


Inter- and intra-cultural variation in learning-through-participation among Hadza and BaYaka forager children and adolescents from Tanzania and the Republic of Congo

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We examined cross-cultural variation in children's learning-through-participation in economic work in two forager societies; the Hadza of Tanzania and the BaYaka of the Republic of Congo. We used observational data from 46 Hadza (41% female) and 65 BaYaka (48% female) children and adolescents between the ages of 3 and 18; interview data from 73 Hadza (49% female) and 52 BaYaka (56% female) adults; and ethnographic observations from both populations. Results showed that by providing tools, assigning chores, and foraging with children, Hadza and BaYaka adults provided opportunities for autonomous learning through facilitating participation. Furthermore, although both Hadza and BaYaka children foraged alongside adults when they could be of help, Hadza children were more likely than BaYaka children to forage independently, and BaYaka children were more likely than Hadza children to participate in domestic tasks. We argue that these strategies provided children with opportunities to learn while contributing economically.

Nous avons examiné les variations interculturelles dans l'apprentissage des enfants dans le contexte de leur participation à des travaux économiques dans deux sociétés de chasseurs-cueilleurs; les Hadza de Tanzanie et les BaYaka du Congo. Nous avons utilisé les données d'observation de 46 enfants et adolescents Hadza (41% femmes) et 65 BaYaka (48% femmes) âgés de 3 à 18 ans, celles d'interviews de 73 adultes Hadza (49% femmes) et de 52 adultes BaYaka (56% femmes), ainsi que des observations ethnographiques sur ces deux groupes. Les résultats montrent qu'en leur fournissant des outils, en leur assignant des tâches et en chassant et en cueillant avec les enfants, les adultes Hadza et BaYaka leur offrent des possibilités d'apprentissage autonome tout en facilitant leur participation. En outre, alors que les enfants Hadza et BaYaka chassent et cueillent aux côtés des adultes quand ils peuvent, les enfants Hadza sont plus susceptibles que les enfants BaYaka de recourir à la chasse et à la cueillette. Ces derniers sont aussi plus susceptibles que les enfants Hadza de participer aux tâches domestiques. Nous en concluons que ces stratégies fournissent aux enfants des opportunités d'apprentissage tout en contribuant, parallèlement, aux ressources économiques de leur groupe.

Keywords: learning-through-participation, hunter-gatherers, child development, cross-cultural psychology

Introduction

Child development is influenced by a variety of factors including physical and social settings, customs of childcare, ethnotheories regarding appropriate child and parent behaviour, and peer cultures (Nsamenang & Lamb, 1995; Super & Harkness, 1986). For example, in Western societies, adults primarily organise children's learning didactically, with school teachers and parents striving to facilitate knowledge acquisition through explicit instruction and pedagogical conversations (Morelli, Rogoff, & Angelillo, 2003). On the other hand, in small-scale subsistence societies, children's learning is woven into the fabric of everyday practice and experience; by meaningfully participating in economic activities in collaboration with adults and other children, children also develop moral, social, and intellectual competencies (Paradise & Rogoff, 2009; Serpell, 2011).

Bame Nsamenang frequently bemoaned the ways in which contemporary psychology retained a Eurocentric bias, highlighting the persistent colonial nature of the field (Nsamenang, 2007). For example, in his work with the Nso of Northwest Cameroon, Nsamenang challenged the assumption that child development was unaffected

by the social and cultural setting in which it occurred (Nsamenang, 1995; Nsamenang & Lamb, 1993, 1995). He demonstrated that socialisation practices varied *within* cultures alongside gender, generation, religion, and education. He also argued that socialisation was achieved through anticipatory socialisation, guided participation, peer culture, and parental expectations. In doing so, he prioritised indigenous African cultural traditions while acknowledging the role of Arabic/Islamic influence and Western cultural legacies on contemporary Africa's educational landscape.

In honour of Nsamenang's commitment to research on indigenous African socialisation, this paper aimed to explore inter- and intra-cultural variation in children's learning-through-participation (Rogoff, Paradise, Arauz, Correa-Chávez, & Angelillo, 2003) within two African hunter-gatherer societies; the Hadza of Tanzania and the BaYaka of the Republic of Congo. Unlike agricultural societies like the Nso studied by Nsamenang, hunter-gatherers (or foragers) are mobile populations that primarily rely on non-domesticated resources; are fiercely egalitarian in the sense that there is no inherited hierarchy according to age, and little differentiation of status

according to sex (Woodburn, 1982); value autonomy in the sense that individuals rarely direct each other or impose their will on one another (Gardner, 1991); share food widely (Kitanishi, 1998); rarely store food; and have few material belongings (Kelly, 1995). Despite these cultural similarities, BaYaka and Hadza children's contributions to subsistence are variable, ranging from rare to substantial (Crittenden, Conklin-Brittain, Zes, Schoeninger, & Marlowe, 2013; Hagino & Yamauchi, 2016). This variation is likely due to ecological constraints (for example, access to easily acquirable food, risk of getting lost) and ethnotheories about children's capabilities, roles, and responsibilities.

