Consistency and variability between cultures during toddlers' naturalistic play

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⁰The data that support the findings of this study will be made openly available at OSF: <https://osf.io/d7rc6/>.

Abstract

Empirical studies of play have borne out some of the predictions of classical theories, showing that children preferentially engage with surprising stimuli, will play in order to learn, and generally show a similar progression of increasingly-complex play behaviors through infancy. Past research has also characterized the types of support and guidance that parents offer during guided play with their child, as distinguished from individual free play. However, most of these studies come from Western nations, and relatively few cross-cultural comparisons have been made, despite observations of wide variability in cultural play traditions. The goal of this study is to examine the variability and consistency of play behaviors in a large sample of 1–2-year-old children—a critical period in the development of play behaviors—in two cultural contexts: the United States and Hong Kong. Our investigation covers both individual and guided play, with measures related to joint attention, stereotypical play behaviors, language use, and types of support offered by caregivers during guided play. This rich, annotated corpus of video and audio data also provides an important resource for research on early play.

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Research Highlights

- This research examines the variability and consistency of naturalistic play behaviors in a large sample of 1–2-year-old children in the United States and Hong Kong.
- This study offers a rich, annotated corpus of video and speech data for research on early guided and individual play.

Introduction

Play encompasses such a wide variety of activities that researchers have struggled to define the essential characteristics of play (Zosh et al., 2018), but it is generally recognized to be spontaneous, rewarding, intrinsically-motivated, and without an immediate survival function (Miller, 2017). From the earliest months of life, children explore and gather information about the world during play (Stahl & Feigenson, 2015), and spend a large portion of their time engaging in increasingly-complex play behaviors (Belsky & Most, 1981). There is tremendous cultural variability in the play contexts and activities that children around the world engage in, however: from playgrounds using manufactured toys with caregiver-structured activities in urban contexts, to unsupervised groups of children roaming in nature, playing with natural materials—not to mention the various structured games that differ widely across cultures (e.g., marbles, hopscotch, dolls, kite-flying). Despite this tremendous variability in all aspects of play activities, children's play is universally observed. Further, play is far from frivolous: by actively exploring and interacting with their environment (Bruner, Jolly, & Sylva, 1976; Piaget, 1951; Singer, Golinkoff, & Hirsh-Pasek, 2006), children are thought to learn not only about the properties and functions of objects but also about the causal relationships between them (Piaget, 1930).

From a historical perspective, research on play has emphasized either its consistencies across individuals or cultures, or alternatively its variability. Piaget (1951) theorized that play is children's effort to make the world match their developing concepts, and is thus how children actively assimilate new experiences into knowledge. Piaget proposed a set of universal developmental stages of play, and emphasized the value of solo free play, where the child plays individually, observed by but not frequently interacting with their caregiver. In contrast, however, Vygotsky (1962) placed greater emphasis on the influence of language and culture, giving a primary role to social interactions in bringing about cognitive development. This theory emphasized what has come to be called *guided play*, in which more-skilled play partners set learning goals and scaffold the child-directed activity (Weisberg, Hirsh-Pasek, Golinkoff, Kittredge, &

Klahr, 2016). Guided play is hypothesized to allow access to a broader range of learning examples (in the child's "zone of proximal development," just out of reach of their current capacities). In contrast to the Piagetian universalist theory, Vygotskian theory predicts that play will vary from culture to culture, and emphasizes the importance of adults transmitting knowledge via language during guided play. Reflecting the diversity of research in this area, empirical findings are often cited as being consistent with both these views, having demonstrated academic achievement benefits of both individual free play (Lillard et al., 2013) and guided play (Stipek, Feiler, Daniels, & Milburn, 1995), as well as broader beneficial impacts of play on the development of cognitive (Hutt & Bhavnani, 1972; Singer et al., 2006), motor (Bjorklund & Brown, 1998; Pellegrini & Smith, 1998), and social skills (Astington & Jenkins, 1995; Leslie, 1987; Taylor & Carlson, 1997).

