show that the expertise that Baka children display in specific categories, such as mice, fish, caterpillars, and mushrooms, fades as children approach adulthood. Children have higher expertise than adults in items that are collected through techniques and in environments adapted to childhood. But, as children's expertise varies with age, so does their knowledge. For example, we found that whereas children from middle childhood reported many generic terms, their knowledge became more precise with age, with adolescents reporting more accurate terms. In that sense, echoing findings also reported among other small-scale societies (Gurven et al. 2006; Hewlett and Hewlett 2012), our work suggests that the early acquisition of generic knowledge on animals and wild edibles seems to be a requirement for the acquisition of more complex knowledge, as children seem to learn through a multi-stage process involving many actors (Reyes-García et al. 2016a). In other words, as also reported among other small-scale societies (Quinlan et al. 2016; Zarger 2010; Zarger and Stepp 2004), children tend to acquire knowledge related to the close and easy-to-target elements of their environment first, a step that seems to play an important role in children's cognitive development (Wyndham 2002). As children age, both their ecological and social environment expand, allowing them to acquire new knowledge and skills.

Once children enter adolescence, they begin to learn more complex skills and, at the same time, they start shedding their childhood behaviors, knowledge, and practices (Montgomery 2008a). For example, our ethnographic observations suggest that the use of bow and arrows or slingshots (children's hunting techniques) becomes rare during Baka adolescence. Instead, adolescents perform collective hunting of small mammals using smoke and they start to use adults' spears, mainly for hunting with dogs, a sign that they are entering adulthood. Similarly, while young girls usually play at cooking plants and gather sub-spontaneous tubers in the surroundings of the village, it is rare to see pre-teen girls indulging in such practices, other than when they do so to accompany and take care of the younger ones. Adolescent girls replace these activities with others that are more common in the adult world, such as gathering commercial forest products or agricultural tasks.

Conclusion

Through the focus of children's knowledge, the work presented here emphasizes that there is some specificity in Baka children's LEK, a fact that points to the direction of the existence of a Baka "children's culture." By taking a

child-focused approach, this study underscores the importance of examining an unexplored area within the research on cultural transmission; i.e., how children's knowledge might be integrated into adults' culture and how might it contribute to cultural changes. Understanding the dynamic nature of children's culture might yield insights into research on cultural change. For example, considering the existence of children's culture, might it be worth asking how children's culture influences adult culture? Under which circumstances does children's specific knowledge and techniques enter into adults' behaviors? It might also help raise questions on the pathways through which knowledge is transmitted. Thus, while most studies exploring cultural transmission mainly focus on the way children acquire knowledge (Hewlett and Cavalli-Sforza 1986), it might be worth considering whether and how children bring new cultural elements and participate in the transmission of knowledge within the whole society. Do some elements of children's culture also affect the knowledge and practices of older children and adults? To what extent might children's innovations enter into adulthood once these children become adults? Answering to such questions would let us understand more accurately the role played by children in the process of cultural changes.

Note

[1] The questionnaires used for this study are available in http://icta.uab.cat/Etnoecologia/lek/.

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