Infant Behavior & Development 38 (2015) 147–161

Contents lists available at ScienceDirect

Infant Behavior and Development

Symbolic play and language development

Edna Orr[a], Ronny Geva[a,b,*]

[a] The Developmental Neuropsychology Lab, The Gonda Multidisciplinary Brain Research Centre, Bar Ilan University, Israel
[b] Department of Psychology, The Gonda Multidisciplinary Brain Research Centre, Bar Ilan University, Israel

ARTICLE INFO

Article history:
Received 6 July 2014
Received in revised form 8 December 2014
Accepted 3 January 2015
Available online 4 February 2015

Keywords:
Symbolic development
Play
Babbling
Speech
Mother responsiveness

ABSTRACT

Symbolic play and language are known to be highly interrelated, but the developmental process involved in this relationship is not clear. Three hypothetical paths were postulated to explore how play and language drive each other: (1) direct paths, whereby initiation of basic forms in symbolic action or babbling, will be directly related to all later emerging language and motor outputs; (2) an indirect interactive path, whereby basic forms in symbolic action will be associated with more complex forms in symbolic play, as well as with babbling, and babbling mediates the relationship between symbolic play and speech; and (3) a dual path, whereby basic forms in symbolic play will be associated with basic forms of language, and complex forms of symbolic play will be associated with complex forms of language. We micro-coded 288 symbolic vignettes gathered during a yearlong prospective bi-weekly examination ($N = 14$; from 6 to 18 months of age). Results showed that the age of initiation of single-object symbolic play correlates strongly with the age of initiation of later-emerging symbolic and vocal outputs; its frequency at initiation is correlated with frequency at initiation of babbling, later-emerging speech, and multi-object play in initiation. Results support the notion that a single-object play relates to the development of other symbolic forms via a direct relationship and an indirect relationship, rather than a dual-path hypothesis.

1. Introduction

1.1. Relationship between symbolic play and language

Symbolic play, or pretend play, and language are known to be highly interrelated (DeLoache, 2002; McCune, 2010; Smith & Jones, 2011). Both rely on representational capacity, namely, employing one element as a signifier to represent another element (McCune, 2010). In pretend play, objects or situations are used or performed in a way that does not exist in the immediate reality, whereas in language, a vocal symbol (a word) represents an internal meaning that is related to entities or events in the real world (McCune, 2010). Furthermore, both behaviors, pretend play and language, share a similar developmental architecture, progressing from the most basic to more advanced forms. The transition from basic to advanced forms is evident by an increase in the number of representational units that an infant can combine to create a coherent symbolic act (McCune, 2010; Piaget, 1962; Zittoun, 2010).

* Corresponding author at: Department of Psychology, The Gonda Multidisciplinary Brain Research Centre, Bar Ilan University 5290002, Israel. Tel.: +972 3 5318172; fax: +972 3 5352184.
E-mail address: Ronny.Geva@biu.ac.il (R. Geva).

http://dx.doi.org/10.1016/j.infbeh.2015.01.002
0163-6383/

1.2. The development of symbolic play

Symbolic play begins at the pre-symbolic level, when infants are capable of recognizing the real relationship between familiar objects and their related actions (e.g., drinking from a cup; Fein, 1981; McCune, 1995). Generally, the transition to symbolic play is evident when the infant uses sound effects or gestures, indicative of the referent behaviors (e.g., tossing the head back to drink; McCune, 1995). As symbolic ability increases, infants become more capable of combining mental representations of several signifier-signified relationships into sequences or organizing them into a hierarchical order (e.g., making mixing motions, feeding a doll with a stick). Infants reach the pre-symbolic level between 8 and 11 months of age, and the first milestone of symbolic play is typically evident at around 11–12 months of age (Fein, 1981; McCune, 1995, 2010).

1.3. The development of language

Language, like symbolic play, begins with basic forms. The development of language begins with babbling (vocalizations consisting of syllable repetition, e.g., bababa). Babbling is considered to be a major milestone in early language development, which, in most typically developing infants, emerges before the ability to talk, generally before 10 months of age (Iverson, Hall, Nickel, & Wozniak, 2007; Molemans, Van Den Berg, Van Severen, & Gillis, 2012). Speech is considered a developmental continuation of babbling (Petitto, Holowka, Lauren, Levy, & Ostry, 2004). This phase is then followed by the production of single-word utterances, a transition that typically occurs at approximately 12 months of age (Huttenlocher, Waterfall, Vasilyeva, Vevea, & Hedges, 2010; Osório, Meins, Martins, Martins, & Soares, 2012).

