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Gender-Typed and Gender-Segregated Play Among Tanzanian Hadza and Congolese BaYaka Hunter-Gatherer Children and Adolescents

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Few data exist on gender-typed and gender-segregated play in hunter-gatherer societies, despite their unique demographic and cultural features which may influence children's gendered play. Using naturalistic observations of Hadza (N = 46, 41% female) and BaYaka (N = 65, 48% female) hunter-gatherer 3- to 18-year-olds from Tanzania and the Republic of Congo, we showed that access to playmates was negatively associated with playing in mixed-gender groups. Young boys did not engage in more rough-and-tumble play than girls, but adolescent boys participated in this type of play more than adolescent girls. Children were also more likely to participate in work-themed play which conformed to gender norms within their society. Findings are discussed within the context of gendered division of labor, child autonomy, and demography.

Play is a universal feature of human childhood (Konner, 2010) and likely contributes to children's physical and intellectual development, including the acquisition of gendered roles and skills (Edwards, Knoche, & Kumru, 2004). Research conducted among postindustrialized, pastoralist, and small-scale farming societies has shown that demography and subsistence influence children's gender-typed and gender-segregated play (Edwards, 1993; Harkness & Super, 1985; Maccoby, 1998; Munroe & Romney, 2006). However, few studies on the play of hunter-gatherer children exist (Hewlett & Boyette, 2013). Research on hunter-gatherers can elucidate how culture and demography shape the development of children's gendered play behaviors because hunter-gatherer social organization is distinct from that of other societies. Hunter-gatherer camps are small, which limits children's access to playmates (Konner, 1976). Hunter-gatherer children have relatively more free time to participate in play than children from other societies (Draper, 1975; Hewlett, Fouts, Boyette, & Hewlett, 2011). And, adults maintain a gendered division of labor (Marlowe, 2007). Furthermore, because hunter-gatherers are diverse in their cultural practices, beliefs, histories, and ecologies (Reyes-García & Pyhälä, 2016), comparative studies can examine how such differences influence children's gendered play. This study used observational data to compare the development of gender-typed and gender-segregated play among Hadza and BaYaka hunter-gatherer children and adolescents from Tanzania and the Republic of Congo.

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The Developmental Function of Play

Play is an evolved feature of juvenility across mammalian species (Byers & Walker, 1995). It is considered to have the following features: (a) no obvious, immediate benefit; (b) characterized as a voluntary, pleasurable activity; (c) involves movements which are exaggerated, repeated, or fragmented, and (d) occurs in the absence of stress (Fagen, 1981). Time spent in play typically decreases as individuals approach maturity (Byers & Walker, 1995). The pervasiveness of play in human childhood suggests that it may enable children to learn the physical and social skills necessary for adulthood, including gender-specific norms and activities (Bock & Johnson, 2004; Lancy, 2016; Li & Wong, 2016; Montgomery, 2009; Pellegrini & Smith, 1998b).

Three main categories of play have been theoretically and empirically tied to learning during the mammalian juvenile period: exercise play, object play, and social play (Fagen, 1981). Exercise play, such as running or climbing, may contribute to physical training of neuromuscular and cardiovascular systems (Byers & Walker, 1995), as well as improved skill and economy of movement (Pellegrini & Smith, 1998a). In humans, exercise play seems to occur more frequently and at higher levels of intensity in boys than in girls (Biddle, Atkin, Cavill, & Foster, 2010; Pellegrini & Smith, 1998a; Yu, Winter, & Xie, 2010) and peaks between 3 and 4 years of age. Object play, which involves object manipulation, is hypothesized to facilitate tool use and construction capabilities (Pellegrini & Bjorklund, 2004). Object play peaks in middle childhood, after which it decreases in early adolescence (Bjorklund & Gardiner, 2012; Pellegrini, Dupuis, & Smith, 2007). Some studies also suggest that boys engage in object play more frequently than girls (Bjorklund & Gardiner, 2012; Pellegrini & Bjorklund, 2004; Yu et al., 2010). Social play, such as rough-and-tumble play (RTP), involves a balance between cooperation and competition, and takes special priority during the juvenile period in nearly all social mammals (Pellegrini & Smith, 1998a). Usually unrelated to aggression, RTP in early and middle childhood may facilitate the development of social (Flanders, Leo, Paquette, Pihl, & Séguin, 2009) and fighting skills (Fry, 2014). In adolescence, RTP may help establish dominance in order to attract mates (Pellegrini, 2003). RTP appears to be a male-dominated form of play in diverse societies including in the United States (Pellegrini & Smith, 1998a), United Kingdom (Blurton Jones & Konner, 1973), China (Yu et al., 2010), and among some small-scale farmers (e.g., Boyette, 2016a). In the west, RTP increases throughout middle childhood, peaks between 11 and 12 years, and declines thereafter (Humphreys & Smith, 1987; Pellegrini, 1995).

In addition, two human-specific play types may also contribute to learning: structured games and pretense play. Structured games may contribute to the development of children's moral and role-taking capabilities (Piaget, 1965; Roberts & Sutton-Smith, 1962). Studies investigating gender differences in children's structured games largely suggest that boys spend more time in structured games than girls (Blatchford, Baines, & Pellegrini, 2003; Deaner et al., 2012; Lever, 1978; Mauldin & Meeks, 1990), and that 11-year-olds engage in more structured games than 7- and 9-year-olds do (Humphreys & Smith, 1987). Pretense play, defined by Lillard (1993, p. 349) as "the projecting of a supposed situation onto an actual one, in the spirit of fun," emerges between 18 and 24 months of age. Pretense may enrich various aspects of children's cognition, including creative thinking (Mullineaux & Dilalla, 2009), narrative and linguistic competence (Hoffmann & Russ, 2012), and theory of mind (Goldstein & Winner, 2011). Since children often imitate the work of same-gender adults in their pretense, this form of play may be a setting in which children practice gendered skills (Bock & Johnson, 2004; Fein, 1981; Lew-Levy & Boyette, 2018; Li & Wong, 2016). Findings regarding gendered participation in pretense have been mixed, with some experimental and naturalistic play studies reporting that girls participate in pretense more than boys, whereas other naturalistic studies report no such difference (see Göncü, Patt, & Kouba, 2002 for review). Pretense play peaks in early childhood, representing 33% of the play of preschoolers in western settings, after which it declines (Fein, 1981).

Beyond gender-typed play, preferences for same-gender playmates are also pervasive in childhood (Maccoby, 1998; Moller & Serbin, 1996; Munroe & Romney, 2006; Whiting & Edwards, 1973). Lee, Howes, and Chamberlain (2007) found that only 11% of 6- to 12-year-old children's self-reported social networks included opposite-gendered individuals. In adolescence, when children have more freedom to choose the contexts in which they interact with peers, adolescents still prefer to "hang out" with same-gender peers (Strough & Covatto, 2002), even as heterosexual teenagers begin to explore romantic relationships (Connolly, Craig, Goldberg, & Pepler, 2004). While most studies suggest that children begin to segregate by gender around the age of three (Maccoby, 1998), cultural features may

also influence the timing of children's gender segregation. For example, Harkness and Super (1985) found that Kipsigis pastoralist children primarily interacted in mixed-gender groups until the age of 6. Between 7 and 9 years, however, children increasingly assorted into single-gender groups, perhaps because children in middle childhood were afforded greater freedom to choose their play partners and were expected to carry out gender-typed household chores.

Children may prefer to play with same-gender others because their behaviors are more compatible (Maccoby, 1998; Pellegrini, 2004). For example, because boys are more physically active than girls (Biddle et al., 2010; Fabes, Martin, & Hanish, 2003), they may find it more satisfying to play with other boys. In a study of preschoolers, boys tended to play more vigorously than girls in single-gender groups, and single-gender playgroups were more frequent than mixed-gender playgroups (Fabes et al., 2003). However, when playing in mixed-gender groups, boys played less vigorously, and girls more vigorously, than when in single-gender groups. Children also participated in less gender-typical play in mixed-gender groups. Thus, while energetic expenditure may motivate gender segregation (Pellegrini, 2004), children nonetheless adjust their play styles to match those of their play partners.

Play in Hunter-Gatherers

Hunter-gatherers can be broadly categorized into two groups: delayed-return and immediate-return. Delayed-return hunter-gatherers tend to store food, are sedentary, accumulate material culture, and sometimes have complex political systems (Kelly, 1995). Immediate return hunter-gatherers tend to be mobile, live in small camps averaging 25–45 individuals, have low population densities, and have multiple residences (Woodburn, 1982). This study is concerned with immediate-return hunter-gatherers, which we will refer to simply as "hunter-gatherers" throughout the remainder of the text.

Hunter-gatherers often share a similar ethos of political, gender, and age egalitarianism, value personal autonomy, and share widely (Hewlett, 1991b; Kelly, 1995; Marlowe, 2010). All hunter-gatherers maintain a gendered division of labor. Among subtropical hunter-gatherers, men typically target animal products and women typically target plant products. However, the degree to which men and women divide labor varies by culture and ecology (Brown, 1970; Kelly, 1995). Because hunter-gatherer children are afforded extensive individual autonomy (Konner, 2016), self-socialization, including through play, is central to their gender development (Draper, 1975).