How does play change over developmental time? Descriptive laboratory studies have found systematicity in the variety and developmental trajectory of children's individual play behaviors (Fenson, Kagan, Kearsley, & Zelazo, 1976; Piaget, 1951; Sinclair, 1970); for review see Casby (2003). For example, when playing alone, children (and certain animals; cf. Corey, 1978, Burghardt, 2005) are particularly engaged by events or objects that are relatively novel, leading them to discover new information (Berlyne, 1960; Dember & Earl, 1957; Hutt & Bhavnani, 1972). Further, empirical work suggests that young children can learn causal relationships and higher-order generalizations during exploratory play in response to unexpected events (Schulz & Bonawitz, 2007; Sim & Xu, 2017; Stahl & Feigenson, 2015).

However, what is considered novel changes considerably over the first two years of life, as infant play changes from sensorimotor practice, object exploration, and ritualistic action patterns (such as banging objects; Piaget, 1951), to relational play with multiple objects, instrumented and sequential goal-directed activities (e.g. building a tower), and later evolving into imaginative play with symbolic objects towards the beginning of the third year (Fenson et al., 1976). Broadly, children who engage in more solitary free play show benefits in language and literacy learning (Lillard et al., 2013;

Neuman & Roskos, 1992), as well as socio-emotional development (Pagani, Fitzpatrick, Archambault, & Janosz, 2010; Romano, Babchishin, Pagani, & Kohen, 2010).

Of course—as emphasized by Vygotsky (1962)—not all play is unconstrained and purely driven by the child: aside from solo play or play with peers, in many cultures a large portion of children’s play takes place under the guidance of their caregivers. During such guided play, caregivers may set the activity’s learning goals, giving children a chance to mimic serious adult behavior, allowing them to establish relationships, to learn how to behave in imagined social situations, and to practice important life skills ranging from locomotion to emotional regulation (Vygotsky, 1978). These guided play contexts provide a rich environment in which caregivers scaffold children’s learning by offering various types of support and direction (Weisberg et al., 2016).

This guidance comes in many forms: caregivers may provide general encouragement (‘Now you try it!’), give specific instructions (‘Put the block on the train.’), or engage in direct demonstration, e.g., showing the child how to place one block on top of another (Wood & Middleton, 1975). In turn, children are highly attentive to these kinds of social signals from their caregivers (Csibra & Gergely, 2009) following the caregivers focus of attention during both naturalistic and experimental contexts (Deák, Krasno, Jasso, & Triesch, 2018; Rossmanith, Costall, Reichelt, López, & Reddy, 2014) and extending the focus of their own attention on the event or object at hand (Yu & Smith, 2016).

When infants and caregivers are mutually focused on each other *and* on a third object or event (e.g., stacking blocks), this is termed an episode of *joint attention* (Bakeman & Adamson, 1984), which emerge in the latter half of the first year of life (Corkum & Moore, 1995; Tomasello, 1988). Infants’ ability to participate in joint attention episodes has been linked to both individual differences in language outcomes (Mundy & Gomes, 1998) as well as theory-of-mind and social abilities in later childhood (Charman et al., 2000; Nelson, Adamson, & Bakeman, 2008; Vaughan Van Hecke et al., 2007). When joint attention episodes occur during naturalistic play, infants also tend to engage in more advanced functional and relational play with objects, suggesting that

caregivers may scaffold children's learning such that children remain both engaged and challenged (Bigelow, MacLean, & Proctor, 2004). Indeed, caregivers' involvement during joint attention episodes may also be linked to later enhanced language development (Tomasello, 1988; Tomasello & Farrar, 1986). More generally, these guided interactions likely facilitate children's acquisition of generic knowledge (e.g., "airplanes fly"; Csibra and Gergely, 2009) as well as culturally-relevant knowledge.

However, most systematic research on the development of play behaviors has taken place in WEIRD contexts (Western, Industrialized, Rich, Democratic; Henrich, Heine, & Norenzayan, 2010)—limiting its generalizability to most of the world's population. Furthermore, given the rich social context in which these guided play episodes are embedded, early guided play could show variability across different cultural and linguistic contexts. Indeed, there seems to be tremendous cultural variability in the amount of dyadic play (Goncu, Mistry, & Mosier, 2000), access to play activities (Morelli, Rogoff, & Angelillo, 2003), and the amount of time children spend in dyadic (i.e., one-on-one) interactions with caregivers (for a review, see Akhtar & Gernsbacher, 2007). Qualitative research on parents' ethnotheories of play suggests that parents in different cultures may value free play differently; in particular, parents from some Asian cultures (i.e., China, Korea, Pakistan, Nepal, India; Parmar, Harkness, & Super, 2004) may value free play less than their Euro-American counterparts, instead placing more emphasis on early academic training (Lin, Li, & Yang, 2019; Parmar et al., 2004).