However, this notion of babbling as a verbal precursor has been challenged since babbling is also shown to follow rhythmic motor activity, such as repetitive arm movements that accompany repetitive vocalization (Iverson et al., 2007). According to this view, babbling may represent a vocal play designed to train the motor challenges that are involved in speaking.

McCune (1995) emphasized that children undergo language-related transitions at the same time as, or following, the proposed structurally equivalent representational development of play. For example, children who exhibit hierarchical combination in play (e.g., stirring milk and then feeding the doll) also succeed in producing syntactic combinations in language (e.g., "I need paper and crayons"). Therefore, McCune (1995) ascribed a parallel pattern of development to symbolic play and language.

1.4. Theoretical hypothesis of the mechanisms involved in symbolic play and language development

Our aim in this study was to deepen the understanding of the mechanisms involved in the development of symbolic play by examining the relationships between budding motor capacities and verbal developmental milestones during spontaneous play. Based on the above assumptions and literature, three developmental paths were tested in the current study (see Fig. 1): (1) the direct-path hypothesis, whereby initiation of basic forms in symbolic action or babbling will be directly related to all later emerging language and motor outputs (Bejarano, 2011; Piaget, 1962; Smith & Jones, 2011; Thelen, Schöner, Scheier, & Smith, 2001); (2) the indirect mediated path, whereby basic forms in symbolic action will be associated with more complex forms in symbolic play, as well as with babbling, and this relationship with babbling will be related to speech (an additional possibility is that babbling will link to speech that will, in turn, be related to complex symbolic play forms (Petitto et al., 2004)); and (3) the dual-path hypothesis, whereby basic forms in symbolic action will be linked to basic forms in language, i.e., to babbling, and complex symbolic play forms will be linked to complex language forms, such as single words, or vice versa (McCune-Nicolich, 1981; McCune, 2010).

The direct-path hypothesis implies that the earliest steps in the development of symbolic activity would emerge first, followed by babbling and language. Alternatively, it is conceivable that babbling would precede early symbolic play milestones and serve as a precursor to symbolic activity. The rationale here may be that babbling provides children with oral motor practice, thereby facilitating motor development of other organs, such as manual manipulation of toys (Iverson et al., 2007).

We examined the framework that the development of symbolic play may be related to later-emerging language, as compared with the notion that both systems develop simultaneously. Therefore, we expected that a prospective, longitudinal, bi-weekly follow-up design would enable us to explore this chicken-and-egg riddle by adding a temporal dimension to the well-established relations of symbolic play and language (Iverson et al., 2007; Piek, 2002). More specifically, this study explored the role of early symbolic acts and early babbling activity in the development of complex symbolic play and the development of language to further broaden the knowledge on the first building blocks of these behaviors. Therefore, we documented the age of initiation and the frequency of first use of each new milestone using a prospective bi-weekly follow-up of each child. We postulated the following main effects hypotheses:

- The development of a symbolic act would begin from simple actions that require the grasping of one object, progressing to the grasping of two objects, and performing a sequence of actions (Piek, 2002). Age of initiation of play activity with a single object would predict the age of initiation of multi-object play.
- Audio-vocal output during play will begin with babbling. This phase will be followed by single-word or simple phrases that have a general holistic meaning (i.e., mama, doll, dog; Molemans et al., 2012; Tomasello, 2006). Age of initiation of

