RUNNING HEAD: Symbolic play and non-verbal communication.

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Symbolic play promotes non-verbal communicative exchange in infant-caregiver dyads.

Sara Quinn[a, b] & Evan Kidd[a, b, c]

[a]*The Australian National University, Canberra Australia*

[b]*ARC Centre of Excellence for the Dynamics of Language*

[c]*Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands*

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Addresses for correspondence:

Sara Quinn
Research School of Psychology
The Australian National University
Acton
Canberra 2601
Australia
Email: sara.quinn@anu.edu.au

Evan Kidd
Language Development Department
Max Planck Institute for Psycholinguistics
PO Box 310
Nijmegen 6525 XD
The Netherlands
Email: evan.kidd@mpi.nl

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Abstract

Symbolic play has long been considered a fertile context for communicative development (Bruner, 1983; Vygotsky, 1962, 1978). In the current study we examined caregiver-infant interaction during symbolic play and compared it to interaction in a comparable but non-symbolic context (i.e., 'functional' play). Fifty-four ($N = 54$) caregivers and their 18-month-old infants were observed engaging in 20 minutes of play (symbolic, functional). Play interactions were coded and compared across play conditions for joint attention and gesture use. Compared with functional play, symbolic play was characterised by greater frequency and duration of joint attention and greater gesture use, particularly the use of iconic gestures with an object in hand. The results suggest that symbolic play provides a rich context for the exchange and negotiation of meaning, and thus may contribute to the development of important skills underlying communicative development.

A crucial claim of socio-cultural developmental theory is that specific behaviours and contexts support children's entry into the distinctly symbolic nature of human society (Bruner, 1983; Rakoczy, 2008; Tomasello, 1999; Vygotsky, 1962, 1978). One behaviour that has received considerable attention is *symbolic play* – the non-literal use of objects, actions or persons, typically in the spirit of enjoyment. According to socio-cultural theory, the representational nature of joint symbolic play provides a unique social context that cultivates symbolic development. Take, for instance, the classic case of object substitution (e.g., a child, who is playing with their caregiver, pretends a block is a car), which highlights two sophisticated and arguably uniquely human skills. Firstly, it assumes that the child understands that in this specific context the block represents a different concept (i.e., a car); that is, there is a symbolic mapping between the object and its new conceptual function. Secondly, the mutual understanding of the transformation presupposes that the dyad (i.e., a child and an interlocutor) is engaged in a cooperative meeting of minds; that is, they are engaged in *collective intentionality* (Rakoczy, 2006, 2008; Tomasello, Carpenter, Call, Behne, & Moll, 2005).

In the current paper we investigated how the context of symbolic play fosters behaviours that are known to be particularly important for early communicative development and which provide the foundation for language acquisition. There has been a long-proposed although not uncontroversial hypothesis that symbolic play is important for language development (for discussions see Hall, Rumney, Holler, & Kidd, 2013; Hirsh-Pasek, Golinkoff, Berk, & Singer, 2009; Lillard et al., 2013). However, following Piaget (1962), empirical work in this space has mostly been driven by the assumption that the symbolic play-language relationship derives from the underlying symbolic nature of the two systems. Here we investigate the hypothesis that the *context* of symbolic play necessitates and therefore fosters behaviours that enable the negotiation

of meaning, and which are therefore important to communicative development. In particular, under the assumption that joint symbolic play necessitates collective intentionality (Rakoczy, 2008), we explore the hypothesis that dyadic infant-caregiver symbolic play promotes early dyadic communicative behaviours: joint attention and non-verbal gesture use.

Early communicative behaviour: joint attention and gesture.

Joint attention (JA) has long been recognised as a functionally significant type of interaction across development (e.g., Bruner, 1983; Tomasello, 1995). JA episodes are important for learning about others' experiences and, perhaps more fundamentally, the mechanics of social interaction, especially when the focus of mutual attention involves the negotiation of ambiguous objects or events (Moll & Tomasello, 2007).

The cooperative imperative of collective intentionality leads to the prediction that symbolic play and JA are related (Rakoczy, 2006; Tollefsen, 2005). Charman et al. (2000) suggested that the two belong to a shared social-communicative representational system, alongside language, imitation, and theory-of-mind. Empirical work by Lillard and colleagues suggests that the 'out-of-the-ordinary' context of symbolic play elicits behaviours typical of JA. Lillard and Witherington (2004) asked mothers to engage in a real and a pretend snack with their 18-month-old infants. The pretend (i.e., symbolic) context was characterised by greater overall looks to their infant compared to the real condition, and mothers also smiled more frequently and for longer durations.[1] Subsequent analyses of the sequential nature of the interactions suggested that the mothers' modification of their looking behaviour and affective signalling (i.e., smiling) in the pretend condition served to cue the infants to the symbolic nature of the action (Nishida &

[1] 'Pretend' and 'symbolic' have been used interchangeably in the field. By definition, a pretend act is symbolic because it invokes an alternative construal of an action or event. Although our preference is to use 'symbolic', we use 'pretend' when faithfully representing past research or research instruments.

Lillard, 2007). These data suggest a direct link between JA and symbolic play, whereby play behaviours serve as social referencing cues to symbolic contexts.

In infancy JA is arguably a necessary condition for the exchange of meaning, which early in development is significantly supported by manual gesture. The pointing gesture emerges towards the end of the first year of life (around 8 – 15 months, Carpenter, Nagell & Tomasello, 1998). Infants point to manipulate their caregivers' attention during interaction (Bruner, 1983; Carpenter et al., 1998; Tomasello, Carpenter, & Liszkowski, 2007), with recent evidence suggesting the behaviour reflects a sophisticated understanding of others as social and intentional agents. For instance, Liszkowski and Tomasello (2011) showed that index-finger but not whole-hand pointing in 12-month-old infants was associated with the comprehension of the referential intention behind adult points, suggesting that index-finger pointing is a fully communicative act of reference. More recent work by Esteve-Gibert, Prieto, and Liszkowski (2017) has shown that 12-month-old infants have a particularly sophisticated understanding of the different social and pragmatic functions underlying different deictic gesture types and the prosodic patterns that accompany them, even in the absence of shared background knowledge. Faced with the same ambiguous situation (the sudden appearance of a novel object), infants behaved differently according to an adult's speech + gesture combination, providing evidence that children can distinguish between imperative, expressive, and informative communicative intentions in novel situations with novel interlocutors.