A few studies have indeed found variability in toddlers' guided play behaviors across different cultural contexts. In one study, while American toddlers were more likely to attend to one object or event at a time during guided play, Guatemalan Mayan toddlers were more likely to simultaneously attend to multiple things (Chavajay & Rogoff, 1999; Rogoff et al., 1993). Other work hints at variability in the degree to which parents provide explicit directions vs. support children's individual explorations (W. Haight, Wang, Fung, Williams, & Mintz, 1999). In one cross-cultural comparison, Chinese and Mexican caregivers tended to direct infants' attentional focus more than American and British caregivers, who were more likely to follow their infants'

attentional focus (Vigil, 2002; Vigil, Tyler, & Ross, 2006).

These parent-child interactions are also embedded in different linguistic contexts, which may shape what children attend to during play: for example, qualitative studies of the Kaluli in New Guinea and a Samoan community found that adults used very little child-directed speech until children were already speaking (Ochs & Schieffelin, 1995); more generally, cross-cultural research has found surprising variability in the amount of child-directed speech that pre-verbal infants receive in different cultures (Lieven & Stoll, 2013). Even when children do hear child-directed speech, the content of this speech may differ considerably across linguistic contexts: for example, Mandarin-speaking children tend to hear more verbs (vs. nouns) relative to their English-speaking counterparts during guided play (Snedeker, Li, & Yuan, 2003). This cross-linguistic variability during guided play could also have downstream effects on language learning: while it has long been theorized that the propensity for young children to learn nouns at a faster rate than verbs (i.e., a noun bias) is universal—due to the relational aspect of verbs making them conceptually more difficult to learn than nouns (for a review, see Waxman et al., 2013)—some research suggests that Mandarin children show less of a noun bias than most other languages (e.g., Tardif, Gelman, & Xu, 1999).

At the same time, the broad developmental trajectory of joint attention skills seems to vary relatively little across different cultural contexts; a comparison of 8-month-old to 3.5-year-old children in India, Peru, and Canada found that children began imitation, pointing, and helping at similar ages across cultures (Callaghan et al., 2011). Furthermore, some cultural differences in guided play could also be related to variability in individual play behaviors; some evidence suggests cross-cultural differences in symbolic play behaviors play in older children (Callaghan et al., 2011; Chick, 2010). However, despite a number of ethnographic studies of play in various cultures (for a review, see Haight and Black, 2001), relatively little work has systematically examined the development of individual and guided play behaviors across different cultural/linguistic contexts with large sample sizes. Thus, a more in-depth investigation of the language and guidance that caregivers use during play across

different cultures may inform these myriad issues.

The present study

In the present study, we investigate the consistency and variability in the development of both individual and guided play behaviors in the second year of life, examining how these behaviors differ across two different cultural/linguistic contexts: Hong Kong, China and Stanford, California, USA. Throughout, we will refer to effects of these two different cultural contexts (HK and US, respectively), which we acknowledge encompass both differences in social norms as well as language. We will conduct a two-phase naturalistic play experiment where each child participates in both an individual-play session (i.e., the child plays with toys without guidance), and a guided-play session (i.e., child and caregiver play with toys together as they normally would at home). We focus on the second year of life, as this is a time when children are starting to locomote independently, verbally express themselves, and to engage in pretend play, thus making it a period when we expect to see many developmental changes in both free and guided play.

Thus, the present experimental design addresses gaps in the empirical literature on the development of play behaviors in three key ways. First, we examine free and guided play within the same children, allowing us to account for substantial variation between children in play behaviors. Second, by examining these behaviors with the same protocol across two different cultural contexts, we ensure a modest amount of generalizability across different populations. Further, we hope that building this reusable protocol will be the first step towards a more complete account of these developmental trajectories across many different sites. Third, by focusing on a larger and younger age range than previous studies, we are well-poised to track the early emergence of variability—or consistency—in guided play behaviors across individuals and cultural contexts.