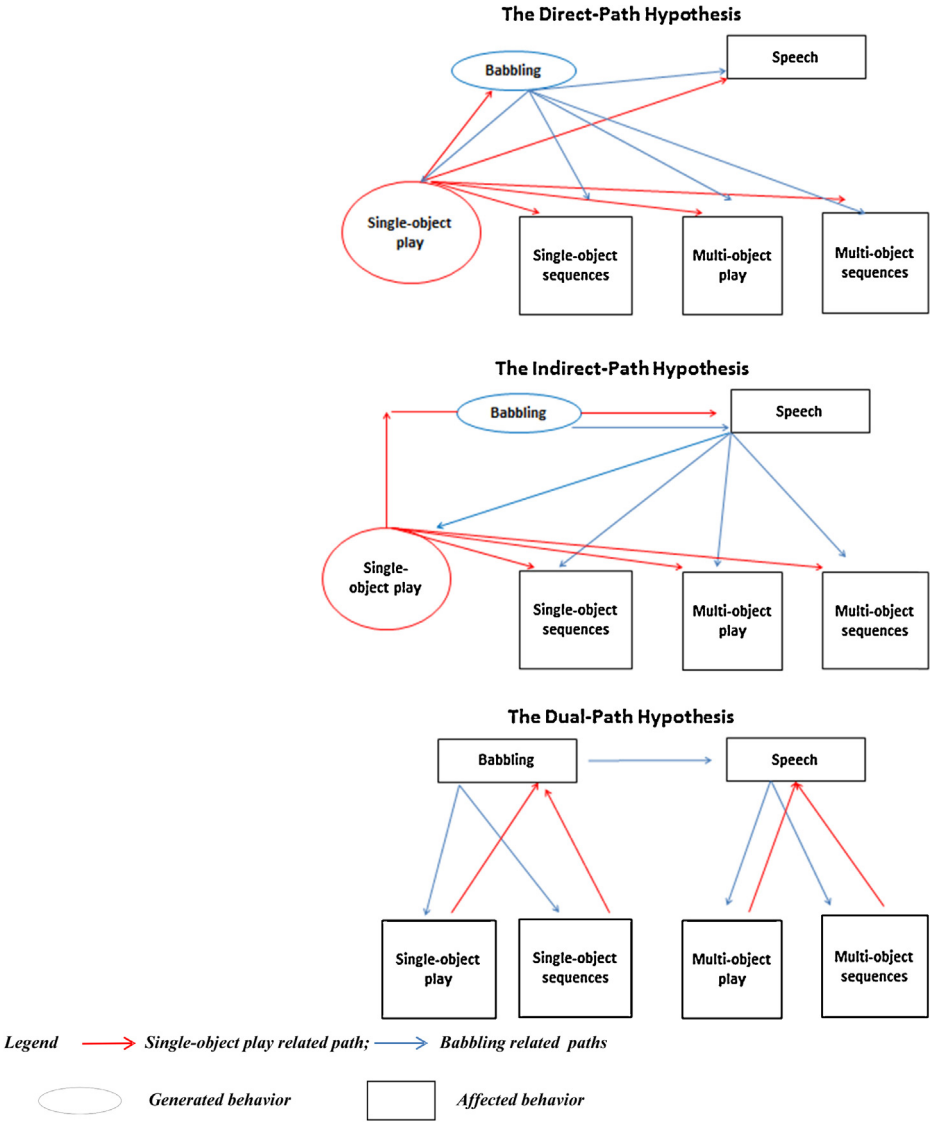

Fig. 1. The three alternative hypotheses for symbolic development: the direct-path hypothesis, the indirect-path hypothesis, and the dual-path hypothesis.

audible rattle (the sound evoked from play with objects) would predict the onset of babbling, which, in turn, would predict the age of initiation of speech (production of one word utterances, e.g., baby or mommy).

- Simple symbolic stages in play would precede complex levels of representations such as those involving the combination of several representations in one symbolic act. For instance, the act of mixing may develop to more progressive actions, during which the infant may introduce several actions in sequence, such as mixing, pouring, and feeding a doll (McCune, 1995).

We also considered a hypothesis concerning the inter-relations between language development and pretend-play milestones. The current available literature yields two alternative hypotheses. First, given that the development of verbal abilities and object manipulation skills co-occur, we theorized that a change in the symbolic level of play would be accompanied by a developmental shift in *both* domains (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979; McCune-Nicolich, 1981; McCune, 1995; Shore, O'Connel, & Bates, 1984). Thus, it was hypothesized that the onset of high levels of linguistic communication (i.e., speech) would be correlated with the age of initiation of high levels of symbolic development, such as multi-object play activity.

Second, the alternative hypothesis postulated that development in the symbolic level would be driven by development in either verbal or motor capacities, but not necessarily in both. As such, three alternative hypotheses can be derived (Fig. 1) that correspond to the following three themes:

- The age of initiation of object manipulation would precede the age of initiation of babbling and single-word utterance, as well as complex symbolic play progression (Zittoun, 2010).
- The age of initiation of babbling, but not necessarily speech, would be related to the development of symbolic play from the early phases of single-object play through multiple object play (McCune, 2010).
- The age of initiation of simple symbolic representation would predict the age of initiation of speech (Bejarano, 2011; Piaget, 1962; Smith & Jones, 2011).