During their second year of life children begin to produce representational or 'iconic' gestures. These are frequently action-based enactments of events (e.g., holding hand to mouth and simulating chewing to denote 'eating'), and increase in frequency in spontaneous speech after children's second birthday (Özçalişkan & Goldin-Meadow, 2011; Stefanini, Bello, Caselli,

Iverson, & Volterra, 2009). Infants appear to treat iconic gestures and words as equally viable symbols for referents, suggesting an early 'equipotentiality' between the gestural and verbal modalities (Abrahamsen, 2000; Capirci, Contaldo, Caselli, & Volterra, 2005). This effect is likely to reflect conventional form-meaning mapping of the kind used in early word learning, since children do not appear to understand the representational relationship between iconic gestures and their referents until they are around 2 years of age (Namy, 2008). Infants' early iconic gestures are also likely to be acquired from interactions with competent others rather than being spontaneously generated, as they tend to be in adults. Behne, Carpenter, and Tomasello (2014) created novel situations in which 21-month-old and 27-month-old children could use spontaneously created iconic gestures to help a puppet perform a novel action, and found that only the older group were consistently able to invent spontaneous iconic gestures. Since even younger children will some (possibly conventionalised) iconic gestures in their repertoire, the data suggest that the emergence of adult-like iconic gesture use is protracted.

How children acquire iconic gestures is unclear because they are comparatively rare in the input (Iverson et al., 1999; Namy, Vallas, & Knight-Schwartz, 2008). Symbolic play may provide one fertile context in which children learn gestural symbols because of the inherently representational yet ultimately ambiguous nature of the context (Hall et al., 2013). That is, in symbolic play infant-caregiver dyads must jointly negotiate meaning, and in the absence of the infant's verbal capacity to establish reference, both participants are likely to use gesture. There is some evidence for this proposal, with studies showing that infants derive early iconic gestures from action-based schemas in infant-caregiver play (e.g., Acredolo & Goodwyn, 1988; Bates et al., 1983; Capirici, Contaldo, Caselli, & Volterra, 2005). For instance, Namy, Vallas, and Knight-Schwartz (2008) showed that parental *in-hand* symbolic iconic gestures (e.g., 'flying' a

toy plane), which are particularly common in play, were significantly associated with 16 – 22 months old infants' gesture comprehension and production, as measured by parental report. In contrast, parental out-of-hand iconic gestures (e.g., pretending to hold an invisible plane while making it fly) did not predict children's gesture. The authors suggested that infants may be deriving out-of-hand iconic gestural symbols from (symbolic) action patterns observed through interaction in play.

The Current Study

Symbolic play is an early emerging and potentially significant behaviour in development. Although it has long been linked to socio-communicative and cognitive development, the mechanisms underlying these links are not well understood (Lillard et al., 2013). The aim of this study was to explore differences in specific socio-communicative aspects of the caregiver-infant interaction during symbolic play and a comparable yet non-symbolic play context, which we call *functional* play. Infant-caregiver dyads participated in both types of play, and their interactions were coded for JA and gesture use. There were two hypotheses derived from the argument that, following Rakoczy (2006, 2008), symbolic play constitutes the first unambiguous demonstration of collective intentionality. Following past research by Lillard and Witherington (2004), it was hypothesised that JA episodes would be more frequent and of greater duration in the symbolic play condition than in the functional play condition. Secondly, as infants' early communicative exchanges are gesture-rich and symbolic play context necessitates the negotiation of what objects and actions may represent, it was hypothesised that infants and caregivers would gesture more in symbolic play. We did not make any specific predictions regarding *which* gestures would be used more across the two conditions; past studies have shown that in-hand iconic gestures are particularly frequent in play (Namy et al., 2008), but no past studies have compared gesture use

across symbolic and non-symbolic contexts. Therefore, while we expected a high degree of in-hand iconic gestures, we had no a priori reason to not expect greater gesture use in symbolic play across the board.

Method

Participants

Fifty-four primary caregivers (50 mothers) and their biological infants (31 girls) were recruited from a medium-sized Australian city. The infants were, on average, 18 months of age (M = 18.32, SD = 0.98, range = 16.58 to 20.26 months). This age was chosen because it marks the point at which children begin to regularly engage in symbolic play (Fein, 1981; McCune, 1995; Rubin & Howe, 1985). All infants were monolingual and typically developing, with no known or suspected developmental delay. Analyses of the children's speech during the play sessions revealed that the average mean length of utterance in morphemes was 0.97 (SD = 0.31); therefore the children were still in the one-word stage of language development. The majority of infants were first born (70%, n = 38), 67% did not have any siblings (n = 36), and 65% attended childcare (n = 35; $M_{days/week}$ =1.73, $SD_{days/week}$ = 1.51). Socio-economic status was estimated from caregiver education as high: 78% of mothers (n = 42) and 69% fathers (n = 37) had bachelor degrees or higher.

Materials

Play conditions.

We aimed to create a naturalistic play setting in which infant-caregiver dyads engaged in symbolic play and a comparable but non-symbolic play context. Specific types of toys promote specific types of play and this is influenced by the number of toys available, object form (e.g., size, shape, material, complexity), and the child's knowledge of the function of objects (e.g.,

saucepans are stirred by big wooden spoons) (e.g., see Morrissey, 2014; Rubin & Howe, 1985). To this end, we selected two sets of toys that were designed to elicit either symbolic or functional play (see Figure 1).