Goal of the study

Here, using qualitative and quantitative observational and interview data, we sought to investigate how cultural and ecological variation contributed to differences in Hadza and BaYaka children's participation in economic work, and how forager adults facilitated this participation.

Ethnographic contexts

The Hadza are arid savannah-woodland foragers from Northern Tanzania (Blurton Jones, 2016; Marlowe, 2010). Approximately 150 of the 1 000 Hadza hunt and gather as their primary means of subsistence. These foraging Hadza maintain a strict division of labour; Hadza men primarily collect honey and bow-hunt small and large game. Women gather berries, baobab, and tubers (Blurton Jones, 2016; Marlowe, 2010). As a result of climate change and encroachment on their lands by pastoralists (Mabulla, 2012), the Hadza are increasingly reliant on maize and other domesticates gifted by missionaries and ethno-tour companies or acquired by trade with neighbouring pastoralists (Yatsuka, 2015). In the past, Hadza camps were highly nomadic and moved every two to three months (Marlowe, 2010); presently, most camps are semi-permanent.

The BaYaka surveyed as part of this study are most closely related to the Mbendjele BaYaka (Lewis, 2002). They live in the tropical rainforest of the Congo Basin. Men primarily collect honey and hunt with spears, crossbows, traps, and nets. Men also hunt with guns provided by their farming neighbours, with whom they maintain extensive trade relationships (Joiris, 2003). Women focus on collecting wild yams, nuts, mushrooms, *koko* (*Gnetum spp*) and other greens. Both men and women tend low-maintenance forest gardens, collect liana fruit and caterpillars, and fish (Kitanishi, 1995). In contrast to the Hadza, BaYaka men and women's foraging activities often overlap, with men sometimes gathering, and women sometimes participating in hunting activities (Hewlett, 1991). The BaYaka surveyed here live in a village setting for approximately six months of the year, though overnight fishing, hunting, and gardening trips often occur during this time. Approximately two months of the year are spent at caterpillar camps, and another three to four months at long-term fishing camps. Data collection for this paper straddled honey and berry collecting seasons among the Hadza (Marlowe & Berbesque, 2009), and fishing and caterpillar seasons among the BaYaka (Kitanishi, 1995).

Data were considered comparable because children in both societies are relatively productive during these seasons and often work alongside adults.

Methods

Consent procedure

All consent procedures and research protocols were approved by the University of Cambridge Department of Psychology Research Ethics Committee (PRE.2016.026; PRE.2018.023). In-country permission was received from the Tanzanian Commission for Science and Technology (COSTECH) and for the Republic of Congo from the Centre de Recherche et D'Etudes en Sciences Sociales et Humaines (CRESSH) and the Institute de Recherche en Sciences Exactes et Naturelles (IRSEN). Before data collection began, a community meeting was held in each camp in which the researcher intended to work. During this meeting, and with the help of an interpreter, the researcher explained the study aims, the data collection procedure, and the gifts to be given to participants at the end of the stay. Participants were also told that they could withdraw from the study at any time. Camp members were given the opportunity to ask questions about the research before deciding by consensus whether research could be conducted in the camp. No camps refused participation. This process was repeated with all individual participants, to ensure their free, prior and informed consent. Oral adult consent and child assent was obtained from all participants. Following the research stay, gifts were given to all camp members, irrespective of whether or not they had participated in the study.

Demographic information

Among the BaYaka, quantitative data were collected in August through September 2016, 2017, and 2018 in 7 camps ranging in size from 8 to 51 inhabitants (mean=31, SD=17.98). Among the Hadza, quantitative data were collected in March and April 2017 in 3 camps of 41 to 73 inhabitants (mean= 53.67, SD=17.01). Upon arrival in a camp, a census was conducted to learn the names of all permanent residents and their kinship relationships, marital status, number of children, and age. In order to estimate the age of children, we asked adults to rank their own children, or a set of cousins, from oldest to youngest. Age was estimated based on this rank, as well as developmental cues and dentition.

Behavioural observations

Forty-six Hadza (mean age = 9.98; 41% female) and 65 BaYaka children (14 children sampled >1 year, mean age in first year observed = 10.58; 48% female) between the ages of three and 18 were observed using a focal follow procedure. Focal children and adolescents – which we will collectively refer to as children – were assigned two 2-hour sampling blocks; one in the morning (usually between 8 and 11am) and one in the afternoon (usually between 12 and 3pm). In 2016, these sampling blocks were scheduled over two randomly assigned days; in 2017 and 2018, these were scheduled on the same day. Focal follows were terminated if we perceived that the child was growing uncomfortable or anxious due to our presence.