An additional goal of this project is to create a reusable video dataset with high-resolution measurements of infant and caregiver behaviors during individual and

guided play. To this end, we will not only record bird's-eye views of a standardized play environment, but we will also use head-mounted cameras to record both caregiver and children's egocentric perspective during these free-play sessions. Trained coders will then annotate all play sessions for episodes where the child engages in relational play with two or more objects and code the level of caregiver support (from 0 = uninstructed play to 4 = direct instruction; see Methods). These two key variables will allow us to examine both the consistency in the development of individual and guided play behaviors over the second year of life and the degree to which they differ across cultural contexts. All materials and methods, videos, annotations, and analyses will be made publicly available for reuse by other research groups.

Overall, we expect to see relative consistency in the development of individual play behaviors across cultures, with an increase in relational play as children grow older (Fenson et al., 1976). However, we expect that we may see cross-cultural differences in how children interact with their caregivers across these two contexts. Based on differences in parents' attitudes towards play and early education across these cultures (Lin et al., 2019; Parmar et al., 2004) and directing vs. supporting children's play (W. Haight et al., 1999; X. Chen, 1998), we may expect in our study to find that caregivers in HK will show higher levels of caregiver support during guided play relative to caregivers in CA, which may also lead to a higher proportion of relational play under guidance, especially in older children. Together, these analyses will both ensure positive controls on our dataset, aim to replicate existing findings on the development of play behaviors, and examine the variability and consistency in individual and guided play over the second year of life.

Methods

Participants. We will recruit enough participants to include 120 children in analysis after exclusions (see Data Exclusions), with 60 infants from Stanford, CA, United States and 60 infants from Hong Kong, China. We will recruit infants between 12-24 months of age, stratified such that 30 children will be between 12;0 - 17;31 months

of age and 30 children will be between 18;0 - 23;31 at each site. Though we do not have strong a priori expectations for effect sizes in this study, this sample size will allow us to detect an effect size of Cohen's $d = .5$ on our dependent variables (see Analysis Plan) with 78% power for the two main effects of interest (age and cultural site) according to a Bayesian power analysis (see SI). This large sample size will also make this dataset more valuable for future research on the development of infants' play behaviors.

Design. Children at each site will participate in a two-phase play session (minimum: 5 minutes, maximum: 20 minutes) with three different sets of toys. The *solo play* phase will consist of an individual play session with minimal interaction with the caregiver, while the guided phase will consist of the child and caregiver playing together. Whether the child first participates in individual play vs. guided play will be counterbalanced within each age group and testing location, and the transition between the two phases of the experiment will occur 10 minutes after the beginning of the first play session. Caregivers will be instructed to sit behind their child, who will initially start with the hollow ball. The other toys will start equidistant from but within reach of the child (see Figure 1); the locations of the three toy sets will be randomized with respect to each infant.

Materials. The play sessions will take place in a standardized playroom (approximately 10' x 10'), outfitted specifically for this protocol. Children and their caregivers will be seated on a gray play mat in the middle of the room, and the only objects in the room will be four sets of toys. The exact same toys will be used in both sites and will be a hollow red ball, a 2D shape sorter, a set of four blue stacking blocks, and a set of four wood stacking cups with a spoon (see Figure 1). These toys were selected in order to be commonplace and generic enough that most children will have some familiarity with similar toys, while affording a range of relational play combining objects (e.g., support, containment), and some possibility of symbolic play (e.g., pouring, stirring).

Audio and Video Recordings. Three third-person cameras will capture the play session in detail; two cameras will be mounted in the corners of each testing room

Figure 1. Overview of the experimental setup; the caregiver and child will be seated in the middle of a playroom with three toy sets that are equidistant from the child. Two wall-mounted cameras and one overhead camera will capture three perspectives.

and one overhead camera will capture the entire scene from above (see Figure 1). In addition, both children and their caregivers will be fit with an egocentric, head-mounted camera to capture a portion of their field of view. The cameras will be aimed slightly upwards to capture socially-relevant information. Caregiver's speech will be recorded using a wireless lavalier microphone attached to the caregiver's shirt (Shure BLX14/CVL-H10) or from an overhead microphone (Shure MX202). All video and audio data will be shared using Databrary (Databrary, 2012) for participants who give consent to do so.