Toy selection for the symbolic play condition was guided by standardised measures (e.g., Test of Pretend Play; Lewis & Boucher, 1997) and past symbolic play research (e.g., Bigham & Bourchier-Sutton, 2007; Brown, Rickards, & Bortoli, 2001; Fekonja, Umek, & Kranjc, 2005; O'Brien & Nagle, 1987; Taylor, Cartwright, & Carlson, 1993). The set included a saucepan and lid, a wooden spoon, a teapot, two teacups and a teaspoon, a teddy bear and a plastic toy mobile phone. Toy household items (e.g., saucepan, lid and wooden spoon and the tea set) tend to elicit pretence behaviours (e.g., pretending to cook soup or eating and drinking behaviours), and toy mobile phones elicit pretend conversations with others (e.g., see Taylor et al., 1993). Non-representational objects (e.g., piece of red cloth, small yellow cylinder, and small white cube) do not immediately represent real world artifacts and as more 'abstract' items encourage object substitution (e.g., the red cloth is a "picnic rug" or a "cape" for teddy).

Functional play was defined as engaging in object play where the toy was used for its intended purpose; that is, in an *adult-defined* manner (Fenson, Kagan, Kearsley, & Zelazo, 1976; Laplante, Zelazo, Brunet, & King, 2007). The set of toys in the functional play condition consisted of a magnetic drawing board and magnetic stamps, a wooden peg and hammer set, a wooden animal block puzzle and its wooden tray, and a wooden maraca and castanet. These toys were chosen as they have a specific function or are 'rule-based' (e.g., the hammer bangs the pegs, the magnetic drawing board is for drawing).

[insert Figure 1 about here]

As a manipulation check, caregiver-infant interactions were first assessed for the level of symbolic play in both play conditions. The highest level of play of both caregivers and infants was recorded using the Pretend Play Observation Scale (Brown et al., 2001, see Appendix). The reliability of coding was high: 12 of 54 (22%) of play sessions were coded independently by two coders, who reached 92% agreement. The symbolic play condition had significantly higher levels of symbolic play than the functional play condition for both infants and caregivers (Infants: $M_{Symbolic} = 5.74$, $SD = 2.19$, $M_{Functional} = 0.19$, $SD = 1.03$, $t(53) = 17.80$, $p < .001$, $d = 3.59$, CI_{95} [2.98, 4.19]; Caregivers: $M_{Symbolic} = 7.26$, $SD = 1.91$, $M_{Functional} = 0.52$, $SD = 1.85$, $t(53) = 15.78$, $p < .001$, $d = 3.24$, CI_{95} [2.67, 3.82]). Thus the toys used in the symbolic play condition elicited higher levels of symbolic play from infants and their caregivers than did the toys in the functional play condition. Note that we cannot claim that dyads *never* engaged in symbolic behaviour during functional play, although the low means in the functional condition suggest symbolic acts were vanishingly rare. Accordingly, our results reflect joint communicative behaviours elicited in instances of more versus less symbolic play, and the toy manipulation therefore achieves our goal of creating two comparable play contexts that differ primarily in their symbolic content.

Procedure

Caregivers were encouraged to sit on a play mat on the floor and face the direction of the camera. They were then asked to play with their infant as they normally would. Importantly, unlike in past studies (e.g., Lillard & Witherington, 2004), at no point were caregivers instructed to engage in symbolic play, thereby ensuring their behaviour was spontaneous and that the study had a high degree of ecological validity. Dyads completed both the functional and symbolic play conditions in one continuous play session (within-subjects), which lasted approximately 20

minutes. The transition between the play sessions was seamless: at around the ten minute mark (or if the infant had lost interest in the current toy set) the researcher offered the dyad a new set of toys and took the other set away. Play conditions (i.e., functional or symbolic) averaged ten minutes (M = 602s, SD = 52.62s) and ranged in duration from 7mins, 30s to 12mins, 23s. The order of conditions was randomised across participants to avoid order effects. Play sessions allowed for breaks as required. Sessions were videorecorded for later transcription and coding.

Coding

JA duration and frequency were measured and compared for differences between the two play conditions. Unlike verbal acts that convey information without visual attention, gestures require shared visual attention. Visual attention is a prerequisite of JA; therefore gesture production was coded within JA episodes to ensure they were communicative acts. The unit of analysis within JA was a turn.

Joint attention.

JA was operationalised to include the major definitions from the past literature (e.g., Bakeman & Adamson, 1984; Bigelow, MacLean, & Proctor, 2004; Carpenter et al., 1998; Saxon & Reilly, 1998; Tomasello & Farrar, 1986; Tomasello & Todd, 1983). For each dyad, the onset, offset, and who initiated and ended JA episodes were coded from video footage and were included as separate tiers in transcripts created in the Codes for the Analysis of Human Language program (CHAT; MacWhinney, 2013), allowing automated analysis in the Child Language Analysis (CLAN) software (MacWhinney, 2013). JA coding criteria and examples are provided in Tables 1 and 2.

[insert Tables 1 & 2 about here]

A second coder independently coded ten (19%) randomly selected dyads for JA. To be

considered a match, episode frequency and who initiated/ended episodes had to be coded exactly the same for both raters. Episode duration was considered a match if coding was accurate within two seconds and a non-match if it differed by more than two seconds. Inter-rater reliability was substantial, $\kappa = .751$ ($SE_\kappa = 0.07$, $CI_{95,\kappa}$ [0.614, 0.889, Landis & Koch, 1977], percentage agreement = 88.04%). Discrepancies were resolved via discussion with a third senior researcher who was blind to the play conditions.

Gesture.

Gestures were coded within JA episodes from the video footage. The following gestures types were coded:

Deictic gestures. This category was restricted to points, which were defined as an extension of the arm (either fully or slightly bent) accompanied by an index finger or open hand, palm down, in the direction of (or touching) a referent in the immediate environment (Iverson & Goldin-Meadow, 2005). Points were further coded as *declarative* (wishing to divert the attention of the play partner) or *imperative* (if the individual appeared to be requesting or wanting an object).