1.5. Micro-analysis of symbolic play behavior

The relationships between language, motor activities, and symbolic play have been widely explored using verbal and nonverbal behavior for identifying the child's intention to display symbolic acts (Fein, 1981; Leslie, 2002; Lewis & Ramsay, 2004; McCune, 1995; Woolley, 1995). According to Baldwin, Baird, Saylor, and Clark (2001), an intentional action has specific units, and each unit has specific behavioral characteristics. Baldwin's system of analyzing the intentional behavior streams may be implemented in studies of early symbolic play development (Baldwin et al., 2001). This study attempted to identify and analyze symbolic acts using Baldwin's three main units: (1) beginning the action and locating a relevant object, (2) contacting and manipulating the object, and (3) releasing the object and completing the action. Each of these units has specific behavioral characteristics that can provide accurate and sensitive criteria to enrich our knowledge regarding the relationships between language, motor activities, and symbolic play. Furthermore, little is known about the developmental trajectories of these relationships as new cognitive milestones emerge. Object manipulation is an essential capability for symbolic play. The capability to hold two objects in different hands and perform full and successive action schemata requires maturation of manual control (Piek, Dawson, Smith, & Gasson, 2008). Infants are able to manipulate and coordinate between both hands while holding two objects close to their second birthday (Piek, 2002). We suggest using Baldwin et al.'s (2001) sensitive indicators for identifying early emergence of the symbolic acts:

Beginning of the symbolic act: Using an object or activity in a novel context may be recognized as symbolic at the very beginning of the symbolic vignette. An observer who records where children fixate their eyes and the ballistic way they reach for an object to display their target action may detect behavioral indicators for a pre-planned representation of an intentional symbolic activity.
Contact with and manipulation of the object: Upon completion of the motor act and during achievement of the action's goal, the infant may produce linguistic and nonlinguistic vocalizations, such as saying "*Mam*," babbling, or evoking rattle sounds. This audible information plays an important role in speech production, based on auditory feedback about the speaker's own voice (Tamura et al., 2012), and is important for action monitoring (Deutsch & Newell, 2005). Recording the audio-vocal outputs during a symbolic act may further support the recognition of the action as symbolic and provide researchers with knowledge on the development of audio-vocal actions at different developmental stages of symbolic play.
Completing the symbolic act: Upon completing the symbolic act, children may smile, laugh (Garvey, 1990), or search for a response from their mothers (Lillard & Witherington, 2004). Having mothers as play partners is known to facilitate play performance (Lillard & Witherington, 2004; Osório et al., 2012). Thus, examining the mother's response at the end of the symbolic act and its relation to baby's symbolic play can illuminate the role of external factors in the development of symbolic play.

1.6. Microanalysis of motor acts

The aforementioned behavioral indices provide additional criteria for recognizing symbolic behavior. However, symbolic acts also involve motor capabilities—to appropriately understand the development of symbolic acts, motor capabilities must be taken into account because symbolic acts require appropriate maturation of manual control (i.e., grasping ability), which is a pivotal skill for object manipulation. To better assess motor capability, we suggested dividing action schemata into the number of objects manipulated and the number of action units combined within a single play act. This suggestion was developed from the results of a case study that followed five infants for a year, from 6 to 18 months of age. This case study showed that infants progress from single-object to multi-object play while simultaneously progressing from performing single movements to several. For instance, infants who can hold a jar in one hand and a stick in the other hand could perform a variety of actions with those same objects, such as stirring or mixing imaginary liquid with the stick, pouring this liquid from the jar, and pretending to feed themselves or their mothers.

There are four types of symbolic actions that are based on number of objects and actions that can be involved in a symbolic act: (1) single-object play, (2) single-object sequences, (3) multi-object play, and (4) multi-object sequences. Our aim to examine the emergence of symbolic skills required a microanalysis of the full action schemata. A case study conducted for this purpose yielded four types of action. The four types were defined according to the number of objects and actions that could be combined at each symbolic act were as follows:

1. *Single-object play*: The baby holds a single object and performs a single pretend action that is directed deliberately toward himself or herself or toward the mother. This type of action could include the baby attaching or joining the object to his

Fig. 2. Single-object play: the baby holds a single object and performs a single pretend action, such as putting a stick next to the ear for a telephone.