If a child was not available during the assigned sampling block, the block was rescheduled or omitted based on circumstance. Each child was observed, on average, for 256.7 minutes (SD = 123.52), totalling 28 494 1-minute long observations.

Using a 30-second observe, 30-second record procedure, we first recorded whether the focal child was working, and then described the type of work they were engaged in. Following Munroe and colleagues (1984), we defined work as: “all instrumental activities judged to contribute to the maintenance of the household or the well-being of its members” (p. 369). Following data collection, we then grouped work activities into five categories using the descriptions in our notes. These categories were determined based on our perception of task difficulty, both in terms of finding resources, and the strength and knowledge needed to successfully collect them (Lew-Levy & Boyette, 2018). These were:

- i* *Gathering* – for the Hadza, of berries, baobab, and greens, and for the BaYaka, of fruit, caterpillars, grub, garden products, fish, tree gum, and greens.
- i* *Hunting and trapping* – for the Hadza, with bows and arrows or by hand, and for the BaYaka, with spears, snares, guns, and sling shots.
- i* *Honey collecting*
- i* *Collecting wild tubers*
- i* *Household chores* – including fetching water, firewood, participating in household construction, doing dishes, laundry, sweeping, manufacturing tools and containers, and cooking.

We also recorded whether children were interacting with adults, and whether adults were in proximity of the children. Proximity was defined as within speaking and/or sight distance of the focal child, and thus close enough to monitor their behaviour and intervene when necessary. Finally, in a subset of observations, we recorded any chores assigned to the focal child during the 30-second-observation window (Lew-Levy et al., in press).

Inter-coder reliability was assessed among the BaYaka only in 2017. SLL and AHB simultaneously followed 7 village-dwelling children for a total of 711 observations (female = 4; early childhood = 1, middle childhood = 2, adolescence = 4). Reliability was high across all codes; participation in work (yes/no), Kappa = 0.93, $Z = 24.9$; working alongside adults, Kappa = 0.93, $Z = 24.9$, and chore assignment (yes/no), Kappa = 0.89, $Z = 23.8$. We did not assess the reliability of adult proximity ratings.

Adult interviews

Interviews were conducted in four of seven BaYaka camps and all three Hadza camps. Interviews were conducted with all individuals determined to be adults – individuals of marriageable age (approximately > 18 years of age), though not necessarily married or with children. The following questions were asked every evening in each camp for 7 to 13 days in a row:

- i* “What did you do today?”
- i* If the participant said that they had foraged, we asked “Who did you forage with?”
 - ñ* If the participant did not name a child, we asked “Why didn’t you take a child foraging with you?”

- ñ* If the participant did name a child, we asked “Why did you take this child foraging with you?”

In Congo, these interviews were primarily conducted in BaYaka, the first language of the participants; in Tanzania, they were primarily conducted in Swahili, the second language of the participants. In cases where individuals who had foraged together were also together during the interviews, we asked one of these individuals, and then asked the other individual if they had anything to add. We included these responses as having been given by both individuals. In cases where individuals who had foraged together were not together during the interviews, we asked each participant separately. If an individual was not in camp during the interview period, we followed up in the morning or evening of the following day. When participants visited other locations overnight (for foraging trips, visits with kin in other camps, or village visits), we asked them about their whereabouts upon their return. If we could not confirm the location of a participant, the interview was omitted.

For the Hadza, this yielded a total of 469 interviews of 73 Hadza adults (female = 49%), with a mean of 6.42 responses per individual (SD = 1.18). For the BaYaka, this yielded a total of 475 interviews of 52 BaYaka adults (female = 56%). Six BaYaka adults were sampled twice or more, as they inhabited more than one sampled camp during the 2016 and 2017 field seasons. This yielded a mean of 9.13 responses per BaYaka individual (SD = 6.23).

Participation observation

Participant observation was conducted over 12 months between 2016 and 2018 by SLL among the BaYaka; and over 20 months between 2004 and 2016 by ANC among the Hadza, with an additional two months conducted in 2017 by SLL. We participated in culturally salient activities including foraging, cooking, childcare, dancing, singing, and ceremonies. Additionally, we conducted informal interviews on learning and life history with children and adults. Because the ethnographic work occurred over several years, we were able to qualitatively examine how children’s participation in adult activities changed with age.