Although there have been few studies of gender segregation by hunter-gatherer children during play, published studies overwhelmingly report little or no gender segregation. For example, in the only systematic study of gender segregation in play among hunter-gatherer children, Fouts, Hallam, and Purandare (2013) found that Bofi forager children from the Central African Republic were less likely than their farmer neighbors to play in gender-segregated groups in early childhood. Similarly, in a cross-cultural survey of six hunter-gatherer societies from Asia, Africa, and South America, Konner (2005) also found play in multiaged, mixed-gender groups to be the norm. This may be due to the demographic constraints inherent to hunting and gathering as a mode of subsistence, where settlement size is relatively small, and thus, children have limited opportunities to choose same-aged and same-gender playmates (Hewlett, 1991a; Konner, 1976). As a result, both boys and girls may need to adjust their energetic play to match that of opposite-gender playmates (Draper, 1975; Fabes et al., 2003; see also Lancy, 1984), and thus, gender differences in play usually considered gender-typical, such as RTP, may be less pronounced.

Indeed, researchers working with hunter-gatherers in diverse contexts, including the San of the Kalahari, the Aka of the Central African Republic, and the Parakaña of Brazil have found no significant gender differences in the frequency of RTP, whereas these same studies reported differences in RTP in the farming and urban populations studied (Blurton Jones & Konner, 1973; Boyette, 2016a, 2016b; Draper & Cashdan, 1988; Gosso, e Morais, & Otta, 2007). Although differences in RTP may be attenuated, gender differences in other types of play may not be. For example, various studies have found that hunter-gatherer children preferentially imitate gender-specific work activities in their pretense play, suggesting that, as in nonhunter-gatherer societies, some gender roles may be acquired through pretense (Bock & Johnson, 2004; Draper, 1975; Gosso et al., 2007; Lew-Levy & Boyette, 2018). Whereas most of the studies described here focused on single hunting and gathering populations, or compare hunter-gatherers to farmers, more research is needed to uncover how the gendered play of hunter-gatherer children differs from one society to the next.

The Study

Considering the literature reviewed above, this study aimed to examine cross-cultural differences in gender-typed and gender-segregated play among BaYaka and Hadza hunter-gatherers. Our study included participants in early childhood, middle childhood, and adolescence. Although many studies of play track its development during the transition from early to middle childhood, when children demonstrate a growing understanding of family and gender roles (Maccoby, 1998; Moller, Hymel, & Rubin, 1992; Montgomery, 2009), and a greater knowledge of moral norms (House et al., 2013; Konner, 2010), the inclusion of adolescents requires justification. First and foremost, adolescent activities are under-studied in small-scale societies generally (Schlegel & Hewlett, 2011). Hunter-gatherer adolescence is a unique period in development because, although many adolescents can and do assist in childcare and foraging tasks, they are not required to do so and are still primarily provisioned by others (Crittenden, Conklin-Brittain, Zes, Schoeninger, & Marlowe, 2013; Hewlett & Hewlett, 2012). As such, hunter-gatherer adolescents spend much of their time exploring and learning subsistence, social, and sexual skills through imitation, observation, and play (Hewlett & Hewlett, 2012). Thus, it may be informative to include adolescents when seeking to elucidate developmental trends in gendered play among hunter-gatherers.

This study tested a series of hypotheses derived from previous developmental and anthropological research. First, we investigated the relation between gender and time allocation to play. Studies of farmers suggest that girls enter the workforce earlier than boys, and as a result, devoted less time to play as they aged than boys (Bock & Johnson, 2004; Boyette, 2016a; Nag et al., 1978; Whiting & Edwards, 1973). In one of the few analyses of gender, age, and time allocation to play which included data from hunter-gatherers, Boyette (2016a) found that Aka hunter-gatherer and Ngandu farmer girls devoted less time to play with age than boys. Here, with a larger sample of hunter-gatherer children and adolescents from two different societies, we revisited Boyette's original hypothesis, which posits that because hunter-gatherer children and adolescents are provided extensive autonomy, gender differences in child and adolescent time allocation to play should be limited.

Second, we investigated the association between play partner availability and gender segregation. Consistent with previous observations that hunter-gatherer children predominately play in mixed-age and -gender groups (Konner, 2016), and that small camp size limits children's access to same-gender and same-aged children (Konner, 1976), we hypothesized that Hadza and BaYaka children and adolescents would be more likely to segregate by gender during social play in larger camps than in smaller camps. Third, whereas several studies suggest that gender differences in certain play types, such as RTP, are consistent across cultures, these findings have not been replicated among hunter-gatherers. This may be because hunter-gatherer children have fewer opportunities to segregate by gender and thus may have to adjust their energetic play to match that of their opposite-gender playmates. Here, we tested whether gender differences in play types were evident in the two hunter-gatherer populations surveyed. We hypothesized that hunter-gatherer children and adolescents would show few gender differences in these types of play.

Finally, we investigated gender differences in the pretense themes engaged in by Hadza and BaYaka children and adolescents. Adults in both societies differ in the degree to which men and women participate in overlapping foraging activities. For example, one study of Aka net-hunters found that husbands and wives were within view of each other 47% of daylight hours, including during foraging, whereas Hadza spouses were less likely to forage together (Blurton Jones, 2016; Hewlett, 1992; Marlowe, 2010). BaYaka gender roles are also more flexible in other domains. In particular, BaYaka fathers engage in extensive childcare, with Hewlett (1991b, p. 169) reporting that Aka "fathers do more infant caregiving than fathers in any other known society" (see also Konner, 2016). We thus expected BaYaka children and adolescents to show fewer gendered differences in work-themed pretense play than the Hadza because the BaYaka division of labor is less pronounced than that of the Hadza. Although we did not test other specific predictions regarding cultural differences in play, we describe the ethnographic settings for the study, placing special emphasis on socialization and subsistence differences which may lead to cross-cultural variation in play.

Method

Ethnographic Settings

The Hadza live in arid savanna-woodlands in Northern Tanzania (Blurton Jones, 2016; Marlowe, 2010). Living in camps of 20–100 inhabitants, only

approximately 150 of a total population of 1,000 Hadza still hunt and gather for subsistence. As noted above, the Hadza maintain a gendered division of labor (Blurton Jones, 2016; Marlowe, 2010). Honey collecting and bow-and-arrow hunting of small and large game are performed by men while women collect berries and baobab fruit and dig for tubers (Blurton Jones, 2016; Crittenden, 2016b). Hadza children extensively participate in foraging, sometimes producing 25% to over 100% of their daily caloric needs (Crittenden et al., 2013). Compared to other foraging societies, in which adults mostly indulge children and rarely reprimand them (Hewlett, 1991b; Konner, 2016), Hadza parents often use physical punishment and shout at children (Blurton Jones, 1993). Recently, the Hadza have increased their dietary reliance on domesticated cultigens (e.g., wheat, maize) provided to them by local missionaries, ethnotour companies, and sometimes researchers (Blurton Jones, 2016; Crittenden et al., 2017; Gibbons, 2018). Children increasingly attend boarding schools, meaning that fewer children live in the bush year-round; this trend seems to be especially accentuated for Hadza girls.

In this paper, the term BaYaka is used to refer to linguistically related hunter-gatherer groups in Northern Congo, including the Aka and Mbendjele. The subgroup of BaYaka surveyed in the present research are most closely related to the Mbendjele BaYaka (Lewis, 2002). The BaYaka inhabit the dense tropical rainforest of the Congo Basin, and live in camps averaging 22 inhabitants (Hewlett, 1991a). The BaYaka foraging ecology is diverse; collected species include tubers, and especially wild yams, as well as nuts, mushrooms, caterpillars, insect grub, and liana fruit. Various forms of fishing are also conducted, including bail fishing, fishing with traps, poison fishing, and fishing with hook and line. Both collecting and fishing are usually, but not exclusively, conducted by women. Collecting honey, gun hunting, spear hunting, and trapping with wire snares are almost exclusively done by men. Historically, men hunted with crossbows while both men and women hunted with nets, but these activities no longer occur at the research site. Finally, both men and women maintain gardens, in which they grow cassava, plantain, taro, maize, and sweet potato. The BaYaka maintain extensive trade relations with their farming neighbors (Hewlett, 1991b; Lewis, 2002). In contrast to the Hadza, hitting a child rarely occurs and is possibly grounds for divorce (Hewlett, 1991b). While BaYaka children now have access to schools in most village settings, children usually only attend for 2–3 months of the year during less abundant foraging seasons.

Participants

For the BaYaka, data collection took place in August through September 2016, 2017, and 2018 in the Likouala province of northern Congo. Sixty-five BaYaka children were sampled from seven camps (48% female). Of these, 10 children inhabited camps surveyed over 2 years, and four inhabited camps surveyed in all 3 years, leading to repeated observations of these individuals. For the Hadza, data collection took place in March and April 2017 near Lake Eyasi, Tanzania. Forty-six Hadza children were sampled from three camps (41% female). Nearly all (86.7%) of the 3- to 18-year-old children inhabiting the ten surveyed Hadza and BaYaka camps were studied, with children excluded only because they were afraid, shy, or ill, or because there were more children in a camp than we could sample during our allocated stay. No children were followed while they were attending school. Table 1 shows the sample characteristic by age category, gender, and ethnicity.