Iconic gestures. This category included any representational gestures with or without an object in hand. Out-of-hand ("empty handed") gestures included the concrete imagistic representation of an object or action's characteristics (e.g., running fingers through hair "as-if" they are the teeth of a comb, using a hand as a telephone). In-hand gestures were defined as representational gestures completed with an object in hand (e.g., stirring imaginary food with a wooden spoon in a pot, talking on a toy telephone). Importantly, we made a distinction between in-hand actions that were symbolic versus non-symbolic in content, and only coded the former as iconic gestures. For instance, if in the symbolic play condition an infant banged a saucepan with

a spoon without any indication that the action involved a symbolic element (i.e., cooking imaginary food), this was not coded as an in-hand gesture. However, if the child stirred the spoon in the saucepan as if stirring imaginary food, this was counted. Similarly, banging pegs with the hammer in the functional play condition was not coded as an iconic gesture because there is no clear symbolic element. However, banging the pegs while pretending to build a house was counted. This follows our desire to ensure that we only counted truly symbolic actions as in-hand gestures, which differs from past research. For instance, Namy et al. (2008) coded all caregiver in-hand gestures as symbolic, but coded infants' in-hand gestures as non-symbolic to avoid having to distinguish between ritualised play behaviours and in-hand iconics that functioned as true communicative symbols (p. 309). However, our focus was on how a symbolic versus non-symbolic play context would affect joint communicative behaviour, and so it was important to scrutinize infants' in-hand actions for their communicative value.

Coding this distinction was not always straightforward, and often required disambiguation from the verbal and non-verbal context. For example, in the symbolic play context, if the infant looked at the base of the saucepan, waved the spoon in the saucepan, the parent uttered "*Can you see your reflection?*", and the infant then smiled, this would not be considered symbolic because there was no clear symbolic element to this action. However, if this same sequence of actions was accompanied by verbal material indicating a symbolic action (e.g., a child's use of a mimetic *mmm* or a parental utterance such as *"Is that soup?"*), the action was coded as an in-hand iconic gesture. Thus behaving "as-if" was one crucial way in which object manipulation could be considered symbolic.[2] It is important to point out that there was not an

[2] A skeptical reader might argue that we are blurring the distinction between symbolic play and communicative gesture. However, it is important to stress that pretend actions with an object in hand are just as symbolic and communicative as out-of-hand gestures, and both are different from functional actions. For instance, if I am in a restaurant in a foreign country and gesture to my waiter that I am signing a bill, the symbolic and communicative

identity relation between iconic gestures and pretend actions. Rather, a pretend action was only coded as an iconic gesture if it occurred within a JA context and was therefore potentially communicative. The converse was also true: it was possible to have an iconic gesture that was not a pretend action. For example, one parent mimed hammering by tapping a finger on his open palm. The common denominator for all actions coded as iconic gestures was that they were all (arguably) communicative and symbolic.

To avoid artificial inflation of gestural use, repeated deictic and iconic gestures were only counted as one gestural token (e.g., multiple points to the same object were counted as one deictic gesture; repeated sips of "tea" during a "tea party" were counted as one iconic gesture). The following gesture types were not coded: (i) non-manual gestures (e.g., facial expressions), (ii) conventional non-verbal communicative acts (e.g., nod "yes", gestures learned within the context of a song such as "star" in "Twinkle Twinkle Little Star"), (iii) emblematic gestures (e.g., unambiguous culturally specific gestures used to convey emotional content such as "thumbs up"), and (iv) beat gestures (e.g., hand movements that emphasise discourse elements of speech). These were not coded because their relationship to communicative development is equivocal. Discrepancies were resolved via discussion with a third senior researcher who was blind to the play conditions.

Overall inter-rater agreement between gesture presence and type was almost perfect, κ = .836 (SE_κ = 0.05, $CI_{95,\kappa}$ [0.739, 0.913], percentage agreement = 91.30%). Inter-rater agreement for deictic gestures was almost perfect for caregivers, κ = .850 (SE_κ = 0.08, $CI_{95,\kappa}$ [0.685, 1],

value is the same whether or not I am holding a pen (in-hand) or holding my fingers in a pincer grip holding an imaginary pen (out-of-hand). That is, both signal a request to the waiter, and crucially differ from the action of actually signing the bill, a functional behaviour that has no symbolic communicative value (beyond signalling the intention to honour a financial agreement). Our study investigates whether a symbolic play context increases the former behaviours but not the latter. We return to this issue in the Discussion.

percentage agreement = 92.50%) and substantial for infants, κ = .778 (SE_κ = 0.12, $CI_{95,\kappa}$ [0.537, 1], percentage agreement = 88.89%). Inter-rater agreement for iconic gestures was substantial for caregivers, κ = .754 (SE_κ = 0.10, $CI_{95,\kappa}$ [0.556, 0.953], percentage agreement = 88.37%) and almost perfect for infants, κ = .873 (SE_κ = 0.07, $CI_{95,\kappa}$ [0.738, 1], percentage agreement = 94.12%).

Analyses.

We compared JA and gesture use across and within play contexts using series of two-tailed paired comparisons. The data violated assumptions of normality required for paired-samples *t*-tests. Therefore, non-parametric Wilcoxon signed-rank tests (Wilcoxon, 1945) were used.[3] While Wilcoxon signed-rank tests are usually reported with medians, means and standard deviations are also reported to indicate the range of data dispersion (Field, 2013). The significance level was .05.

Results

Joint attention.

Every dyad engaged in at least one episode of JA across the entire testing session. However, there was an absence of JA in 15 dyads in the functional play conditions and one in symbolic play condition. JA episodes were mostly infant-led: 317/413 episodes were initiated by infants ($p < .001$, binomial test). In contrast, infants and caregivers were equally likely to end a JA episode (187 versus 225, one ambiguous, $p = .068$, binomial test). JA episode initiation (infant versus caregiver) did not significantly vary with play condition ($\chi^2 = .68$, df = 2, $p = .44$), and neither did episode ending ($\chi^2 = .17$, $df = 2$, $p = .74$). JA episode duration did not differ

[3] Effect sizes for Wilcoxon signed-rank tests were calculated using the formula: $r = \frac{z}{\sqrt{observations}}$ (as recommended by Field, 2013) and is interpreted according to Cohen's (1988) criteria (where .1 = small, .3 = medium, .5 = large).

according to who initiated the episode [$z = 1.8$, $p = .07$, $r = .09$], but did differ according to who ended the episode; episodes ended by infants were significantly longer ($M = 35.85$ sec, $SD = 40.96$, $M_{dn} = 21$, range = 279) than those ended by caregivers ($M = 25$ sec, $SD = 32.81$ sec, $M_{dn} = 13$, range = 170), $z = 4.64$, $p < .001$ $r = .23$.