Analysis

We tested for differences in overall time allocation to work, proximity to adults during work, and interaction with adults during work using Mann-Whitney U tests. In order to examine cross-cultural variation in these activities, the first set of analyses were conducted on the sample as a whole, with ethnicity as the grouping variable. In order to investigate intra-cultural sex differences in activities, the second set of analyses were conducted on the Hadza and BaYaka samples separately, with sex as a grouping variable. Since age was not a predictor variable in these analyses, counts of time allocation to work, proximity to adults during work, and interaction with adults during work were summed across years for children with repeated observations. To examine cross-cultural variation in why adults did or did not forage with children, we created response categories based on the interviews. These were the dependent variables in a series of multilevel logistic

Table 1. Percent of observations and Mann-Whitney U tests results examining inter-ethnic and intra-ethnic sex differences in work participation an adult proximity and interaction during work.

	Hadza			BaYaka			Total		
	Female	Male	Z	Female	Male	Z	Hadza	BaYaka	Z
<i>% total observations</i>									
Gather	9.19	3.90	1.97*	6.69	3.48	1.06	6.20	4.94	-0.26
Honey	0.28	7.03	-3.10**	0.07	1.43	-0.98	4.10	0.81	4.73***
Household	6.81	3.86	-0.57	17.42	7.00	4.22***	5.14	11.73	-3.87***
Tubers	4.81	2.11	2.85**	7.54	3.45	1.61	3.28	5.31	-1.31
Hunt/Trap	0.09	5.58	-2.44*	0.05	2.01	-1.38	3.20	1.12	1.86
Total work	21.19	22.48	-0.11	31.78	17.37	3.74***	21.92	23.91	-0.45
<i>% work</i>									
Proximity to adults	47.91	29.04	1.90	67.03	52.12	0.41	36.95	61.12	-2.20*
Interaction with adults	25.88	14.56	1.76	33.90	21.59	1.11	19.31	29.02	-1.98*

Note. Percentages represent population proportions. Wilcoxon rank-sum tests were conducted on participation proportions; for work activities, the denominator was total observations; for proximity and interaction with adults, the denominator was total observations spent in work. Positive z-scores indicate that children in the first column (female/Hadza) participate in said activity more than children in the second column (male/BaYaka); negative values indicate the opposite. *p* values: * ≤ 0.05 ; ** ≤ 0.01 ; *** ≤ 0.001 .

regressions, which included the main effects of sex, ethnicity, and their interaction. Because these interviews were made up of repeated responses, and because different camps were sampled, we included interviewee and camp as random effects.

Results

The population proportions for work activities, adult availability, and interaction with adults by ethnicity and sex is presented in Table 1. While Hadza boys and girls participated in work at similar rates ($U = 251.5$, $p = 0.92$), BaYaka girls participated in work significantly more than BaYaka boys ($U = 811.5$, $p < 0.001$). However, there were stronger sex differences in work types among the Hadza than the BaYaka, consistent with a more rigid sexual division of labour among the former (Froehle et al., 2019; Lew-Levy, Boyette, Crittenden, Hewlett, & Lamb,

in press). Finally, Hadza children were less likely to be in proximity of adults ($U = 1\,061$, $p = 0.03$) or interact with adults ($U = 1\,094.5$, $p = 0.048$) during work when compared to BaYaka children.

Hadza adults reported foraging on 54.3% of interview days, representing a total of 160 foraging trips. Of the Hadza foraging trips, 32.5% included children included an average of 1.8 children (max = 7, SD = 1.5). BaYaka adults reported foraging on 62.6% of interview days, representing a total of 212 foraging trips. The 37.7% of BaYaka foraging trips which included children also included an average of 1.8 children (max = 7, SD = 1.3). Women in both societies were more likely to report foraging with children than men (Hadza: 48.0% vs. 28.4%; and BaYaka: 43.3% vs. 33.1%). The kinship relationships between adults and children who foraged together can be found in Table 2. Table 3 outlines the percent of foraging days adults spent in different foraging activities and shows that Hadza adults were most likely to report foraging with children when targeting honey (50% of honey collecting trips, usually from stingless bees), while BaYaka adults were most likely to report foraging with children when gathering (62.5% of gathering trips).

Why do, or don't, adults forage with children?