Procedure. Before beginning the session, caregivers will be told about the two different phases of the study. Specifically, caregivers will be told “In one phase, we’re interested in how children explore toys by themselves, so we will ask you to let your child play independently while we have you fill out a questionnaire. If your child asks you to interact with the toys, feel free to smile and say encouraging phrases to your child, but please do not pick up the toys yourself or give them to your child. Similarly, please do not direct your child’s attention to any one of the toys.” For the guided play portion of the study, caregivers will be told that they can “play with your child as you normally would.”

After the consent procedure, the experimenter will outfit both the caregiver and child with head-mounted cameras (see SI for details), during which the child is given the red hollow ball to play with. Caregivers will be encouraged to help the experimenter put the head-mounted camera on the child, and another experimenter may help distract the child during this process. If the child is not engaged with the hollow ball, an experimenter will present another distracting toy to the child at this time, and then replace it with the hollow ball at the very beginning of the experimental session. After the placement of the head-mounted cameras, the caregiver will bring the child into the room and have a seat with the child in their lap at the indicated location. If, however the child becomes overly fussy during this procedure (i.e., removes the headcam themselves more than twice or is crying for more than 2 minutes once the headcam is placed), the experiment will proceed without head-mounted video data from this infant. Similarly, if the child removes the head-mounted camera once the procedure has begun, the experimenter will not re-enter the room to try to re-affix it, and caregivers will be told to put the camera aside as piloting revealed that this often upset the child, resulting in them disengaging from the toys and not completing the play session.

The child will begin the experimental play session with the hollow ball and be seated equidistant from the blocks, shape sorter, and stacking cups with a spoon. In the individual play first condition, an experimenter will follow the caregiver in with a clipboard and ask the caregiver to complete a survey (here, the Communicative

Development Inventory, see Demographic Surveys) while their child plays solo. After 10 minutes, the experimenter will retrieve the clipboard and ask the caregiver to now play with the child as they normally would. After a further 10 minutes of guided play, the experimental session is complete. In the guided-play first condition, the caregiver is first asked to play as they normally do with their child for 10 minutes, and then the experimenter will come in and ask the caregiver to fill out a questionnaire on a clipboard while the child is allowed to play independently. In pilot testing of a similar paradigm, all three infants played for a full 20 minutes.

Demographic surveys. Caregivers will be asked to complete several demographic surveys to assess the variability in children's vocabulary, parenting knowledge, parenting practices, and basic demographics both within and across our two respective samples. These surveys will be started during the experimental sessions but may be completed at home by the parents and caregivers. The age-appropriate Communicative Developmental Inventory¹ (CDI; Fenson et al., 1994; Hao, Shu, Xing, & Li, 2008; Tardif & Fletcher, 2008) will be used to assess vocabulary and administered during the individual play portion of the study; parents will be instructed to not query their children with specific words from the survey during the session. In addition, the Knowledge of Infant Development Inventory (KIDI; MacPhee, 1981) will be used to assess parenting knowledge and the Early Parenting Attitudes Questionnaire (EPAQ; Hembacher and Frank, 2018) will be used to assess parenting practices. The KIDI and EPAQ will be administered after the experimental session is complete to prevent any possible influence. Finally, we will collect basic demographics on each child, including their exact age, gender, as well as maternal and paternal education and occupations, and marital status. The parent measures will be used in combination as a proxy for socio-economic status (SES; Hollingshead et al., 1975). All surveys will be administered in the native language of the caregiver (i.e., English or Cantonese/Traditional Chinese).

While we will not analyze most of the results of these surveys in our primary

¹The short form CDI will be used for children younger than 18 mos (i.e., CDI: Words and Gestures) and the long form for those 18 mos or older (i.e., CDI: Words and Sentences).

analyses, we will include the SES proxy measure as well as parenting knowledge as covariates in exploratory, secondary analyses (not included here) to understand any of the main effects we may find. Furthermore, these extensive surveys will be publicly available for reuse by future researchers who may have specific hypotheses.

Data Exclusion. First, the session will be stopped if child is continuously fussy (defined as crying while simultaneously disengaged from the toys) during the session for more than a 1-minute period or for two or more 30-second periods. Children will then be excluded if: (1) the child participates for less than 5 minutes overall, (2) the child participates in only one of the two phases (less than 2 minutes in either phase), (3) parent reports a developmental disability or language delay, (4) the parent does not follow instructions (e.g., ignores survey task and gives frequent instructions during individual play stage). This will be operationalized as caregivers giving either specific verbal instructions or giving direct demonstrations more than twice during the solo free play session (see Appendix: caregiver support guidelines). Participants will also be excluded if (5) the child is clingy during the free play phase such that they do not engage with the toys for over half of the session, as this would result in very few play events, or (6) a technical malfunction in more than one of the 3rd-person cameras (missing data from two cameras will result in an exclusion; we anticipate that these interactions should be codable with video from 2/3 cameras). As noted, we will not exclude children for whom we do not have data from the head-mounted cameras.