Upon arrival at a camp, a census was conducted. This census indicated that, on average, 15.7 three- to eighteen-year-old children lived in each camp (SD = 7.9), with 3–24 children in BaYaka camps and 11–26 children in Hadza camps. Biological age for both Hadza and BaYaka children was not known. Therefore, in order to estimate children's ages, we ranked children from oldest to youngest by asking parents about children's birth order, either within a nuclear family or within a set of

Table 1
Age Categories Used in the Analysis, and Number of Participants Based on Gender, Age, and Ethnicity

		Hadza (N = 46)		BaYaka (N = 65)		
Age (years)	Developmental stage	N girls	N boys	N girls	N boys	Total
3–6	Early childhood	3	6	6	7	22
7–12	Middle childhood	10	12	11	15	48
13–18	Adolescence	6	9	14	12	41
Total		19	27	31	34	

Note. For repeated observations of BaYaka participants, only the age category of the first year in which a child was observed is included.

closely related cousins, allowing for ties (Boyette, 2016a; Fouts et al., 2013). Alongside this rank, SLL and a field assistant considered children's physical maturation and capabilities (e.g., Can the child touch their left ear with their right hand? Does the child help with household tasks?), dentition (e.g., Does the child still have deciduous teeth? Smith, 1991), and average inter-birth interval for each society, and then assigned a numerical age to each child. This method is commonly used by anthropologists working in populations that do not know their age in biological years (e.g., Boyette, 2016a; Crittenden et al., 2013). All consent procedures and research protocols were approved by the University of Cambridge Psychology Research Ethics Committee (PRE.2016.026; PRE.2018.023). In-country permission was received from the Tanzanian Commission for Science and Technology and for Congo from the Centre de Recherche et D'Etudes en Sciences Sociales et Humaines and the Institute de Recherche en Sciences Exactes et Naturelles.

Procedure

Observations were systematically recorded in situ using an established focal follow procedure (Boyette, 2016a). SLL lived in the camps where data collection took place, and, in order to build rapport with participants, waited 1–2 days before data collection started. Individual children were then assigned two 2-hr sampling blocks: one in the morning (usually between 8 and 11 a.m.) and one in the afternoon (usually between 12 and 3 p.m.). Observations were paused or postponed in cases of especially bad weather or community events in which the researcher could not participate (e.g., community meetings, dances) and resumed as soon as possible, usually the same day. The timing of these observation blocks allowed us to sample children both inside and outside of camp (Hadza; 45.3% observations in camp, BaYaka; 57.3% observations in camp). We stayed in close proximity to the focal child for approximately 1 hr before the start of the follow in order to habituate the child to our presence. Follows were terminated if we noticed the child growing tired or anxious about our presence. Each child was observed, on average, for 256.7 min (SD = 123.5), totaling 28,494 one-min long observations. In 2016, these blocks were randomly assigned over two separate days whereas in 2017 and 2018 these sampling blocks occurred over a single, randomly assigned day.

Child and adolescent activities were observed for 30 s after which SLL recorded this activity on her data sheet for an additional 30 s before commencing observations again. When play was coded, the observer assigned the play to one of seven specific types (Table 2). Five of these (object play, exercise play, RTP, structured games, and pretense play) were derived from previous studies of human and nonhuman play generally and gender-typed play specifically. An additional two play types, roaming and gentle-and-tumble, were derived from previous studies of play in hunter-gatherer populations (Boyette, 2016a; Konner, 1972). Because these two additional categories were infrequently observed, and are not related to our hypotheses, we included them in measures of overall play but did not consider them in further analyses. In the case of pretense play, the theme of the play was recorded, and categorized upon return from the field. From 2017 onwards, we also noted whether children and adolescents were interacting in mixed-gender or same-gender groups during social play. Social play involved individuals who were actively playing together, as well as individuals who were participating in "onlooker" play, or interacting with players during play (Hughes, 2010). Thus, social play could include adults, and did not necessarily involve collaborative play. Observations of older children playing with infants in the context of childcare was not coded as play.

Inter-Coder Reliability

Inter-coder reliability data were collected among the BaYaka only before the start of the 2017 field season. The Congo research team (SLL and AHB) simultaneously followed seven 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; group composition by gender (mixed-gender, yes/no), K = .99, SE = .005; play (yes/no), K = .92, SE = .02; and play type, K = .92, SE = .02. After each focal follow, reliability assessments were conducted, and any disagreements were resolved by consensus. We did not conduct reliability on pretense play themes, as these were determined by consulting field notes upon return from fieldwork. Reliability could not be conducted with the Hadza, as SLL did not have access to another coder in Tanzania.

Data Analysis

Because our dependent variables were counts (i.e., number of events), seven Poisson generalized linear mixed-models were fit using the *glmer* function with

Table 2
Categories Coded as Play, and Associated Definitions

Play types coded during fieldwork[a]	
Object play	Included activities such as playing with balls (but not soccer), throwing rocks, chopping down trees for the purpose of fun, building toys, such as making balls out of rubber or leaves, fixing dolls, fixing play spears, and making toys. Did not included instances where objects were used in the context of other forms of play (e.g., the construction of houses for pretense)
Exercise play	Playing hide and seek/tag or chasing one another outside of the context of pretense (when playing spirit or animals, chasing would sometimes occur. This was not included here); playing with one's own body, such as cartwheels, downward-facing dog-like postures, etc.; Climbing trees outside of the context of foraging
Rough-and-tumble play	Playful karate chopping, wrestling, hitting, slapping, etc. Did not include play-fighting in the context of pretense (e.g., imitation of adult domestic violence)
Structured games	Organized fun which usually included rules, such as jacks, soccer, and games that involved marching around camp with a rope tied around everyone, etc
Pretense play	Included activities such as pretending to sleep, pretending to do spirit dances, pretending to be animals, pretending to hunt, pretending to harvest honey, pretending to cook, and doll play
Gentle-and-tumble play (not investigated here)	Rolling around on a blanket and sex play
Roam (not investigated here)	This usually consisted of looking for butterflies to catch, looking for play objects in the forest, and walking around camp with no purpose. The child was focused on exploring the environment
Pretense play themes coded after fieldwork	
Playing house	Making small huts and hearth, play cooking, cleaning, etc
Play hunting	Imitating hunting during play, such as pretending to set traps, pretending to hunt with spears, and playing hunter/hunted
Play foraging	Pretending to collect fruits, mushrooms, nuts, etc., and pretending to dig tubers
Doll play	Portraying an object as a doll and treating it as an infant. For the Hadza, the objects included infant bush babies, baobab fruit, and cloth dolls. For the BaYaka, the objects included infant monkeys and stalks of banana
Play honey collecting	Pretending to collect honey, pretending to search for honey, and climbing trees in a manner used for honey collecting
Play tool manufacture	Pretending to make bows, arrows, baskets, matts, and rope
Play fishing	Pretending to bail water for fishing, pretending to fish with hooks, pretending to fish with poison (BaYaka only)
Nonwork themed play	Nonwork-themed pretense such as pretending to sleep, pretending to ride in cars, pretending to be animals, imitating adult social interactions, and imitating religious ceremonies

Note. [a]All play type categories are mutually exclusive.

the bobyqa optimizer in the lme4 package in R (Bates, Mächler, Bolker, & Walker, 2015). In order to test the hypothesis that there would be no gender difference in the age-dependent decrease in play among Hadza and BaYaka children and adolescents, Model 1 investigated overall time allocation to play across childhood. Counts of total observations in which play occurred (i.e., all play behaviors outlined in Table 2) per child per year sampled was the dependent variable. The main effects of gender (0 = girl, 1 = boy), age, and ethnicity (0 = Hadza, 1 = BaYaka), and the two-way interactions between gender and ethnicity, gender and age, and ethnicity and age were included in the model. In order to compare across developmental periods, we grouped age into three categories; early childhood (3–6 years; reference category), middle childhood (7–12 years), and adolescence (13–18 years). Comparisons between children in middle childhood and adolescence were conducted using a post hoc Tukey test with the package lsmeans (Lenth, 2016). In order to account for variation in children's observation time, we included as an offset the log of the total number of observations for each child per year sampled.

In order to test the hypothesis that gender segregation would be more common in camps with a greater availability of play partners, Model 2 investigated time allocation to social play in mixed-gender groups. Counts of social play observations in mixed-gender groups per child per year sampled was the dependent variable. The main effects of ethnicity, gender, age, and the number of children available in camp (continuous), as well as the two-way interactions between gender and ethnicity,

gender and age, and ethnicity and age were included in the model. In order to account for variation in children's time spent in social play, we also included as an offset the log of the total number of observations spent in social play for each child per year sampled. Because mixed-gender play was not measured in 2016, this model included data from 2017 and 2018 only. A further three children never participated in social play during follows and were omitted from this analysis. Thus, the total sample size for Model 2 was 96 children and adolescents (45 Hadza, 51 BaYaka).

In order to test the hypothesis that Hadza and BaYaka children would show few gender differences in play types, Models 3–7 investigated play time allocation to five types of play. Count of total observations per child per year sampled of object play (Model 3), exercise play (Model 4), RTP (Model 5), structured games (Model 6), and pretense play (Model 7) were the dependent variables. Models 3–7 included the main effect of ethnicity, gender, and age, and the interactions between ethnicity and age, ethnicity and gender, and age and gender. Each of these five models included as an offset the log of the total number of observations spent in play for each child per year sampled. Two children never participated in play during follows and were omitted from this analysis. Thus, the total sample size for Models 3–7 was 109 children and adolescents (46 Hadza, 63 BaYaka).

In addition to the fixed and interactive effects described above, two random effects were included in Models 1–7; first, because over-dispersion is common in observational studies of behavior, and because 14 BaYaka children were sampled in more than 1 year, we nested observations within participating children (Elston, Moss, Boulinier, Arrowsmith, & Lambin, 2001). Second, in order to account for the possibility that children's behaviors were influenced by other camp members, we also included a random effect for camp.