Results for the logistic regressions investigating reasons for foraging/not foraging with children can be found in the Appendix. Adults cited a multitude of reasons for not foraging with children. The main reasons involved

Table 2. Percent of foraging groups that contained at least one related adult-child/adolescent dyad

	Hadza	BaYaka
Parent-offspring	34.62	46.25
Sibling	13.46	12.50
Aunt/uncle-niece/nephew	15.38	16.25
Grandparent/grandchild	15.38	17.50
Other/no kin dyads	36.54	23.75

Note: Values add up to >100% because groups contained more than one type of adult-child/adolescent dyad

Table 3. Percent of foraging reports that included various foraging activities

Activity	Hadza				BaYaka			
	Total foraging days	Female foraging days	Male foraging days	With children/adolescents	Total foraging days	Female foraging days	Male foraging days	With children/adolescents
Honey	46.72	15.60	69.33	50.00	6.92	2.92	12.71	2.78
Hunt/Trap	13.13	3.67	20.00	16.67	24.22	6.43	50.00	15.28
Gather	32.43	50.46	19.33	29.76	56.06	61.99	47.46	62.50
Tubers	18.53	40.37	2.67	20.24	25.26	37.43	7.63	26.39

Note. Values represent population proportions. Note that these are self-reports regarding the resources targeting during foraging trips; individuals foraging in groups sometimes reported resources that were collected by the group, not necessary by the individuals themselves (e.g. Hadza women rarely collected honey, but sometimes accompanied their husbands during honey collection trips). Values add up to >100% because some individuals reported participating in more than one activity per trip.

distance, danger, autonomy, and disturbance. Concerns regarding distance included that the foraging patch was too far, children were not able to walk well, or that children were too slow. Men were 2.94 times more likely than women to cite distance as a reason not to forage with children, 95% CI [0.20, 1.95], $p = 0.02$. Concerns regarding dangers included weather (for example, rain and high or low temperatures), presence of elephants, lack of food, having to walk through deep waters, or risks involving climbing on rocks. Sex, ethnicity, and their interaction were not significant predictors for citing danger as a reason not to forage with children. Additionally, adults cited autonomy as a reason for not to take children; children were already occupied, either in play or work, or in a subset of cases (9%) adults themselves did not want to forage with children. The BaYaka were 7.91 times more likely than the Hadza, 95% CI [0.90, 3.24], $p < 0.001$, and women 3.33 times more likely than men, 95% CI [-2.02, -0.39], $p = 0.004$, to cite autonomy as a reason not to forage with children. However, the interaction between sex and ethnicity was also significant, 95%CI [0.09, 2.22], $p = 0.03$, indicating that the effect of sex on citing autonomy as a reason to forage with children was true for the Hadza only. Disturbances such as fussing for food or the possibility of scaring off animals with noise or motion were cited by the Hadza only. Sex was not a significant predictor for citing disturbance among the Hadza.

Furthermore, adults cited several reasons for why they foraged with children. These were grouped into company, autonomy, imparting knowledge, and help. Both the Hadza and BaYaka stated that they took children for company; either because adults themselves had no one to forage with, because there was no one in camp to watch the children, or because adults enjoyed foraging with children. Sex, ethnicity, and the interaction between sex and ethnicity were not significant predictors for citing company as a reason to forage with children. Adults also reported that they foraged with children because children followed them independently. The Hadza were 12.92 times more likely than the BaYaka to state that children autonomously joined adult foraging groups, 95% CI [-4.64, -0.48], $p = 0.02$. Because of low cell counts, we could not investigate the effect of the interaction between sex and ethnicity on citing autonomy as a reason to forage with children. Imparting knowledge (in BaYaka; *bosesi mayele*, literally, to show

knowledge, in Swahili; *kufundisha*, literally, to teach) was also cited as a reason to forage with children. This included imparting knowledge about foraging, medicinal plants, and changing the behaviour of children who were misbehaving when left in camp. Sex, ethnicity, and their interactions were not significant predictors for citing imparting knowledge as a reason to forage with children. Additionally, adults cited taking children to forage in order for children to help with work. For the Hadza, this included carrying baobab, collecting firewood, starting fires, making pegs for honey harvesting, or providing childcare. For the BaYaka, this included finding tubers, taking care of infants, and leading the way to a resource that a child had previously located. Men were 3.11 times more likely than women to cite help as a reason to forage with children, 95% CI [0.18, 2.09], $p = 0.02$. The interaction between sex and ethnicity was also significant, indicating that Hadza men were more likely than BaYaka men to mention foraging with children for help, 95% CI [-4.17, -1.14], $p < 0.001$.

How did adults facilitate children's work?

Drawing from our ethnographic observations, we now outline three ways in which Hadza and BaYaka adults facilitated children's participation in work: providing tools, assigning chores, and composing foraging groups.