A Wilcoxon signed-rank test indicated that JA was established significantly more frequently in the symbolic play ($M = 5.46$, $SD = 3.61$, $M_{dn} = 4.50$; range = 16) than in the functional play condition ($M = 2.19$, $SD = 2.30$, $M_{dn} = 2.00$; range = 9), $z = 5.91$, $p < .001$, $r = .57$. Data were then analysed to compare differences in the duration of time spent in JA between functional and symbolic play. To account for differences in the length of time each dyad spent in play interactions, the duration of time spent in JA was divided by the specific play session length (i.e., functional or symbolic play, see Figure 2).

[insert Figure 2 about here]

A Wilcoxon signed-rank test indicated that the proportion of time spent in JA was significantly higher within symbolic play ($M = 0.28$, $SD = 0.20$, $M_{dn} = 0.27$, range = 0.76) than in functional play ($M = 0.10$, $SD = 0.13$, $M_{dn} = 0.06$, range = 0.55), $z = 5.95$, $p < .001$, $r = .57$.

Gesture

Overall, caregivers gestured significantly more in symbolic play than in functional play (symbolic play: $M = 5.06$, $SD = 4.16$, $M_{dn} = 4.00$, range = 16; functional play: $M = 1.19$, $SD = 2.22$, $M_{dn} = 0.00$, range = 11, $z = 6.17$, $p < .001$, $r = .56$). This was also the case for infants (symbolic play: $M = 6.02$, $SD = 4.56$, $M_{dn} = 5.00$, range = 19; functional play: $M = 0.56$, $SD = 1.25$, $M_{dn} = 0.00$, range = 6; $z = 6.10$, $p < .001$, $r = .59$).

We next analysed whether rates of iconic and deictic gesture use differed within play conditions. For each individual the number of deictic (declarative, imperative) and iconic

gestures (in-hand, out-of-hand) were summed for each play condition and were divided by total gesture use across the full session to control for individual differences in gesture production. In the symbolic play condition, both infants and caregivers produced a significantly greater proportion of iconic than deictic gestures (Infants: $M_{\text{Iconic}} = 0.85$, $SD = 0.25$, $M_{dn} = 1.00$, $M_{\text{Deictic}} = 0.09$, $SD = 0.19$, $M_{dn} = 0$, $z = 5.82$, $p < .001$, $r = .59$; Caregivers: $M_{\text{Iconic}} = 0.72$, $SD = 0.31$, $M_{dn} = 0.8$; $M_{\text{Deictic}} = 0.15$, $SD = 0.21$, $M_{dn} = 0$, $z = 5.42$, $p < .001$, $r = .54$). In contrast, in the functional play condition both infants and caregivers produced a greater proportion of deictic than iconic gestures (Infants: $M_{\text{Deictic}} = 0.05$, $SD = 0.1$, $M_{dn} = 0$; $M_{\text{Iconic}} = 0.01$, $SD = 0.03$, $M_{dn} = 0$, , $z = 2.61$, $p = .009$, $r = .26$, Caregivers: $M_{\text{Deictic}} = 0.12$, $SD = 0.22$, $M_{dn} = 0$, $M_{\text{Iconic}} = 0.02$, $SD = 0.06$, $M_{dn} = 0$, $z = 3.14$, $p = .002$, $r = .31$).

Finally, we analysed whether there were differences in gesture use across the two play contexts for all gesture types. Each participant's declarative and imperative gestures were summed and computed to proportions by dividing the value by the participant's total number of deictic gestures. Likewise, in-hand and out-of-hand gestures were computed as proportions of overall iconic gestures. The results are presented in Figure 3.

[insert Figure 3 about here]

As shown in Figure 3, caregivers produced a significantly greater proportion of in-hand iconic gestures when engaged in symbolic play ($M = 0.92$, $SD = 0.17$, $M_{dn} = 1.00$) compared to functional play ($M = 0.01$, $SD = 0.04$, $M_{dn} = 0$), $z = 6.45$, $p < .001$, $r = .64$. The same result was observed in the infants ($M_{\text{Symbolic}} = 0.99$, $SD = 0.05$, $M_{dn} = 1.00$; $M_{\text{Functaional}} = 0.01$, $SD = 0.04$, $M_{dn} = 0$), $z = 6.61$, $p < .001$, $r = .68$). No other comparisons were significant.

Discussion

The current study explored how early communicative behaviours that provide the socio-cognitive foundations for language development differ during caregiver-infant interaction in symbolic compared to functional play. Rakoczy (2006, 2008) has argued that symbolic play unambiguously marks the infant's capacity for *collective intentionality*: the ability to engage in shared cooperative activities in which infants understand the intentional structure of events. In fact, he suggested that symbolic play might be "the cradle and bootstrap for developing collective intentionality, understanding of and participation in conventional world making more generally" (Rakoczy, 2006, p. 122). The suggestion is that this challenging symbolic context, which necessitates in-the-moment meaning making, fosters crucial socio-cognitive skills such as joint attention, shared action, and imitative cultural learning, skills which provide the foundation for communicative development (Ibbotson, 2011; Tomasello, 2003). Accordingly, we tested two hypotheses. First, it was hypothesised that infant-caregiver dyads would engage in more frequent and longer periods of joint attention in symbolic play when compared to functional play. Second, due to the ambiguous nature of what objects/events may represent and because 18-month-old infants are still not competent in spoken language, we predicted that the frequency of gesture use would be higher in symbolic when compared to functional play.