Finally, in order to investigate children's gendered participation in pretense themes, we conducted a series of Mann–Whitney *U* tests. This nonparametric alternative was preferred to the Poisson regressions due to the sparsity of data. The dependent variables were the proportions of pretense play by theme per child. Analyses were conducted on the Hadza and BaYaka separately, with gender as the grouping variable. Since age was not a predictor variable in this analysis, counts of participation in pretense play were summed across years for children with repeated observations. Thirteen Hadza children and 16 BaYaka children never participated in pretense play; thus, the Mann–Whitney *U* tests included sample sizes of 33 Hadza and 49 BaYaka children and adolescents.

Results

Description of Children's Play

To situate our findings, we first describe the setting and context of play. Although both Hadza and BaYaka children and adolescents participated in a great variety of activities throughout the day, play represented a large proportion of children's time budget in both societies (Table 3). Play usually occurred in or on the immediate periphery of camp (Hadza; 70.4%, BaYaka; 71.8%). Consistent with prior research, we observed that, from infancy onwards, both Hadza and BaYaka children played with adult tools, such as baobab pounding stones and digging sticks in the case of the Hadza, and knives and machetes in the case of the BaYaka (Lew-Levy et al., 2019). By early childhood, children could, and did, participate in most of the types of play in their cultural repertoires (Figure 1). Much of this play was social (92.5% of Hadza play, 83.9% of BaYaka play). Both Hadza and BaYaka children made dolls; for the Hadza, dolls were usually made with baobab fruit or mud (Crittenden, 2016a). Among the BaYaka, children made dolls using banana shoots or empty bottles. Children carried these dolls in slings, and sometimes soothed or groomed them. Hadza and BaYaka children also played tag, climbed trees, and occasionally wrestled (Crittenden, 2016a; Lewis, 2002). Both Hadza and BaYaka children participated in extensive pretense play, which primarily emulated adult activities. For example, children in both societies manufactured small huts by collecting poles, grass, and leaves. Usually, several huts were constructed side-by-side, in the likeness of a camp. Children sometimes brought their bedding into their huts and pretended to nap. Boys often participated in complementary pretense play, pretending to hunt nearby for the play-camp. Girls tended small fires in front of their huts, over which children cooked very small portions of food, such as maize meal or berries among the Hadza and plantains among the BaYaka. These portions were then eaten by the playgroup, with older children carefully sharing the food to ensure all parties received a relatively equal amount (Crittenden & Zes, 2015). Hadza children also participated in work-play, playfully feeding themselves and others, often by conducting child-specific foraging activities such as trapping weaver bird

fledglings with sap (Crittenden, 2016a). Although both Hadza and BaYaka adults perceived play as the work of childhood, adults rarely encouraged or discouraged children's play with the exception of *bolu*, a type of spirit play conducted by BaYaka children (Lewis, 2002). When children initiated *bolu*, adults often acted approvingly, clapped along, joined the dance, and gave advice regarding singing and performance.

Gendered Development of Play Across Childhood

Overall, children and adolescents in the sample devoted 24.2% of their time to play; this represented 17.6% of Hadza child and adolescent time, and 27.7% of BaYaka child and adolescent time (Table 3). The results of Model 1 investigating the association between ethnicity, age, gender, and frequency of overall play can be found in Table S1. The results show that adolescents were 4.84 times less likely than children in early childhood to participate in play, 95% CI [−2.50, −0.65], $p < .001$. A post hoc Tukey test revealed that adolescents were also 1.95 times less likely than children in middle childhood to participate in play, 95% CI [0.23, 1.12], $p = .001$. The interaction between ethnicity and gender was significant, 95% CI [0.21, 1.71], $p = .01$. However, Figure 2a reveals that BaYaka boys were more likely to play than their Hadza counterparts, with no strong differences when comparing the play rates of boys and girls within each ethnic group. Contrary to our hypothesis that Hadza and BaYaka children would show no gender differences in the allocation of time to play with age, the interaction between age and gender was also significant, 95% CI [0.12, 1.55], $p = .02$. Figure 2b shows that adolescent girls were less likely to play than girls in early and middle childhood, while this same effect was not true for adolescent boys.

Table 3
Child and Adolescent Overall Time Budgets and Play Budgets by Gender and Ethnicity

	Hadza			BaYaka		
	% total observations					
	Girls	Boys	Total	Girls	Boys	Total
Play	20.39	15.44	17.59	21.65	32.70	27.68
Foraging/gardening	14.37	18.62	16.78	14.36	10.37	12.18
Domestic work	6.81	3.86	5.14	17.42	7.00	11.73
Childcare[a]	2.52	0.86	1.58	3.80	0.83	2.05
Music	1.03	3.43	2.39	1.44	0.31	0.82
Travel	24.13	23.23	23.62	16.70	18.29	17.56
Rest	26.71	26.36	26.52	16.31	21.43	19.10
Maintenance[b]	17.31	14.06	15.47	14.04	11.28	12.53
	% play					
Object play	12.59	21.90	17.21	30.04	35.09	33.29
Exercise play	18.99	12.98	16.00	12.83	17.33	15.74
RTP	4.12	9.27	6.68	0.76	1.53	1.26
Structured games	4.00	26.77	15.31	10.98	13.33	12.50
Pretense play	58.58	23.99	41.39	36.97	27.20	30.68

Note. From 2017 onward, two activities could be coded concurrently. This represented 7.08% of the observations from 2017 and 2018. Thus, values may add up to > 100%. Reported percentages represent population proportions.
[a]BaYaka values for childcare are from 2017 and 2018 only; childcare was not systematically recorded in 2016. [b]Maintenance activities include hygiene, grooming, and eating.

Overall, children in our sample spent 60.1% of their social play observations in mixed-gender groups, representing 70.1% of social play observations for the Hadza and 54.8% for the BaYaka. Model 2, testing the associations between ethnicity, age, gender, and frequency of social play in mixed-gender groups, can be found in Table S2. In support of the hypothesis that children were more likely to segregate by gender in larger camps, the number of child inhabitants in a camp was significantly and negatively associated with social play in mixed-gender groups, indicating that, for every additional child in a camp, children were 1.03 times less likely to play in mixed-gender groups, 95% CI [−0.05, −0.02], $p < .001$. Age, gender, ethnicity, and their interactions were not significant predictors of play in mixed-gender groups.

Gender Segregation During Play

Gendered Participation in Types of Play

Among both the Hadza and BaYaka, children spent the greatest percentage of play participating in pretense and object play, and the smallest percentage participating in RTP (Table 3). The results of Models 3–7, testing the associations between ethnicity, age, gender, and types of play, can be found in Table S3. The main effects of ethnicity, gender, and age were not significant predictors for participation in object play. However, the interaction between age and ethnicity was significant, middle childhood; 95% CI [0.30, 2.47], $p = .01$, adolescence; 95% CI [0.48, 3.05], $p = .007$. This indicates that for the BaYaka only, play time devoted to object play increased with age. Furthermore, the interaction between ethnicity and gender was also significant,

Figure 1. Hadza and BaYaka children's play. (a) Hadza and (b) BaYaka children making play houses in or near camp. (c) Hadza and (d) BaYaka children with dolls made from mud and an empty bottle, respectively. (e) Hadza children in work-play. (f) BaYaka children playing *montika*, a game played similarly to jacks. Hadza photos by ANC. BaYaka photos by SLL.

95% CI [−2.22, −0.09], $p = .03$. However, contrasts revealed no within-ethnicity effect of gender on object play. Ethnicity was a significant predictor of participation in RTP, with Hadza children 25.11 times more likely than BaYaka children to participate in this form of play, 95% CI [−5.64, −0.81], $p = .009$. Although the main effect of gender was not a significant predictor of participation in RTP, the interaction between gender and age showed that adolescent boys were more likely than adolescent girls to participate in this form of play, 95% CI [0.18, 5.82], $p = .04$. Gender was a significant predictor of participation in pretense play, with girls 3.38 times more likely to participate in pretense play than boys, 95% CI [−2.42, −0.02], $p = .047$. The interaction between ethnicity and age was also significant, indicating that BaYaka children in middle childhood were more likely to participate in pretense play than Hadza children in middle childhood, 95% CI [−2.71, −0.26], $p = .02$. The effects of age, gender, ethnicity, and their interactions were not significant predictors of participation in structured games or exercise play. These results offer mixed support for our prediction that hunter-gatherer children would minimally differ in their participation in play types.