Providing tools

When BaYaka and Hadza infants can independently hold themselves up, mothers take children on foraging expeditions. As among other foragers (see for example Konner, 1976), infants are carried in a sling on the mother's side. However, as shown in Figure 1, during work, children are sometimes placed high in slings on their mother's back. This forward-facing position allows children to see the mother's activities, including the use of tools, such as digging sticks or pounding stones in the case of the Hadza; or knives and machetes in the case of the BaYaka. By the time infants in both populations can independently sit, they are routinely in close proximity to foraging tools, often reaching for them when they are in sight. Between twelve and eighteen months, both Hadza and BaYaka infants played with tools, which in some cases were handed to them as distractions while parents were involved in other tasks, or to facilitate instruction (Hewlett, 1991). Although



a



b

Figure 1. (a) Hadza and (b) BaYaka toddlers looking over their mothers' shoulders as they work. Hadza and BaYaka children are often worn high on the back while mothers work, from where they can observe activities, such as (a) digging tubers or (b) bail fishing. Hadza photo by Alyssa N. Crittenden. BaYaka photo a still from a video made by Sarah M. Pope.



a



b

Figure 2. (a) Hadza boys with bows made with the help of older siblings and parents, and (b) BaYaka toddler with hatchet made for her by her father. Hadza photo by Alyssa N. Crittenden. BaYaka photo by Sarah M. Pope.

some anthropologists have described forager parenting as “laissez-faire” (Lancy, 2016b), parents in both populations appeared to be aware of what their children were doing with potentially dangerous objects (Hewlett, 2012), and monitored accordingly. For example, BaYaka mothers and teenage girls removed especially sharp or heavy knives from toddlers’ hands, replacing them with lighter or duller knives, or oriented young toddlers with knives away from other children. Nonetheless, children in both societies are sometimes injured by fire or knives, even when in the presence of caregivers.

As shown in Figure 2, Hadza and BaYaka adults also made child-sized versions of tools for young children, which children were encouraged to use for practice. For example, among the BaYaka, girls carried small baskets made by female relatives on short foraging expeditions with friends or parents; fruit or tubers were removed or added to the child’s basket by adults during the walk home, based on their perception of their child’s strength and carrying capability (see also Hewlett, Lamb, Leyendecker, & Scholmerich, 2000). Among the Hadza, tools included small digging sticks and small bows and arrows furnished by adults or older children (Crittenden, 2016a). Parents also introduced smaller sized pounding stones for baobab processing or small containers in which Hadza children could boil their own food over their own small fires. By middle childhood, children regularly used tools in play (Lew-Levy et al., in press), and by adolescence, children were proficient at using tools during foraging activities.

Chore assignment

From the moment they can walk, BaYaka and Hadza children were assigned tasks which increase in complexity as children age (Crittenden, 2016b; Lancy, 2012). Toddlers were often tasked with bringing objects across camp, and when the task was completed successfully, sometimes received praise. Perhaps in anticipation of future chore assignments, children in both populations practiced more complex tasks alongside adults. For example, a BaYaka mother cutting *koko* leaves into thin strips, a task which requires fine motor skills, sometimes did so alongside her five-year-old daughter, herself also cutting *koko*, though with less success. Among the Hadza, a young child waiting while her mother dug tubers sometimes assisted her

mother or dug in an adjacent hole with a smaller digging stick, whether or not the hole actually yielded a tuber. As children aged, they received fewer assigned chores, but were tasked with more difficult chores which took them farther from home. For example, a five-year-old boy might be asked to fetch five litres of water from a nearby watering hole, while an adolescent girl might be asked to carry greater volumes from farther distances. Thus, although our systematic observations suggested that children and adolescents were rarely assigned chores (Hadza: 2% of observations and BaYaka: 2.1% of observations), our ethnographic observations show that chore assignment contributed to children’s knowledge acquisition.

Foraging groups

As shown earlier, BaYaka children were more likely than Hadza children to forage alongside adults. Our ethnographic material suggests that this difference is normative. For example, SLL observed several instances in which BaYaka parents invited their children to forage with them. In one instance, an adolescent girl who preferred to forage with her friends was repeatedly asked by her mother, and then by her father, to join them in their foraging excursion (Boyette & Lew-Levy, under review). Rather unhappily, this adolescent girl eventually conceded. On the other hand, among the Hadza, ANC has rarely observed parents insisting that their children forage alongside them.

Although both Hadza and BaYaka adults primarily reported learning to perform subsistence tasks from their parents while foraging, the Hadza also stated that they learned to forage with their friends. For example, a recently divorced Hadza man with several young children explained that he learned to collect honey in the following way:

My father and friends who were older than me [taught me]. They used to take me to the bush and sometimes take me very far to be experienced. They used to make me set fire to the comb, blow soot to make the bees flee.

A young adult, known to ANC since he was a child, and now a father of two, explained how he first learned to hunt smaller animals before graduating to larger prey:

I started to go in the bush with my older brother, and when he saw a small animal, like a chacha [bush baby], he would let me shoot it. When I got a bit older, I then started to hunt big animals, like antelope, by myself.