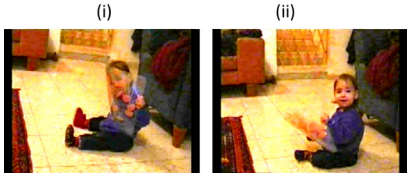

Fig. 3. Single-object sequences: the baby holds a single object and performs several pretend actions, such as holding a placemat over the face to hide and then exposing the face and smiling at the observer.

or her body or to other components in the environment, such as placing a bowl on his or her head or putting a stick next to his or her ear as a telephone (Fig. 2).

2. *Single-object sequences*: The baby holds a single object and performs several pretend actions directed toward himself or herself or toward others, such as holding a placemat over his or her face to hide and then exposing his or her face and smiling at the observer (Fig. 3).
3. *Multi-object play*: The infant uses several objects and performs single pretend actions directed toward himself or herself or toward others. An example of this would be holding a bowl and a doll and placing the bowl on the doll's head as a hat (Fig. 4).
4. *Multi-object sequences*: The infant uses several objects to perform several pretend actions, such as placing several objects into a pot, stirring and then close the pot with a cover (Fig. 5).

Examination of the age of initiation and frequency upon initiation of these motor symbolic play and verbal behaviors among 14 infants may unveil the developmental trajectories of symbolic acts and language and explore which milestone precedes and predicts further development. Using a micro-analytic longitudinal design, we examined the possible paths of developmental trajectories for the interrelations between symbolic play level and verbal milestones.

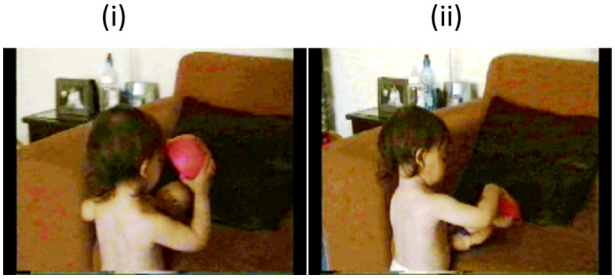

Fig. 4. Multi-object play: the infant uses several objects and performs single pretend actions, such as placing a bowl on the head of a doll as a hat.

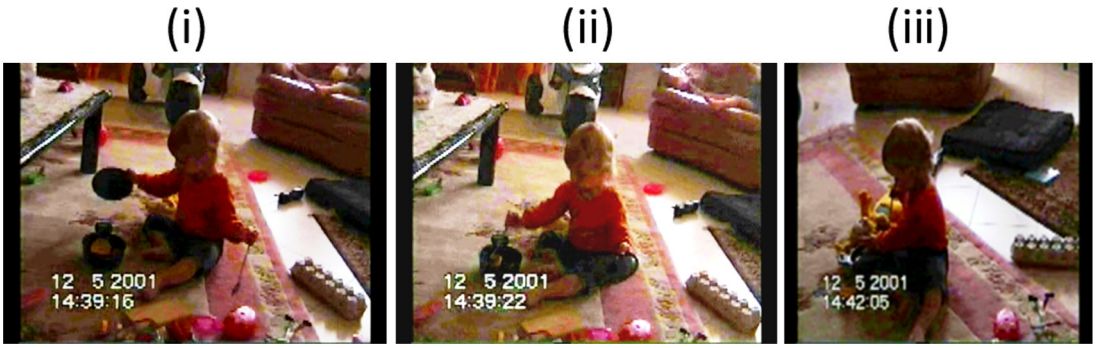

Fig. 5. Multi-object sequences: the infant uses several objects to perform several pretend actions, such as placing several objects into a pot, stirring and then close the pot with a cover.

2. Material and methods

2.1. Participants

Fourteen infants (eight boys and six girls) were studied bi-weekly from 6 to 18 months of age. Participants were of middle socio-economic backgrounds living in an urban center of Israel. From 6 to 12 months of age, all subjects were videotaped for 1 h in their homes every two weeks, whereas from 12 to 18 months of age, subjects were videotaped once every three weeks, giving a total of 280 testing sessions. All participants were videotaped with their mothers sitting nearby. Videotaping was always coordinated with the mothers and scheduled for mornings or afternoons according to the babies' states of wakefulness, and always after they had slept and were fed.