Our first hypothesis was supported: we observed significantly more JA during symbolic play than in functional play, a finding which suggests that this context may foster infants' burgeoning understanding of others as intentional social agents (Tomasello et al., 2005). The result is consistent with similar work by Lillard and Witherington (2004), who showed that symbolic play contexts are signalled by parents via non-verbal behaviours (i.e., smiling, eye-contact). Importantly, we observed this result without priming caregivers to engage in pretence.

Thus symbolic play contexts appear to naturally require greater joint attention in infant-caregiver dyads. The result underscores the cooperative nature of the symbolic play context, in which the representational function of objects must be jointly negotiated and agreed upon.

Our second hypothesis was partially supported. While we did observe more gestures in symbolic play, the pattern of gesture use when broken down according to categories was more nuanced. Specifically, we observed a significantly greater proportion of iconic in-hand gestures in symbolic than in functional play. The role and status of in-hand gestures in early communicative development is an intriguing one. Based on an array of quantitative and qualitative evidence, Bates and colleagues (1979, 1983) argued that they constitute an early form of naming similar to early spoken word use. Specifically, they are acquired in the same way (imitation), have the same function (i.e., reference), show a developmental profile categorised by decontextualisation (i.e., the gradual decoupling of symbol and referent), and are used to express the same basic stock of meanings. Finally, in their data an infant's early manual gesture vocabulary (in- and out-of-hand) was frequently in complementary distribution with their spoken vocabulary, such that they rarely had 'translational equivalent' gestures and words, suggesting that children were not privileging one form of reference over the other. Thus in early development in-hand gestures are a kind of performative naming, or following Bates, Shore, Bretherton, and McNew (1983), "the infant does not *have* her first words; she *does* them" (p. 65).

Somewhat curiously, although Bates et al. (1983) claimed that in-hand gestures constitute a form of naming, they also argued that they were not *communicative* because they did not appear to fulfill functions within the communicative repertoire of the infant, specifically, requesting (e.g., making a drinking gesture with an empty cup to request more juice) and declarative labelling to share attention (e.g., miming drinking with an empty cup to draw

attention to the act itself). It is certainly true that in-hand gestures may not be communicative in every instance; since they are derived from motor schemes they may sometimes reflect sensorimotor exploration. However, there are several key empirical facts that suggest they play a role in communicative development. Firstly, we only coded gesture use within joint attention contexts; the high incidence of in-hand gestures in these contexts suggests a communicative function. Following Bates et al., they may not be imperative or declarative acts, but children already have gestures for these functions (i.e., pointing). Instead, within symbolic play in-hand iconic gestures appear instead to have an *expository* function, identifying and scaffolding the thematic content of the play episode.

Secondly, Namy et al. (2008) found that parental in-hand gesture use was significantly associated with their infant's gesture production and comprehension, suggesting that infants learn and abstract away from these context-bound action schemas and incorporate them into their communicative repertoire. In this sense, symbolic play contexts provide infants with a rich corpus of transparent and contextualised action-based naming events, which may be an important component underlying the relationship between symbolic play and early language development. That is, one contributing factor to the symbolic play-language relationship may be gesture use, whereby children's exposure to and use of in-hand gestures lead to an increased gesture vocabulary, which in turn bootstraps spoken vocabulary development. This interpretation has independent empirical support from correlational studies that have found symbolic play skills to be strongly associated with gesture use, which in turn are more strongly associated with spoken language development (Bates et al., 1979; Hall et al., 2013).

An anonymous reviewer pointed out that infants may not see in-hand iconics as communicative, especially if they use them with equal frequency out of JA contexts. We do not

discount this possibility; however, we suggest that the communicative richness of symbolic play and therefore the communicative function of the in-hand iconics may be best revealed when interpreted in concert with the fact that symbolic play resulted in comparatively high amounts of JA. Gesture use is frequently redundant, but gesture use within symbolic play may play a role in attracting and sustaining an infant's attention. Thus, even if infants fail to see in-hand iconics as symbolic, their function in procuring attention may be one route via which children come to understand their symbolic and therefore communicative function.

Some limitations merit comment. Since we used different sets of toys in each play condition it will be important for future studies to rule out the possibility that the effect is specific to these toy sets. Additionally, it will be important to determine how the specific the effects observed here are to symbolic play, or whether they are a feature of challenging contexts in general. It is likely that any challenging joint activity necessitates sustained joint attention, but it is less clear whether a non-symbolic challenging activity (e.g., building a model aeroplane) would elicit frequent gestures. Note, however, that finding similar behaviours in different contexts would not detract from the suggestion that symbolic play promotes the same behaviours. In Western countries like the United States young children spend between 5 – 20% of their playtime pretending (Dunn & Dale, 1984; Haight & Miller, 1993). Thus any potential developmental links, regardless of their specificity to the context, are notable. More generally, it is important to acknowledge that these findings are likely to be at least partially culturally-bound. Symbolic play is likely to be universal but significantly moderated by culture (Lillard, 2017); it is an open question as to whether these results would replicate in cultures where play is less common and where access to tools is limited.

Conclusion

There is a substantial amount of research documenting the importance of play in a child's healthy development (see Hirsh-Pasek et al., 2009). The current study extends this understanding by suggesting that some play contexts, in particular symbolic play, facilitate the establishment and maintenance of joint attention and are associated with greater use of representational gestures. The results highlight the rich nature of symbolic play as a context that elicits and may even cultivate foundational skills crucial for communicative development.

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Appendix

Symbolic play was coded according to the Pretend Play Observation Scale (Brown et al., 2001), a coding scheme that describes the typical developmental sequence of pretend play according to ten stages. For a description of these stages and their examples see Table A1.

Table A1.