During his adolescence, this same individual often took his own younger brother with him on hunting excursions with the explicit intention of helping him gain hunting and tracking knowledge.

Among the BaYaka, few adults mentioned learning from siblings and other children. Instead, adults reported that their parents or grandparents invited them on foraging trips, sometimes with the expressed purpose of imparting knowledge. For example, an older BaYaka man, a father and grandfather himself, explained how he learned to collect honey in the following way:

When I woke up in the morning, my father said “come walk with me to find honey”. I saw how to collect honey by being close to him. He said “cut the rope, and tie it here”. I was still young, so I couldn’t tie the rope. My father tied the knot and showed me. He told me how to look for honey [by climbing] in the tree. I found the honey in the tree, but didn’t know how to cut the comb, so my father sent me down to make a fire. My father climbed the tree to show me how to get honey.

Another woman explained how she learned to gather: *I learned to gather by walking in the forest with my mother. My mother made me a basket. My mother showed me [how] to find everything.*

Discussion

Using quantitative and qualitative observational and interview data collected among Hadza and BaYaka foragers, we sought to understand variation in children’s participation in work, and how forager adults facilitated knowledge acquisition through participation. As among other foragers (Gardner, 1991; Naveh, 2016), Hadza and BaYaka children were rarely assigned chores. Children decided whether to forage, and with whom. Adults respected children’s decisions to forage with or without adults, even if these decisions countered normative foraging group compositions (i.e. Hadza children foraging with other children; BaYaka children foraging with adults). Taken together, these findings demonstrated that the cultural value of autonomy shared by many foragers is evident in the childrearing practices of Hadza and BaYaka parents (Hewlett et al., 2000). Whereas Nsamenang (2006) noted the indigenous African social ontogenetic paradigm “is premised not on an independent or autonomous frame; its foundational principle is an interdependent or relational script” (p. 295), our data instead suggested that for Hadza and BaYaka foragers, individual autonomy precedes interdependence, even as foragers cooperate in all aspects of life (Endicott, 2011; Gardner, 1991).

However, our results did not show that autonomy translated to laissez-faire socialisation. Indeed, adults actively exposed children to child-sized and adult-sized tools, and, when foraging with children, reported imparting knowledge. Furthermore, while rare, chore assignment was

recognised as a way in which parents facilitated knowledge acquisition. Overall, Hadza and BaYaka adults were attuned to children’s skills, and provided opportunities for learning through intent participation rather than explicit instruction (see also Lancy, 2016a; Nsamenang & Lamb, 1993; Rogoff et al., 1993). While learning was primarily in the domain of subsistence, children also developed an understanding of cultural values and norms of behaviour, such as the sexual division of labour and autonomy.

While ethnotheories of child development shape the learning experiences of children (Super & Harkness, 1986), the opportunities and constraints inherent to children’s ecology also affected the degree to which children can safely learn through participation. For example, adults reported foraging with children when collecting resources that required little skill for success, such as honey from stingless bees (*kanoa*) among the Hadza; or fruits, greens and mushrooms among the BaYaka. Adults also reported soliciting children’s help when participating in these safer foraging activities. More risky activities, such as hunting among the Hadza and climbing tall trees to collect honey from stinging bees (*banjui*) among the BaYaka, were usually not conducted with children because adults were concerned about children’s abilities to walk, inclement weather, and animal encounters.

When unable to forage with adults, our data showed that Hadza and BaYaka children employed different strategies for participating in work. Hadza children usually foraged in child-only groups, independently from adults. This finding is consistent with that of Hawkes and colleagues (1995), who found that Hadza children primarily targeted resources which matched their size and capabilities, such as shallow tubers and small birds located closer to camp, while adults ventured farther away (see also Crittenden et al., 2013). Thus, Hadza children contributed economically by making the best of a small situation (Bird & Bliege Bird, 2002), in the sense that they collected resources which matched their size and capabilities.

Unlike Hadza children, BaYaka children primarily contributed through household and food processing work. While easy-to-acquire resources were less accessible to BaYaka children (Hagino & Yamauchi, 2016), BaYaka food processing is extensive and includes nut cracking, grating cassava leaves, cutting fi strips of *koko*, soaking cassava tubers, and pressing palm nuts into oil, alongside other food processing activities done by both the Hadza and BaYaka, such as roasting and butchering. Thus, though BaYaka children’s contributions were not primarily in the form of foodstuffs, they contributed to the household economy through processing, cooking, and other household work. Similar results were found when comparing child productivity among Hadza and !Kung forager children from the Kalahari in the 1980s (Blurton Jones, Hawkes, & Draper, 1994; Hawkes et al., 1995). These ecologically-dependent strategies provided Hadza and BaYaka children with opportunities to learn while growing into productive participants in the family and campeconomy.

