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.
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-sex adults in their pretense, this form of play may be a setting in which children practice gendered skills (Bock & Johnson, 2004; Fein, 1981; Lew-Ley & 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 Gönçü, 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 sorted 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 sub-tropical 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 multi-aged, 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 3–18-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>
<thead>
<tr>
<th>Age (years)</th>
<th>Developmental stage</th>
<th>Hadza (N = 46)</th>
<th>BaYaka (N = 65)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N girls</td>
<td>N boys</td>
</tr>
<tr>
<td>3–6</td>
<td>Early childhood</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>7–12</td>
<td>Middle childhood</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>13–18</td>
<td>Adolescence</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>19</td>
<td>27</td>
</tr>
</tbody>
</table>

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

Table 1: Age Categories Used in the Analysis, and Number of Participants Based on Gender, Age, and Ethnicity
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 Humanies 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
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 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 [0.23, 1.12], \( p < .001 \). The interaction between age 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.

### Gender Segregation During Play

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.

### 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 of 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,
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

<table>
<thead>
<tr>
<th></th>
<th>Hadza (N = 33)</th>
<th>BaYaka (N = 49)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Girls</td>
<td>Boys</td>
</tr>
<tr>
<td>Playing house</td>
<td>40.23</td>
<td>1.45</td>
</tr>
<tr>
<td>Play hunting</td>
<td>2.34</td>
<td>33.82</td>
</tr>
<tr>
<td>Play foraging</td>
<td>24.61</td>
<td>35.27</td>
</tr>
<tr>
<td>Doll play</td>
<td>16.80</td>
<td>0.00</td>
</tr>
<tr>
<td>Play honey collecting</td>
<td>2.93</td>
<td>1.45</td>
</tr>
<tr>
<td>Play tool manufacture</td>
<td>0.20</td>
<td>1.93</td>
</tr>
<tr>
<td>Play fishing</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Nonwork themed</td>
<td>12.89</td>
<td>26.09</td>
</tr>
</tbody>
</table>

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


**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