Gendered Participation in Culturally-Specific Pretense Themes

Children devoted a quarter or less of their pretense play to nonwork themes (Table 4). In support of our hypothesis, we found that BaYaka children showed fewer gendered differences in work-themed pretense play than Hadza children. Both Hadza and BaYaka girls were significantly more likely

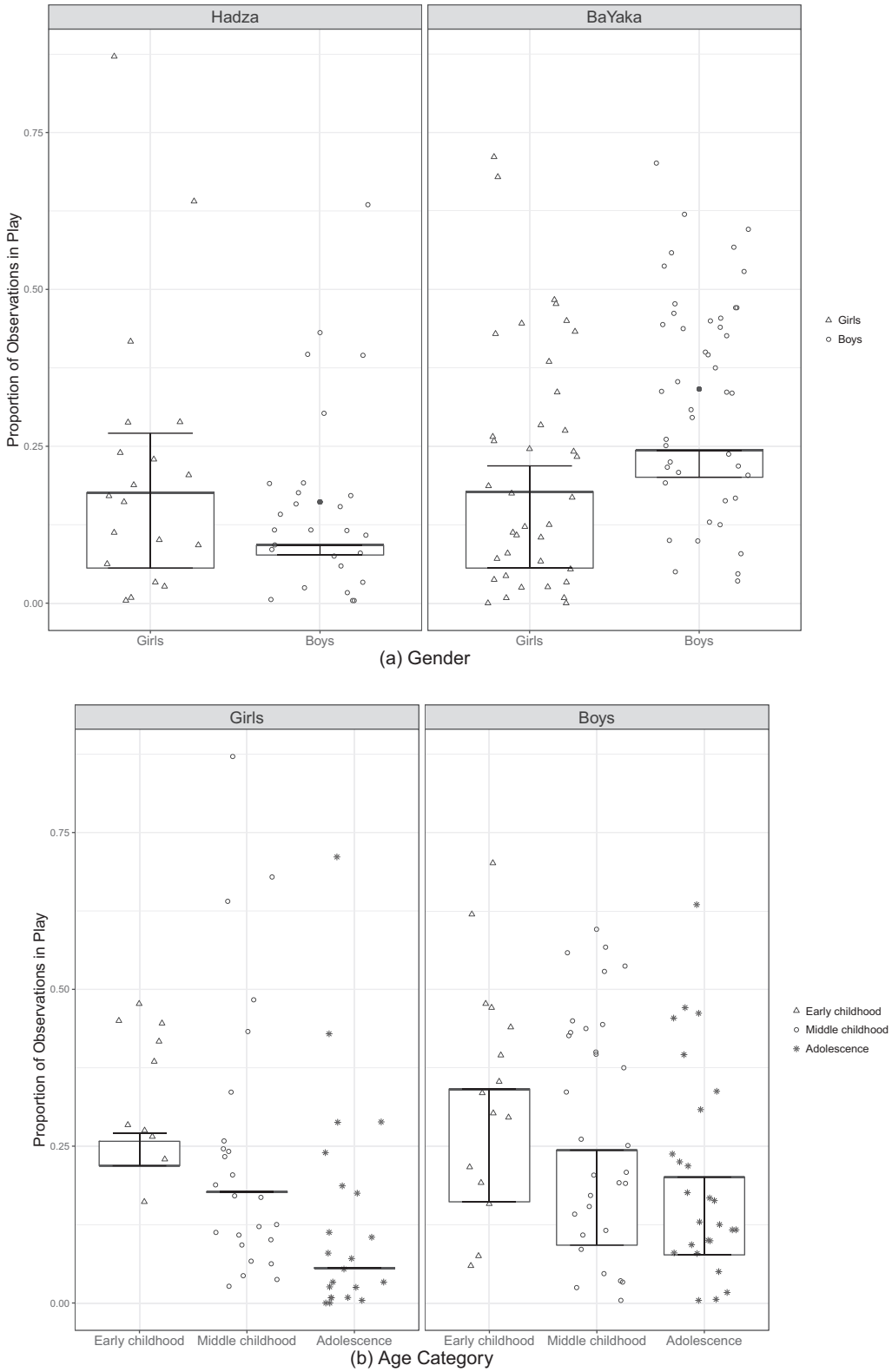

Figure 2. Predictions from Model 1 (with random effects held at 0) showing the proportion of total observations spent in play by (a) gender and ethnicity and (b) gender and age category (early childhood; 3–6 years, middle childhood; 7–12 years, adolescence, 13–18 years). Scatterplot of observed data is overlaid.

than boys to play house, Hadza; $Z = 2.33$, $p = .02$, BaYaka; $Z = 2.98$, $p = .003$. Both Hadza and BaYaka boys were significantly more likely to participate in hunting play than girls, Hadza; $Z = 2.59$, $p = .01$, BaYaka; $Z = 3.91$, $p < .001$. Hadza girls were significantly more likely to play at foraging and to play with dolls than Hadza boys, foraging; $Z = 2.39$, $p = .02$, doll; $Z = 2.77$, $p = .006$. BaYaka boys were significantly more likely to play at collecting honey than BaYaka girls, $Z = 2.43$, $p = .02$.

Discussion

This study used observational data to quantitatively compare the gender-typed and gender-segregated play of Hadza and BaYaka hunter-gatherer children and adolescents. We specifically examined (a) the effect of gender on time allocation to play, (b) whether access to play partners influenced gender segregation during play, (c) children's participation in gender-typed play, and (d) gender differences in work-themed pretense play. Here, we revisit each of these topics in turn.

Gendered Development of Play Across Childhood

Play is hypothesized to provide children with opportunities to learn about subsistence and culture (Bock & Johnson, 2004; Smith, 1982). Like other studies of play in small-scale societies (Boyette, 2016a; Edwards, 2005; Gosso et al., 2007), we found that play took up between a fifth and a quarter of the time budgets of Hadza and BaYaka children and adolescents. The finding that the Hadza played less than the BaYaka is consistent with Crittenden's (2016a) observation that, for Hadza children, foraging itself may be considered play. Work-play provides children with culture-learning opportunities alongside opportunities to contribute to their own and their families' subsistence (Lancy, 2016). While both Hadza and BaYaka children participate in work-play, this form of play seems to be more common among the Hadza. Though some cases of work-play are coded as play in this study, such as children targeting child-only foods, others may not have been coded as play, representing an important limitation of our coding scheme, and a potential explanation for the lower rates of play observed among the Hadza compared to the BaYaka.

In line with previous studies (e.g., Bock & Johnson, 2004; Froehle et al., 2019), we found that participation in play decreased with age, consistent with the hypothesis that play contributes to skill development, and that children trade-off practicing through play with practicing through work. Furthermore, contrary to our hypothesis that there would be no relationship between gender and play in the two populations surveyed, age-related decreases in play were more pronounced for girls than for boys. Thus, even among the Hadza and BaYaka, where children are afforded extensive autonomy, girls played less frequently at an earlier age than boys. However, the ethnographic literature on girls' earlier entry into the workforce and girls diminished participation in play compared to boys suggests that cross-culturally, this transition usually occurs in middle childhood (Montgomery, 2009). Here, we found that girls were only less likely to play than boys in adolescence; thus, the autonomy afforded to girls may delay their transition away

Table 4
Proportion of Pretense Spent in Different Themes (%), and Results of Mann–Whitney U *Tests by Proportion of Theme by Pretense*

	Hadza ($N = 33$)				BaYaka ($N = 49$)			
	Girls	Boys	*U*	*r*	Girls	Boys	*U*	*r*
Playing house	40.23	1.45	181*	.40	57.61	4.54	418.5**	.43
Play hunting	2.34	33.82	72*	.45	7.53	42.26	103.5***	.56
Play foraging	24.61	35.27	180*	.42	5.61	3.76	343	.19
Doll play	16.80	0.00	180.5**	.48	5.61	5.09	338	.27
Play honey collecting	2.93	1.45	128.5	.06	1.33	18.69	200*	.35
Play tool manufacture	0.20	1.93	121	.13	3.99	3.65	275	.05
Play fishing	—	—	—	—	0.15	1.88	283.5	.05
Nonwork themed	12.89	26.09	152	.12	18.17	20.13	257.5	.10

Note. The analyses were run on the Hadza and BaYaka separately, with gender as the grouping variable. Reported percentages represent population proportions.
*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

from play and toward other productive activities (Froehle et al., 2019; Lew-Levy, Lavi, Reckin, Cristóbal-Azkarate, & Ellis-Davies, 2018). Taken together, these findings show that cultural norms of behavior, including child autonomy and participation in work-play, should be considered when examining gender differences in time allocation across diverse societies (Whiting & Edwards, 1973).

Gender Segregation During Play

From the age of three onwards, children have been observed to segregate into same-gender playgroups in western, small-scale farming, and pastoralist societies (Maccoby, 1998; Moller & Serbin, 1996; Munroe & Romney, 2006; Whiting & Edwards, 1973). However, in a survey of six hunter-gatherer societies, Konner (2016) found that much of children's play occurred in multi-aged, mixed-gender playgroups. And, in a study comparing Bofi farmers and hunter-gatherers, Fouts et al. (2013) found that hunter-gatherer children were more likely to be observed in mixed-gender groups than their farmer neighbors. Considering that hunter-gatherer children have limited access to same-aged and same-gender playmates (Draper, 1976; Konner, 1976), we hypothesized that children in camps with a larger population of potential playmates would be more likely to segregate by gender than children in smaller camps. Our findings supported this hypothesis, showing a strong negative relationship between the availability of play partners and play in mixed-gender groups. This finding highlights the potentially important role of demographic constraints on the social context for child development.

Gendered Participation in Types of Play

Gender differences in exercise play, object play, structured games, pretense play and, most notably, RTP have been found in a variety of cultural settings, and, in the case of pretense play, have been mixed (see Göncü et al., 2002; Lafreniere, 2011; Pellegrini & Smith, 1998a for review). However, because hunter-gatherer children primarily played in mixed-gender groups, we hypothesized that both boys and girls would adjust their play levels to match opposite-gender individuals, leading to fewer gender differences in play types (Fabes et al., 2003). In mixed support for this hypothesis, we found gender differences in RTP and pretense play, but no evidence for gender differences in object play, exercise play, or structured games.