Analysis Plan

Video Annotation: Primary. Trained bilingual coders will code the videos for three different kinds of events using Datavyu v. 1.3.7 (Datavyu, 2014); these coders will be blind to the main hypotheses of the study. All videos will first be synced using Adobe Final Cut Pro and trained coders will view all three third-person camera views simultaneously. All videos will be coded at least once, and reliability checks will be conducted for a subset of at least 20% of the videos of each play type. If the reliability of any measure for any given child/play type is less than .75 (using intra-class correlation

coefficients), that child's codes for that measure will be redone and rechecked.

First, videos will be coded for whether the child is engaging in one-object play or multi-object play; times when the infant is not engaging with the toys will also be marked and not analyzed. Thus, each frame in each video will be marked as "OBJECT PLAY/NO OBJECT PLAY" and "RELATIONAL/NON-RELATIONAL"; social play (e.g., tickling) will not be as "NO OBJECT PLAY" for these purposes. Similarly, times when the infant is not playing with the assigned toys (e.g., playing with their shoes or their caregiver's jewelry) will be coded as "NO OBJECT PLAY". This coding will then be used to assess the proportion of play interactions that involve relational play between objects and yield a proportion of relational play (range: 0 to 1) computed for each individual participant and play type (individual vs. guided play).

Second, coders will assess the caregiver's use of support and direct demonstrations during play following a modified version of a support scale used by Conner and Cross (2003); Pratt, Kerig, Cowan, and Cowan (1988); Wood and Middleton (1975). These guidelines were modified to be suitable for 1-2 year-olds and to acknowledge both forms of verbal and gestural support. Caregiver support will be coded on an ordinal scale from 0-4, with 0 being uninstructed play and 4 being direct demonstration; each level of support can include verbal and/or gestural support. See Appendix for full coding guidelines and examples. 0 - No intervention, 1 - General activity orienting ("Here's the ball!") 2 - General feedback to specific actions (e.g., after stacking blocks; "Look, you did it!"), 3 - Specific instructions about a toy ("That one [points] will fit."), 4 - Instructions about entire activity / action sequence (e.g., parent demonstrates containment event). To code caregiver support, coders will watch each video in 30 second segments and code the maximum level of caregiver support in that segment. Thus, the outcome variable will be an average amount of maximal caregiver support for each child and type of play.

Inter-rater reliability for both variables (relational play and caregiver support) will be assessed using the intraclass correlation coefficient (ICC). If the reliability for any of the measured variables is below 0.75, discrepancies will be resolved on a case-by-case

basis between coders.

Regression Models: Primary. Bayesian linear regression models will be used assess whether our two main variables of interest (proportion of relational play and caregiver support) differ with children's age (specified in months), the two different cultural testing sites (HK vs. CA), and their interaction. Regressions will use weakly informative null priors ($\text{normal}(0,10)$) for all coefficients, and the analysis will be performed using the RStan package (Stan Development Team, 2018). Our full set of analyses will entail four separate regressions, as we will analyze the proportion of relational play and level of caregiver support separately for the individual vs. guided play phases. We expect caregiver support to be quite low during individual play, so these two regressions are expected to find no significant effects. For each main effect and interaction we will report the 95% credible interval (CI), the range within which 95% of the posterior distribution falls. The use of Bayesian regression makes it possible to assess the strength of any null effects: given the observed data, the true effect size has 95% probability of falling within the range of the 95% CI. Although Bayesian analyses typically afford the opportunity to implement a stopping rule when some level of evidence has been reached, we will not do so because an additional goal of this study is to collect a large enough dataset that it can be fruitfully used for testing further hypotheses about guided and individual play.