Limitations

The interview format restricted us from investigating how child-specific variables (for example, child age and child sex) influenced the responses of adults. For example, adults who stated that they did not forage with children because they walked too slowly may have had younger children in mind. Furthermore, our data collection was restricted to one or two foraging seasons; a year-long observational study encompassing seasonal variation in resources may reveal different patterns of participation for Hadza and BaYaka children. While none of our child participants were in school at the time of data collection, many had attended a school at some point in their lives, which may have consequences for children's learning and cognition (Davis, 2014). Climate change and logging have contributed to resource stress among the BaYaka, perhaps leading to different patterns of participation among children (Fernández-Llamazares et al., 2015). Climate change, presence of missionaries and NGOs, and ethno-tourism may also have affected resource availability among the Hadza, and thus, children's activities (Pollom, Herlosky, Mabulla, & Crittenden, under review; Yatsuka, 2015).

Conclusion

Nsamenang advocated for research focused on how children from Africa's diverse cultures acquired knowledge through participation in adult tasks. Building on his work, the present paper explored this topic among two populations of African foragers. Our study suggested that, due to environmental risks, resource complexity, and ethnotheories regarding appropriate child and parent behaviour, Hadza and BaYaka children participated in different work activities. Nonetheless, and likely more so than for farmers, Hadza and BaYaka forager children were guided through autonomous participation in culturally relevant activities, including subsistence (Boyette, 2016; Gallois, Duda, Hewlett, & Reyes-garcía, 2015; Lancy, 2016a; Rogoff et al., 2003). Future studies should consider differences in subsistence and environment when investigating learning cross-culturally.

Acknowledgements

Funding for data collection and writing was provided to S.L.L. by the Cambridge International Trust, the SSHRC Doctoral Scholarship (Award no. 752-2016-0555), the Ruggles-Gates Fund for Anthropological Scholarship of the Royal Anthropological Institute of Great Britain and Ireland, the Smuts Memorial Fund, the Worts Travelling Grant, and the Cambridge School of Biological Sciences Fieldwork Fund. We would like to thank the BaYaka and Hadza families who agreed to participate in this research. From Congo, we would like to thank Prof. Clobite Bouka-Biona from IRSEN, who facilitated the acquisition of research permits and infrastructure, Dzabatou Moise, who served as a community liaison, and our field assistants, Mekouno Paul and Koutain Mindoula. From Tanzania, we would like to thank Prof. Audax Z. Mabulla from the University of Dar es Salaam, who facilitated the acquisition of research permits and infrastructure, and our field assistant, Shani Msafir Sigwazi.

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Appendix. Results of the multilevel logistic regressions examining reasons to forage, or not, with children. For fixed and interaction effects, values represent B (SE). For random effects, values represent variance (SD).

Dependent variable	Fixed effects			Interaction	Random effects	
	Intercept	Sex	Ethnicity	Ethnicity X Sex	Individual	Camp
<i>Reasons not to forage with children¹</i>						
Distance	−0.99(0.37)**	1.08(0.45)*	−0.99(0.51)	−0.95(0.69)	0.64(0.80)	0.00(0.00)
Danger	−1.95(0.69)**	−0.03(0.55)	−1.43(0.97)	1.08(0.83)	0.42(0.65)	0.76(0.87)
Autonomy	−0.78(0.44)	−1.20(0.41)**	2.07(0.60)***	1.15(0.55)*	0.00(0.00)	0.30(0.55)
Disturbance (Hadza only)	−6.44(2.08)**	0.19(1.47)	NA	NA	31.25(5.59)	0.00(0.00)
<i>Reasons to forage with children²</i>						
Company	−1.69(0.53)**	−1.69(0.91)	−0.71(0.64)	1.44(1.25)	1.15(1.07)	0.00(0.00)
Autonomy	−2.23(0.44)***	0.17(0.64)	−2.56(1.06)*	NA	0.00(0.00)	0.00(0.00)
Knowledge	−1.13(0.53)*	−0.94(0.59)	0.77(0.70)	0.41(0.79)	0.27(0.52)	0.43(0.66)
Help	−1.23(0.46)**	1.14(0.49)*	0.79(0.59)	−2.66(0.77)***	0.13(0.37)	0.25(0.50)

p values: * ≤ 0.05; ** ≤ 0.01; *** ≤ 0.001.

1. Based on 338 interviews with 108 Hadza and BaYaka individuals who had not foraged with children that day, except for disturbance, based on 163 observations from 63 individuals for the Hadza only.

2. Based on 210 interviews with 88 Hadza and BaYaka individuals who had foraged with children than day.

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