Pretend Play Observation Scale

Stage	Age (mths)	Descriptor and example
1	12 >	Pre-symbolic (closes eyes and pretends to sleep)
2	12-15	Auto-symbolic (feeds self with empty spoon)
3	13-18	Decentred (feeds doll/partner with empty spoon)
4	16-19	Linear sequence (feeds self and doll in any order)
5	18-24	Combinatorial sequence with single recipient (feeds and bathes doll in any order)
*6	18-26	Planned action (searches for, requests, offers materials incorporated into play)
7.0	20>	Simple object transformation (uses saucepan as hat, aerosol lid as cup)
7.5	20>	Complex object transformation (more than one object at a time, within a combinatorial sequence, and/or involving greater dissimilarity to the represented object)
8	21-30	Agency attribution (adopts vocal or physical attributes of another e.g., cat, driver)
9	30>	Ordered sequences (mixes cake, bakes it, eats it, retaining logical order)
10	30>	Imaginary transformation (places imaginary cake on plate, interacts with imaginary character)

Note. Adapted from Brown, Rickards, & Bertoli (2001). * Stage 6 was not coded for caregivers

Following Morrissey (2014), there were two modifications to the coding scheme. Firstly, Stage 7 (object transformations) of Brown's scale was separated into two stages:

simple (7.0) to represent early forms of object transformations (e.g., using a saucepan as a hat, cylinder as a cup) and *complex* (7.5) forms of object transformations (e.g., transforming more than one object at a time, transforming within a combinatorial sequence, and transformations involving greater dissimilarity to the represented object). Secondly, the coding of Stage 6 *planned play* was not applied to caregivers' play as their play activity was considered "modelling" and was frequently accompanied by verbalised intention (planning). If all planned caregiver play was coded at Stage 6 (*planned action*) the contribution of caregiver modelling of play between earlier Stages 2 and 5 (*autosymbolic, decentrered, linear* and *combinatorial sequences*) would have been lost. Therefore, removing Stage 6 as a coding stage for caregiver play allows for nuances of their earlier play activity to be captured descriptively within the coding scheme.

Figures & Tables

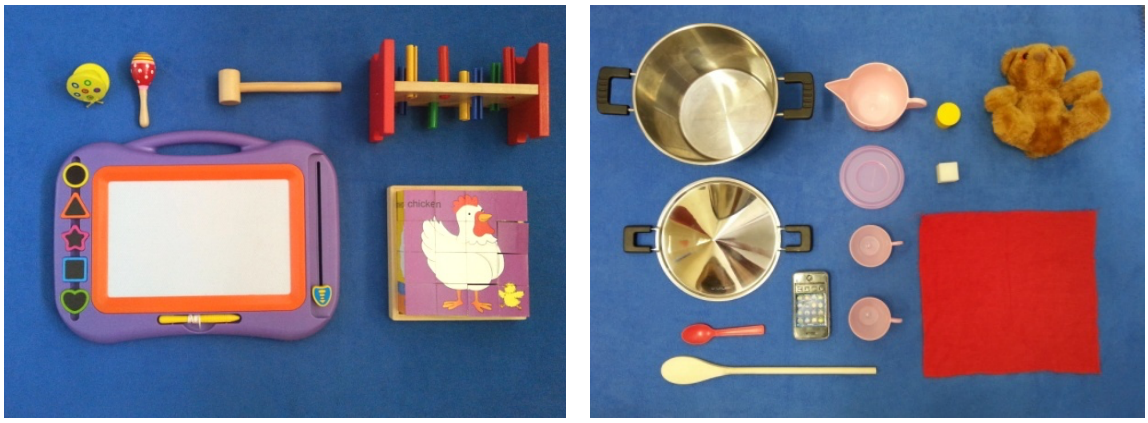

Figure 1. Functional (left) and symbolic (right) condition toys.

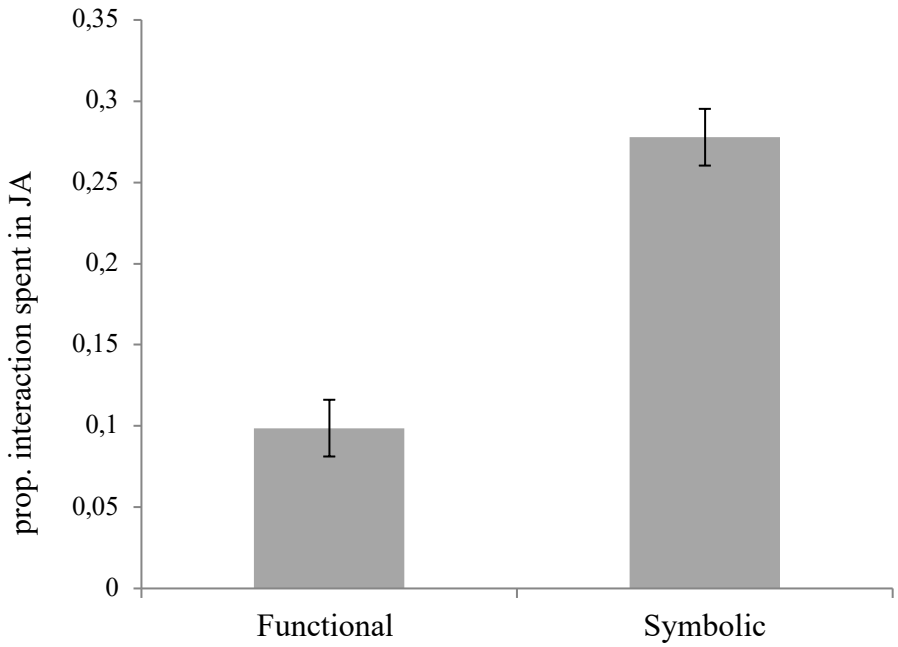

Figure 2. Mean proportion of play interaction spent in joint attention by condition. Error bars are 95% confidence intervals.