2.2. Procedure

Fifty objects were presented by the experimenter to the babies within their observation area during each session so that the participants were consistently exposed to the same objects. A sample of these objects is presented in Fig. 6.

The items differed in size, color, texture, and shape and belonged to different semantic fields (e.g., pieces of soft linen and the written surface of a sheet of paper). Some of these items were common household objects with which the babies were familiar from everyday use, such as a pacifier, bottle, teaspoon, and bowl. Some objects were smaller-sized replicas of the real item. Others were more ambiguous items, such as a cone, a beaded napkin wrap, plastic bracelets, or plastic hoops. Appendix A presents a full list of the objects.

The procedure was based on babies' motor development levels; thus, two development-dependent versions were administered:

1. Phase A—before a baby's ability to sit independently: In this phase, the babies were laid down supine on a mat that was familiar to them from home. Objects were placed, one at a time, in the palms of their hands. The object was replaced only

Fig. 6. A sample of stimuli that were presented to the babies in the study.

when the baby threw it away. The same objects were presented to the babies in the same order in this phase, for example, first a jar, followed by a spoon, then a bowl, and then a pacifier.

2. Phase B—after sitting independently: With the expansion of the babies' motor abilities and their transition to a sitting position, all 50 objects, including four dolls that differed in texture, size, and weight but with clear, prominent facial features, were presented during each experimental session. Appendix B presents an example of the stimuli layout.

These procedures were conducted in a subject-controlled manner: the baby initiated the action and set the duration of play with each item, as well as the session duration. Measures were taken to ensure the baby would not be exposed to any demonstrations. We chose this paradigm to enable the most direct and undisturbed possible observation of actions originating from the baby's independent, internal, and mental processes. To reduce the likelihood of demonstrations by the mothers, they were instructed to hand their babies objects if they had difficulties reaching them; mothers could also offer objects to their babies if the babies requested such a response. However, the mothers were instructed not to demonstrate to their babies how the object in question was used and were reminded of this request, if necessary (Molteno, Jacobson, Carter, & Jacobson, 2010).

2.3. Data coding and analysis

All recorded videos were observed, and the symbolic actions were only marked if they fulfilled two basic conditions: (1) the object chosen by the babies was used in a novel context, and (2) the babies intended to use the object in a novel way. Intentionality was defined using Baldwin et al.'s (2001) behavioral characteristics, namely, (a) gaze direction and body orientation are directed toward the target, and (b) all movements toward the target are in a ballistic manner. After identifying symbolic play, play acts that lasted for a few seconds were coded in terms of the type of action and the type of audio-vocal output, as elaborated below.

The audio-vocal outputs elicited by the infant during or upon completion of the motor act were also classified into the following four categories: non-audible response, babbling, audible rattling, and speech (one-word utterances).

Infants' requests for a response from their mothers, as well as the mothers' subsequent responses, were also coded. Vignettes in which the infants directed their gaze straight ahead at their mother or directed an object toward their mother that sat nearby were marked as infant asking for a maternal response. Maternal responses were coded as classified behaviors: a vocal response from distant places (e.g., 'yes', 'good', 'right'); smiling to the infant; taking an active role following infant request, such as: pretending to eat while supporting the pretend act using exaggerated gesturing and vocalization (e.g., 'Yummy'), or praise of the infant's act (e.g., 'very tasty food'; 'you are a good cook'). The frequency of each behavior was recorded. In total 210 vignettes were coded (122 vignettes refer to infant's request and 79 refer to maternal response). Forty vignettes, about 20% (24 episodes of infant's request and 16 episodes of maternal response), were coded by a second trained coder. The reliability of the coding was tested by calculating the nominal agreement between the two independent coders (Frick & Semmel, 1978), resulting in a Cohen's kappa of .95.

In total, 320 play scenes were collected according to the above criterion of using an object in a novel context. Of these 320 play scenes, 288 actions (90%) were recognized as symbolic-play episodes after examining the intentionally factor for each action. The 10% of actions excluded from the data were actions in which the intention of the infant was only partly understood because they had changed their focus from the original action target or there was an abundance of targets. The decision to exclude ambiguous actions from the main dataset was validated by two observers. Most of the actions (145; 45%) were single-object play (single object, single action), 57 (18%) actions were coded as single object sequences (single object, several actions), 37 (11%) actions were considered multi-objects play (several objects, single action), and 49 (15%) actions were considered multi-objects sequences (several objects, several actions).