Object play may provide children with opportunities to practice using tools and to learn their affordances (Pellegrini & Bjorklund, 2004). Previous studies of children's object play in preschool settings suggest that boys participate in more object play than girls (Pellegrini & Bjorklund, 2004; Pellegrini & Smith, 1998b; Yu et al., 2010). Here, we found no significant differences in object play by gender, consistent with the fact that both Hadza and BaYaka male and female adults use tools in nearly all aspects of subsistence. We also found that, among the BaYaka, children devoted more play time to object play as they aged. This finding accords with our observation that cutting tools are more frequently used by the BaYaka than by the Hadza in cooking, basket weaving, and trail clearing. Thus, BaYaka children's increased play with objects as they aged may reflect their access to, and the importance of, knives and other tools in their daily activities.

RTP is hypothesized to provide opportunities to practice fighting skills (Lafreniere, 2011), and is consistently performed more frequently by boys than girls in nonhunter-gatherer societies. As in previous hunter-gatherer research (Blurton Jones & Konner, 1973; Boyette, 2016a; Draper & Cashdan, 1988; Gosso et al., 2007), we found no main effect of gender on participation in RTP among the Hadza and BaYaka. However, most of these studies did not include adolescents, or did not consider the effect of age on participation in RTP. Our results showed that adolescent boys participated in more RTP than adolescent girls, consistent with Pellegrini's study of RTP in adolescence in American schools (Pellegrini, 2003). These findings suggest that RTP may play a role in establishing dominance in an effort to attract mates.

Beyond gender, some scholars have suggested that children growing up in more violent communities are more likely to participate in RTP. For example, Fry (1990) found that Zapotec Maya children living in a more peaceful community were less likely to participate in RTP than those living in a more violent community. Similarly, Kung, Li, Golding, and Hines (2018) found that, independent of gender, German preschoolers who participated in more "masculine" activities including RTP at 3.5 years were more likely to be aggressive at thirteen. As noted earlier, Hadza parents often use physical punishment and shout at children, while BaYaka parents rarely physically reprimand children. Thus, higher rates of RTP among the Hadza when compared to the BaYaka may reflect higher levels of aggression experienced and observed by the former when compared to the latter.

Hadza and BaYaka foraging tasks require extensive energy expenditure for both males and females (Pontzer et al., 2015). It should come of no surprise, then, that we found no gender differences in Hadza and BaYaka children's exercise play, considering the role of this form of play in physical training and economy of movement (Byers & Walker, 1995; Pellegrini & Smith, 1998a). We further found no gender differences in children's participation in structured games.

Girls' and boys' differential participation in pretense may be influenced by their environment, availability of play materials, and availability of toys (Göncü et al., 2002), leading to mixed findings regarding gender differences in pretense play. Here, in a naturalistic setting with few gendered toys, we found that girls were more likely than boys to participate in pretense play. Furthermore, as in other societies, a majority of Hadza and BaYaka children's pretense play involved the imitation of work, consistent with the theory that work-themed play affords children opportunities to practice activities central to survival and reproduction, including gender-specific skills (Bock & Johnson, 2004).

Gendered Participation in Culturally-Specific Pretense Themes

In support of our hypothesis that BaYaka children and adolescents would show fewer gendered differences in work-themed pretense play than their Hadza counterparts, gender was a significant predictor for participation in foraging play and doll play among the Hadza but not among the BaYaka. House play was the most popular pretense play activity among both Hadza and BaYaka girls. Both Hadza and BaYaka boys were observed imitating hunting in play more frequently than girls. These gender differences accord with the gendered division of labor in adulthood. House construction is almost exclusively performed by women in both societies. And, while both Hadza and BaYaka men do the majority of the hunting, BaYaka men reportedly participate in foraging and childcare more than Hadza men (Hewlett, 1991b, 1992; Marlowe, 2010).

BaYaka boys also participated in more honey collecting play than BaYaka girls, but there were no such gender differences among the Hadza. Whereas both Hadza and BaYaka men primarily collect honey, the lack of gender difference for this type of play among the Hadza may be due to the fact that Hadza boys rarely played at honey collecting, instead participating in actual honey collecting, usually from stingless bees which are found in relatively easy to access trees. Among the BaYaka, on the other hand, honey is primarily found in very tall trees that require greater strength and skill to climb. Thus, whereas Hadza boys in middle childhood can easily participate in the collection of honey from some bee species, BaYaka children cannot, suggesting that, in the absence of practice-through-participation, BaYaka children primarily practice their honey-collecting skills through pretense (Boyette, 2016b; Lew-Levy & Boyette, 2018). Overall, then, pretense play, and, in particular, work-themed pretense play, may serve as a flexible tool through which children come to imitate key aspects of culture, and in doing so, learn appropriate gendered behaviors through identification with same-gender adults (Bock & Johnson, 2004; Lancy, 2016).

Conclusion

This study represented the first quantitative and comparative research on gender-typed play and gender-segregation during play in two hunting and gathering societies. We have argued that contextual features, such as demographic constraints, and cultural features, such as the gendered division of labor, may explain observed differences in Hadza and BaYaka children's gender-typed and gender-segregated play. This study thus adds to a growing body of literature investigating gendered play in diverse, non-western societies (e.g., Edwards et al., 2004; Fouts et al., 2013; Gosso, 2010; Li & Wong, 2016; Yu et al., 2010), and moved beyond the usual "west versus rest" approach to cross-cultural research by systematically exploring similarities and differences in the play activities of children in two different hunting and gathering societies.

Nonetheless, the study suffered from small sample sizes and relatively short observation periods. We were also unable to test the reliability of our coding scheme among the Hadza. Furthermore, our data collection was restricted to one or two foraging seasons; data collected throughout the year may show how gendered play changes as camp size and activities available to children change. Finally, because we had no access to reliable electricity, we were not able to film our follows, limiting our ability to add more nuanced data, such as social interaction, to the current analysis. Future research aims to investigate how hunter-gatherer children interact with, and orient toward play partners of their same and opposite gender, how play partners influence play quality, and how parents conceive of the role of play in child development. Future studies should also investigate how

sedentarization, a process shown to change children's behaviors in other domains, such as subsistence and chore assignment (Draper & Cashdan, 1988; Pollom, Herlosky, Mabulla, & Crittenden, Under review), influences play.

References

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, *67*(1), 1–48. https://doi.org/10.18637/jss.v067.i01

Biddle, S. J. H., Atkin, A. J., Cavill, N., & Foster, C. (2010). Correlates of physical activity in youth: a review of quantitative systematic reviews. *International Review of Sport and Exercise Psychology*, *4*(1), 25–49. https://doi.org/10.1080/1750984X.2010.548528

Bjorklund, D. F., & Gardiner, A. K. (2012). Object play and tool use: developmental and evolutionary perspectives. In A. D. Pellegrini & P. E. Nathan (Eds.), *The Oxford handbook of the development of play* (pp. 153–171). Oxford, UK: Oxford University Press. https://doi.org/10.1093/oxfordhb/9780195393002.013.0013

Blatchford, P., Baines, E., & Pellegrini, A. (2003). The social context of school playground games: Sex and ethnic differences, and changes over time after entry to junior school. *British Journal of Developmental Psychology*, *21*, 481–505. https://doi.org/10.1348/026151003322535183

Blurton Jones, N. G. (1993). The lives of hunter-gatherer children: Effects of parental behavior and parental reproductive strategy. In M. E. Pereira & L. A. Fairbanks (Eds.), *Juvenile primates: Life history, development, and behavior* (pp. 309–326). New York, NY: Oxford University Press.

Blurton Jones, N. G. (2016). *Demography and evolutionary ecology of Hadza hunter-gatherers*. Cambridge, UK: Cambridge University Press.

Blurton Jones, N. G., & Konner, M. J. (1973). Sex differences in behaviour of London and Bushman children. In R. P. Michael & J. H. Crook (Eds.), *Comparative ecology and behaviour of primates: Proceedings of a conference held at the Zoological Society, London, 1971* (pp. 698–750). London, UK and New York, NY: Academic Press.

Bock, J., & Johnson, S. E. (2004). Subsistence ecology and play among the Okavango Delta peoples of Botswana. *Human Nature*, *15*(1), 63–81. https://doi.org/10.1007/s12110-004-1004-x

Boyette, A. H. (2016a). Children's play and culture learning in an egalitarian foraging society. *Child Development*, *87*, 759–769. https://doi.org/10.1111/cdev.12496

Boyette, A. H. (2016b). Children's play and the integration of social and individual learning: A cultural niche construction perspective. In H. Terashima & B. S. Hewlett (Eds.), *Social learning and innovation in contemporary hunter-gatherers: Evolutionary and ethnographic perspectives* (pp. 159–169). Tokyo, Japan: Springer.

Brown, J. K. (1970). A note on the division of labor by sex. *American Anthropologist*, *72*, 1073–1078. https://doi.org/10.1525/aa.1970.72.5.02a00070

Byers, J. A., & Walker, C. (1995). Refining the motor training hypothesis for the evolution of play. *The American Naturalist*, *146*(1), 25. https://doi.org/10.1086/285785

Connolly, J., Craig, W., Goldberg, A., & Pepler, D. (2004). Mixed-gender groups, dating, and romantic relationships in early adolescence. *Journal of Research of Adolescence*, *14*, 185–207. https://doi.org/10.1111/j.1532-7795.2004.01402003.x

Crittenden, A. N. (2016a). Children's foraging and play among the Hadza: The evolutionary significance of "work play." In C. L. Meehan & A. N. Crittenden (Eds.), *Childhood: Origins, evolution and implications* (pp. 155–170). Albuquerque, NM: University of New Mexico Press.