First, to examine the development of individual play behaviors, we will examine how children's age (in months), cultural context (HK vs. CA), and their interaction impacts the frequency of relational play during both individual and guided play phases. For both of these first two regressions, we expect to see a main effect of age on relational play, in line with previous evidence (Fenson et al., 1976), but we do not have any a priori reason to expect differences in relational play across cultures. In accordance with Vygotsky (1962)'s theory that caregivers create a zone of proximal development for children, we expect to see higher levels of relational play during guided play than during individual play, and less of an interaction with age under guided play.

Second, we will examine how levels of caregiver support differ across age and

cultural context. We expect a main effect of age, as we expect caregiver's level of support to increase as their children's cognitive and linguistic abilities are more advanced. Here, we expect a main effect of cultural context, as we expect that caregivers in Hong Kong will show higher levels of parental support relative to caregivers in CA (W. Haight et al., 1999; Parmar et al., 2004; X. Chen, 1998). We expect that this difference may be even more pronounced as children's linguistic abilities emerge towards the end of the second year of life; if this is the case, then we would expect to see an interaction between age and cultural context in this fifth and final regression.

Exploratory Analyses

Additional Video Annotation. For additional exploratory analyses, we plan to code the number of play bouts of different types based on the schema developed by Fenson et al. (1976). These bouts will be coded for whether infants are, in order of increasing complexity simply (0) banging one object or (1) two objects together, (2) engaging in 'inappropriate' relational play with two objects or (3) 'accommodative' relational play between two objects, (4) engaging in symbolic/imaginative play, or (5) engaging in sequential play acts. Given our specific toy set, we define 'accommodative' (appropriate) relational play events as any play bout where there is a clear attempt at either a support (e.g., stacking) or containment relationship between two objects; similarly, inappropriate relational play will be defined as play bouts with two objects where a support or containment event was not attempted. Symbolic play actions include any clear instances of actions involving pretend or imaginary events, such as pouring or sipping from the stacking cups, or stirring or spooning. Finally, sequential acts are defined as two or more successive responses in a clear order, such as stacking blocks or cups, or sorting multiple shapes. These annotations will allow us to calculate the number of acts of each type, as well as the average complexity of a child's play behavior in the individual and guided play phases.

We also plan to conduct detailed joint attention coding for exploratory measure during the guided play session. Every bid for joint attention by either the caregiver or

the child will be coded throughout the guided play session. Second, all joint attention episodes will be coded for whether they are considered *passive* or *coordinated*. In *coordinated* JA, the caregiver and child are mutually focused on a third object, and the child acknowledges the caregiver by looking towards their face, pointing, gesturing, or engaging in turn-taking (see Appendix: Joint Attention Coding Guidelines). In contrast, JA is *passive* when the child does not explicitly acknowledge the caregiver during the interaction.

Regressions. Our exploratory annotations will be used to compute several exploratory dependent variables of interest: the overall 'complexity' of play (following (Fenson et al., 1976), the number of adult- and child-initiated bids for joint attention, and the proportion of coordinated vs. passive episodes of joint attention. As in our primary analyses, we will again conduct Bayesian linear regressions that assess how children's age (in months), cultural context (HK vs. CA), and their interaction affects each exploratory variable. Given that we expect caregivers in Hong Kong (vs. CA) to show higher levels of caregiver support, we might also expect to see more bids for joint attention from caregivers in HK vs. CA during guided play; conversely, we may not expect any differences in the frequency of child-initiated bids for joint attention. Similarly, coordinated joint attention episodes may be more likely to occur during high levels of caregiver support; thus, we might also expect a greater frequency of coordinated vs. passive joint attention episodes during guided play in HK vs. CA.

Language Analysis. Parents' child-directed speech during guided play will be transcribed and analyzed to complement the behavioral analysis of parental support. Based on findings that parents in China may tend to use more directive statements during play (Ng & Wang, 2019; Pomerantz, Ng, Cheung, & Qu, 2014), we tentatively hypothesize that caregivers in Hong Kong may use more imperatives, while parents in CA may use more declaratives. Finally, following from research on the stronger noun bias in young learners of American English as compared to Cantonese (Tardif et al., 1999), we might expect parents in CA to use a higher proportion of nouns compared to predicates in child-directed speech, as compared to HK parents who may use relatively

more predicates. On the basis of the theorized link between predicates and relations, it would be most interesting if the relative balance of parents' nouns vs. predicates were strongly related to the proportion of relational play.

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