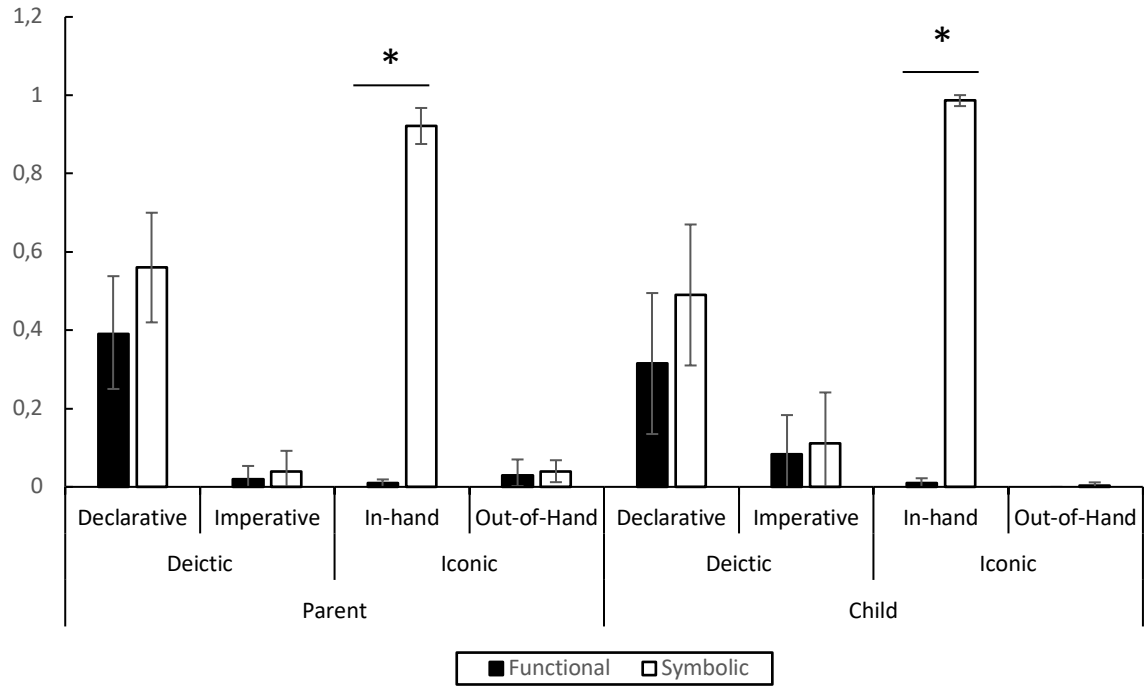

Figure 3. Mean proportion of caregiver and infant gestures by gesture category and condition. Error bars are 95% confidence intervals. *p <.05, exact two-tailed.

Table 1

Joint Attention Coding Criteria

Criterion		
Inclusion		
1	a)	An episode of JA began when one member of the dyad attempted to engage the other in interaction with an object or activity (Bakeman & Adamson, 1984; Bigelow et al., 2004; Tomasello & Todd, 1983). Either caregiver or infant could initiate JA onset.
	b)	Episodes were not coded as established until it was evident that the infant had acknowledged their caregiver's involvement in the interaction. This was indicated by the infant alternating their gaze from an object, to their caregiver's face, and back to the same object (Bakeman & Adamson, 1984; Carpenter, Nagell, et al., 1998). This may also have been accompanied by a gesture or vocalisation directed at the caregiver. In instances when an infant's face was not visible to the camera, other behavioural cues (e.g., head tilting) were used to determine if the infant alternated their gaze between object and caregiver.
	c)	Episodes were coded as initiated by the caregiver when the caregiver showed (e.g., communicative gesture such as a point), gave, or manipulated an object which they had chosen and the infant consequently looked at, reached for, touched or manipulated.
	d)	JA onset was coded from the time JA was established, rather than the time it was initiated by either the caregiver or infant.
2		Both caregiver and infant then visually focused on the same object or activity for a minimum of three seconds (Tomasello & Todd, 1983). After the initial three seconds, either member of the dyad could look away briefly during an extended episode of JA (provided JA has already been established for three secs).
3		Caregiver involvement had to include manipulation of the object, turn-taking, or another active involvement in an activity. Episodes were not coded if they were established, but were not co-ordinated within 10 seconds.
4		JA offset was coded when one of the following occurred:
	a)	The infant played with the object for 10 seconds without acknowledging their caregiver's involvement (either through a look vocalisation, communicative gesture, or turn-taking) (Bakeman & Adamson, 1984; Bigelow et al., 2004; Tomasello & Todd, 1983).
	b)	A period of 10 seconds passed without the caregiver actively involving themselves (e.g., watching or narrating their infant's actions).
	c)	One member of the dyad shifted their attention to a new object or activity, and the other individual did not follow within three seconds (Carpenter, Nagell, et al., 1998).
Exclusion		
1		One member of the dyad watched while the other played with a toy.
2		Both caregiver and infant played next to one another in parallel but not together.
3		The caregiver set up the toy with an agenda to play, and the infant looked at the toy but did not play, the caregiver did not persist.
4		The infant played with an object alone and the caregiver was visually focused on the object that the infant was playing with and/or describing the infant's actions/behaviours throughout. This excluded onlooking either by infant or caregiver (Tomasello & Todd, 1983).

Table 2

Joint Attention Episode Coded According to Inclusion Criteria

Criterion	Example Behaviour	Coding Notes
1a	Father picks up the teacup, "A teacup".	Father initiates JA.
1b	Infant looks at the teacup, to their father's face, and back to the teacup while reaching for it.	Episode onset is coded from time infant looks back to the teacup.
2	Infant takes the teacup from their father and places it on the saucer.	Father and infant are both visually focused on the teacup for 3 seconds.
3	Father says "Are you having tea?"	Father is actively engaged within 10 seconds of JA establishment.
3	Infant stirs the teacup with a spoon and hands it to her father who pretends to sip tea from the teacup.	Episode is maintained via turn-taking, active caregiver involvement, and the infant acknowledging the father's involvement.
4c	Father says "Your turn" and hands the teacup back to the infant. The infant puts the teacup down, picks up the teddy and begins playing with it. The father does not follow the infant's attention within 3 seconds.	Episode offset is coded from the time the infant shifts their attention away from the teacup.