Crittenden, A. N. (2016b). Ethnobotany in evolutionary perspective: wild plants in diet composition and daily use among Hadza hunter-gatherers. In K. Hardy & L. Kubiak-Martens (Eds.), *Wild harvest: plants in the hominin and pre-agrarian human worlds* (pp. 319–339). Havertown, PA: Oxbow.

Crittenden, A. N., Conklin-Brittain, N. L., Zes, D. A., Schoeninger, M. J., & Marlowe, F. W. (2013). Juvenile foraging among the Hadza: Implications for human life history. *Evolution and Human Behavior*, *34*, 299–304. https://doi.org/10.1016/j.evolhumbehav.2013.04.004

Crittenden, A. N., Sorrentino, J., Moonie, S. A., Peterson, M., Mabulla, A., & Ungar, P. S. (2017). Oral health in transition: The Hadza foragers of Tanzania. *PLoS ONE*, *12*(3), 1–19. https://doi.org/10.1371/journal.pone.0172197

Crittenden, A. N., & Zes, D. A. (2015). Food sharing among Hadza Hunter-gatherer children. *PLoS ONE*, *10*, e0131996. https://doi.org/10.1371/journal.pone.0131996

Deaner, R. O., Geary, D. C., Puts, D. A., Ham, S. A., Kruger, J., Fles, E., . . . Grandis, T. (2012). A sex difference in the predisposition for physical competition: Males play sports much more than females even in the contemporary U.S. *PLoS ONE*, *7*, e49168. https://doi.org/10.1371/journal.pone.0049168

Draper, P. (1975). Cultural pressure on sex differences. *American Ethnologist*, *2*, 602–616. https://doi.org/10.1525/ae.1975.2.4.02a00020

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 and London, UK: Harvard University Press.

Draper, P., & Cashdan, E. (1988). Technological change and child behavior among the! Kung. *Ethnology*, *27*, 339–365. https://doi.org/10.2307/3773398

Edwards, C. P. (1993). Behavioral sex differences of children of diverse cultures: The case of nurturance to infants. In L. A. Fairbanks & M. E. Pereira (Eds.), *Juvenile primates: Life history, development, and behavior* (pp. 327–338). New York, NY: Oxford University Press.

Edwards, C. P. (2005). Children's play in cross-cultural perspective: A new look at the six cultures study. *Cross-Cultural Research*, *34*, 318–338. https://doi.org/10.1177/106939710003400402

Edwards, C. P., Knoche, L., & Kumru, A. (2004). Socialization of boys and girls in natural contexts. In C. R. Ember & M. Ember (Eds.), *Encyclopedia of sex and gender: men and women in the world's cultures* (pp. 34–41). New Haven, CT: HRAF.

Elston, D. A., Moss, R., Boulinier, T., Arrowsmith, C., & Lambin, X. (2001). Analysis of aggregation, a worked example: numbers of ticks on red grouse chicks. *Parasitology*, *122*, 563–569. https://doi.org/10.1017/S0031182001007740

Fabes, R. A., Martin, C. L., & Hanish, L. D. (2003). Young children's play qualities in same-, other-, and mixed-sex peer groups. *Child Development*, *74*, 921–932. https://doi.org/10.1111/1467-8624.00576

Fagen, R. M. (1981). *Animal play behavior*. New York, NY: Oxford University Press.

Fein, G. G. (1981). Pretend play in childhood: An integrative review. *Child Development*, *52*, 1095–1118. https://doi.org/10.2307/1129497

Flanders, J. L., Leo, V., Paquette, D., Pihl, R. O., & Séguin, J. R. (2009). Rough-and-tumble play and the regulation of aggression: An observational study of father-child play dyads. *Aggressive Behavior*, *35*, 285–295. https://doi.org/10.1002/ab.20309

Fouts, H. N., Hallam, R. A., & Purandare, S. (2013). Gender segregation in early-childhood social play among the Bofi foragers and Bofi farmers in Central Africa. *American Journal of Play*, *5*, 333–356.

Froehle, A. W., Wells, G. K., Pollom, T. R., Mabulla, A. Z. P., Lew-Levy, S., & Crittenden, A. N. (2019). Physical activity and time budgets of Hadza forager children: Implications for self-provisioning and the ontogeny of the sexual division of labor. *American Journal of Human Biology*, *31*, e23209. https://doi.org/10.1002/ajhb.23209

Fry, D. P. (1990). Play aggression among Zapotec children. *Aggressive Behavior*, *16*, 321–340.

Fry, D. P. (2014). Environment of evolutionary adaptedness, rough-and-tumble play, and the selection of restraint in human aggression. In D. Narvaez, K. Valentina, A. Fuentes, J. J. McKenna, & P. Gray (Eds.), *Ancestral landscapes in human evolution: Culture, childearing and social wellbeing human evolution: Culture, childrearing and social wellbeing* (pp. 169–188). New York, NY: Oxford University Press.

Gibbons, A. (2018). Hadza on the brink. *Science*, *360*, 700–704. https://doi.org/10.1126/science.360.6390.700

Goldstein, T. R., & Winner, E. (2011). Engagement in role play, pretense, and acting classes predict advanced theory of mind skill in middle childhood. *Imagination, Cognition and Personality*, *30*, 249–258. https://doi.org/10.2190/IC.30.3.c

Göncü, A., Patt, M. B., & Kouba, E. (2002). Understanding young children's pretend play in context. In P. K. Smith & C. H. Hart (Eds.), *Blackwell handbooks of developmental psychology. Blackwell handbook of childhood social development* (pp. 418–437). Malden, MA: Blackwell.

Gosso, Y. (2010). Play in different cultures. In P. K. Smith (Ed.), *Children and play* (pp. 80–98). Chichester, UK: Blackwell.

Gosso, Y., e Morais, MLS, & Otta, E. (2007). Pretend play of Brazilian children: A window into different cultural worlds. *Journal of Cross-Cultural Psychology*, *38*, 539–558. https://doi.org/10.1177/0022022107305237

Harkness, S., & Super, C. M. (1985). The cultural context of gender segregation in children's peer groups. *Child Development*, *56*, 219–224. https://doi.org/10.2307/1130188

Hewlett, B. S. (1991a). Demography and childcare in preindustrial societies. *Journal of Anthropological Research*, *47* (1), 1–37. https://doi.org/10.1086/jar.47.1.3630579

Hewlett, B. S. (1991b). *Intimate fathers: The nature and context of Aka Pygmy paternal infant care*. Ann Arbor, MI: University of Michigan Press.

Hewlett, B. S. (1992). Husband-wife reciprocity and the father-infant relationship among Aka pygmies. In B. S. Hewlett (Ed.), *Father–child relations: Cultural and biosocial contexts* (pp. 153–190). New York, NY: Routledge.

Hewlett, B. S., & Boyette, A. H. (2013). Commentary: Play in hunter-gatherers. In D. Narvaez, J. Panksepp, A. N. Schore, & T. R. Gleason (Eds.), *Evolution, early experience and human development: From research to practice and policy* (pp. 388–396). Oxford, UK: Oxford University Press.

Hewlett, B. S., Fouts, H. N., Boyette, A. H., & Hewlett, B. S. B. L. (2011). Social learning among Congo Basin hunter-gatherers. *Philosophical Transactions of the Royal Society B-Biological Sciences: Biological Sciences*, *366*, 1168–1178. https://doi.org/10.1098/rstb.2010.0373

Hewlett, B. L., & Hewlett, B. S. (2012). Hunter-gatherer adolescence. In B. L. Hewlett (Ed.), *Adolescent identity: Evolutionary, cultural and developmental perspectives* (pp. 73–101). London, UK: Routledge.

Hoffmann, J., & Russ, S. (2012). Pretend play, creativity, and emotion regulation in children. *Psychology of Aesthetics, Creativity, and the Arts*, *6*, 175–184. https://doi.org/10.1037/a0026299

House, B. R., Silk, J. B., Henrich, J., Barrett, H. C., Scelza, B., Boyette, A. H., . . . Laurence, S. (2013). The ontogeny of prosocial behavior across diverse societies. *Proceedings of the National Academy of Sciences of the United States of America*, *110*, 14586–14591. https://doi.org/10.1073/pnas.1221217110

Hughes, F. P. (2010). *Children, play, and development*. Thousand Oaks, CA: Sage.

Humphreys, A. P., & Smith, P. K. (1987). Rough and tumble, friendship, and dominance in schoolchildren: Evidence for continuity and change with age. *Child Development*, *58*, 201–212. https://doi.org/10.2307/1130302

Kelly, R. L. (1995). *The lifeways of hunter-gatherers: The foraging spectrum*. New York, NY: Cambridge University Press.

Konner, M. J. (1972). Aspects of the developmental ethology of a foraging people. In N. G. Blurton Jones (Ed.), *Ethological studies of child behavior* (pp. 285–304). London, UK: Cambridge University Press.

Konner, M. J. (1976). Relations among infants and juveniles in comparative perspective. *Biology and Social Life*, *15*, 371–402. https://doi.org/10.1177/053901847601500209

Konner, M. J. (2005). Hunter-gatherer infancy and childhood: The! Kung and others. In B. S. Hewlett & M. E. Lamb (Eds.), *Hunter-gatherer childhoods: Evolutionary, developmental and cultural perspectives* (pp. 19–64). New Brunswick, NJ: Transaction.

Konner, M. J. (2010). *The evolution of childhood: Relationships, emotion, mind*. Cambridge, MA: Harvard University Press.

Konner, M. J. (2016). Hunter-gatherer infancy and childhood in the context of human evolution. In C. L. Meehan & A. N. Crittenden (Eds.), *Childhood: origins, evolution and implications* (pp. 123–154). Albuquerque, NM: University of New Mexico Press.

Kung, K. T. F., Li, G., Golding, J., & Hines, M. (2018). Preschool gender-typed play behavior at age 3.5 years predicts physical aggression at age 13 years. *Archives of Sexual Behavior*, *47*, 905–914. https://doi.org/10.1007/s10508-017-1005-6

Lafreniere, P. (2011). Evolutionary functions of social play: Life histories, sex differences, and emotion regulation. *American Journal of Play*, *3*, 464–488.

Lancy, D. F. (1984). Play in anthropological perspective. In P. K. Smith (Ed.), *Play in animals and humans* (pp. 295–303). Malden, MA: Blackwell.

Lancy, D. F. (2016). Ethnographic perspectives on culture acquisition. In C. L. Meehan & A. N. Crittenden (Eds.), *Childhood: Origins, evolution and implications* (pp. 173–198). Albuquerque, NM: University of New Mexico Press.

Lee, L., Howes, C., & Chamberlain, B. (2007). Ethnic heterogeneity of social networks and cross-ethnic friendships of elementary school boys and girls. *Merrill-Palmer Quarterly*, *53*, 325–346. https://doi.org/10.1353/mpq.2007.0016

Lenth, R. V. (2016). Least-squares means: The R package lsmeans. *Journal of Statistical Software*, *69*(1), 1–33. https://doi.org/10.18637/jss.v069.i01

Lever, J. (1978). Sex differences in the complexity of children's play and games. *American Sociological Review*, *43*, 471–483. https://doi.org/10.2307/2094773

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*. London, UK: London School of Economics and Political Science.

Lew-Levy, S., & Boyette, A. H. (2018). Evidence for the adaptive learning function of work and work-themed play among Aka Forager and Ngandu farmer children from the Congo Basin. *Human Nature*, *29*, 157–185. https://doi.org/10.1007/s12110-018-9314-6

Lew-Levy, S., Crittenden, A. N., Boyette, A. H., Mabulla, I. A., Hewlett, B. S., & Lamb, M. E. (2019). Inter- and intra-cultural variation in learning-through-participation among Hadza and BaYaka forager children and adolescents from Tanzania and Congo. *Journal of Psychology in Africa*. https://doi.org/10.17863/CAM.36446

Lew-Levy, S., Lavi, N., Reckin, R., Cristóbal-Azkarate, J., & Ellis-Davies, K. (2018). How do hunter-gatherer children learn social and gender norms? A meta-ethnographic review. *Cross-Cultural Research*, *52*, 213–255. https://doi.org/10.1177/1069397117723552

Li, R. Y. H., & Wong, W. I. (2016). Gender-typed play and social abilities in boys and girls: Are they related? *Sex Roles*, *74*, 399–410. https://doi.org/10.1007/s11199-016-0580-7

Lillard, A. S. (1993). Pretend play skills and the child's theory of mind. *Child Development*, *64*, 348–371. https://doi.org/10.1111/j.1467-8624.1993.tb02914.x

Maccoby, E. E. (1998). *The two sexes: Growing apart, coming together*. Cambridge, MA: Harvard University Press.

Marlowe, F. W. (2007). Hunting and gathering: The human sexual division of foraging labor. *Cross-Cultural Research*, *41*, 170–195. https://doi.org/10.1177/1069397106297529

Marlowe, F. W. (2010). *The Hadza: Hunter-gatherers of Tanzania*. Berkeley, CA: University of California Press.

Mauldin, T., & Meeks, C. B. (1990). Sex differences in children's time use. *Sex Roles*, *22*, 537–554. https://doi.org/10.1007/BF00288233

Moller, L. C., Hymel, S., & Rubin, K. H. (1992). Sex typing in play and popularity in middle childhood. *Sex Roles*, *26*, 331–353. https://doi.org/10.1007/BF00289916

Moller, L. C., & Serbin, L. A. (1996). Antecedents of toddler gender segregation: Cognitive consonance, gender-typed toy preferences and behavioral compatibility. *Sex Roles*, *35*, 445–460. https://doi.org/10.1007/BF01544131

Montgomery, H. (2009). Learning Gender Roles. In D. F. Lancy, J. Bock, & S. Gaskins (Eds.), *The anthropology of learning in childhood* (pp. 287–308). New York, NY: Rowman & Littlefield.

Mullineaux, P., & Dilalla, L. (2009). Preschool pretend play behaviors and early adolescent creativity. *Journal of Creative Behavior*, *43*(1), 47–63. https://doi.org/10.1002/j.2162-6057.2009.tb01305.x

Munroe, R. L., & Romney, A. K. (2006). Gender and age differences in same-sex aggregation and social behavior: A four-culture study. *Journal of Cross-Cultural Psychology*, *37*(1), 3–19. https://doi.org/10.1177/0022022105282292

Nag, M., White, B. N. F., Peet, R. C., Bardhan, A., Terence, H., Johnson, A., . . . Peet, R. C. (1978). An anthropological approach to the study of the economic value of children in Java and Nepal. *Current Anthropology*, *19*, 293–306.

Pellegrini, A. D. (1995). A longitudinal study of boys' rough- and-tumble play and dominance during early adolescence. *Journal of Applied Developmental Psychology*, *16*, 77–93. https://doi.org/10.1016/0193-3973(95)90017-9

Pellegrini, A. D. (2003). Perceptions and functions of play and real fighting in early. *Adolescence*, *74*, 1522–1533. https://doi.org/10.1111/1467-8624.00620

Pellegrini, A. D. (2004). Sexual segregation in childhood: A review of evidence for two hypotheses. *Animal Behaviour*, *68*, 435–443. https://doi.org/10.1016/j.anbehav.2003.07.023

Pellegrini, A. D., & Bjorklund, D. F. (2004). The ontogeny and phylogeny of children's object and fantasy play. *Human Nature*, *15*(1), 23–43. https://doi.org/10.1007/s12110-004-1002-z

Pellegrini, A. D., Dupuis, D., & Smith, P. K. (2007). Play in evolution and development. *Developmental Review*, *27*, 261–276. https://doi.org/10.1016/j.dr.2006.09.001

Pellegrini, A. D., & Smith, P. K. (1998a). Physical activity play: The nature and function of a neglected aspect of play. *Child Development*, *69*, 577–598. https://doi.org/10.1111/j.1467-8624.1998.00577.x

Pellegrini, A. D., & Smith, P. K. (1998b). The development of play during childhood: Forms and possible functions. *Child Psychology and Psychiatry Review*, *3*, 51–57. https://doi.org/10.1017/S1360641798001476

Piaget, J. (1965). *The moral judgment of the child*. New York, NY: Free Press.

Pollom, T. R., Herlosky, K. N., Mabulla, I. A., & Crittenden, A. N. (under review). Changes in juvenile foraging behavior among the Hadza of Tanzania during early transition to a mixedsubsistence food economy. *Human Nature*

Pontzer, H., Raichlen, D. A., Wood, B. M., Emery Thompson, M., Racette, S. B., Mabulla, A. Z. P., & Marlowe, F. W. (2015). Energy expenditure and activity among Hadza hunter-gatherers. *American Journal of Human Biology*, *27*, 628–637. https://doi.org/10.1002/ajhb.22711

Reyes-García, V., & A. Pyhälä (Eds.). (2016). *Hunter-gatherers in a changing world*. New York, NY: Springer.

Roberts, J. M., & Sutton-Smith, B. (1962). Child training and game involvement. *Ethnology*, *1*, 166–185. https://doi.org/10.2307/3772873

Schlegel, A., & Hewlett, B. L. (2011). Contributions of anthropology to the study of adolescence. *Journal of Research on Adolescence*, *21*, 281–289. https://doi.org/10.1111/j.1532-7795.2010.00729.x

Smith, B. H. (1991). Standards of human tooth formation and dental age assessment. In M. A. Kelley & C. S. Larsen (Eds.), *Advances in dental anthropology* (pp. 143–168). New York, NY: Wiley-Liss.

Smith, P. K. (1982). Does play matter? Functional and evolutionary aspects of animal and human play. *Behavioral and Brain Sciences*, *5*, 139–184. https://doi.org/10.1017/S0140525X0001092X

Strough, J., & Covatto, A. M. (2002). Context and age differences in same and other-gender peer preferences. *Social Development*, *11*, 346–361. https://doi.org/10.1111/1467-9507.00204

Whiting, B. B., & Edwards, C. P. (1973). A cross-cultural analysis of sex differences in the behavior of children aged 3 through 11. *The Journal of Social Psychology*, *91*, 171–188.

Woodburn, J. (1982). Egalitarian Societies. *Man*, *17*, 431–451. https://doi.org/10.2307/2801707

Yu, L., Winter, S., & Xie, D. (2010). The child play behavior and activity questionnaire: A parent-report measure of childhood gender-related behavior in China. *Archives of Sexual Behavior*, *39*, 807–815. https://doi.org/10.1007/s10508-008-9403-4

Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's website:

Table S1. Multilevel Poisson Regression Results for Model 1 Investigating the Association Between Age, Gender, Ethnicity, and Frequency of Observations Spent in Play

Table S2. Multilevel Poisson Regression Results for Model 2 Investigating the Association Between Age, Gender, Ethnicity, Number of Child Inhabitants in a Camp, and Frequency of Observations Spent in Mixed-Gender Social Play

Table S3. Multilevel Poisson Regression Results for Models 3–7 Investigating the Association Between Age, Gender, Ethnicity, and Play Types