All eight types of outputs (four symbolic play stages and four types of audio-vocal outputs) were coded and counted. A randomly drawn subset of 50 vignettes (20%) was also coded by a second trained coder. The reliability of the coding was tested by calculating the nominal agreement between the two independent coders (Frick & Semmel, 1978), and a Cohen's kappa of .90 was found.

In summary, two types of variables were examined: (a) symbolic outputs, which were classified into single-object play, single-object sequences, multi-object play, multi-object sequences and (b) audio-vocal outputs, which were classified as non-audible responses, babbling, audible rattling, and speech. The dependent measures included age of initiation of each developmental symbolic level and audio-vocal milestone and the frequency of its expression after its first emergence. The data were statistically analyzed using analysis of variance (ANOVA) and Pearson's correlation analysis.

3. Results

To examine our main effect hypotheses, the age of initiation of each audio-vocal response and all four types of symbolic actions during spontaneous play were analyzed by a comparison of means.

Results indicated that single-object play (single object, single action) emerged first at approximately 8 months of age, single-object sequences (single object, several actions) emerged at approximately 10 months, and multi-object play (multiple objects, single action) and multi-object sequences (multiple objects, several actions) co-appeared for the first time at approximately 12 months of age (Table 1).

Symbolic output was first initiated typically at approximately 8 months of age ($t[10] = 2.6$, $p < .01$) [$M = 8.18$ months; $SD = 1.83$] and was not yet accompanied by audio-vocal output (Fig. 7).

Table 1
Development of audible and play behaviors from 6 to 18 months of age (paired samples statistics).

	Mean	*N*	*SE*
Type of audible response			
Non-audible response	8.1	10	.690
Babbling	9.62	8	.822
Audible rattling	9.71	7	.680
Speech	12.37	8	1.05
Action level			
Single-object play	8.18	11	.552
Single-object sequences	9.90	10	.948
Multi-object play	11.37	8	.843
Multi-object sequences	11.62	8	1.03

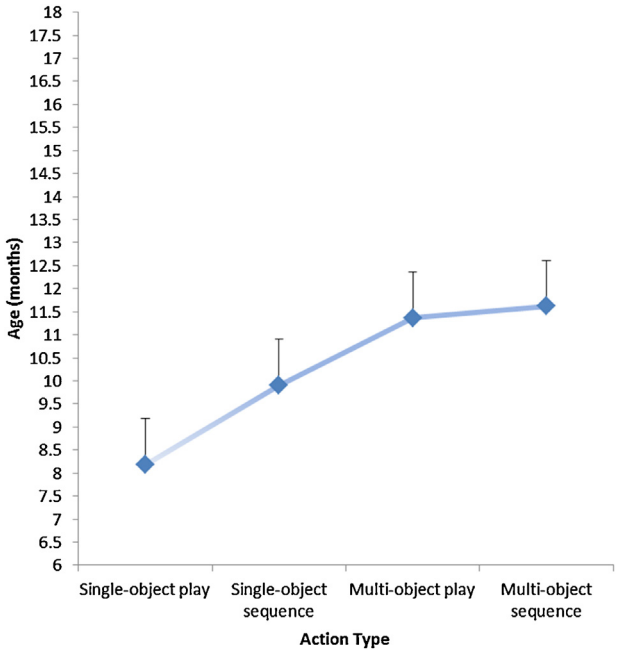

Fig. 7. Age of initiation for symbolic action type.

Analysis of age at first initiation of audio-vocal outputs indicated that audible play, such as audible rattling about the toys or babbling while playing, co-occurred at approximately 10 months of age ($t[8] = 4.33$, $p < .001$) (onset of audible rattling: $M = 9.71$ months; $SD = 1.80$; onset of babbling: $M = 9.36$ months; $SD = 2.06$). Both babbling and audible rattling preceded speech during play, which typically initiated at approximately 12 months ($t[8] = -2.8$, $p < .01$) [$M = 12.37$; $SD = 2.97$] (Fig. 8).

To explore the developmental path (direct, indirect, or dual) of symbolic play and language, we examined the relationship between ages of onset of audio-vocal phenomena and symbolic play. We computed the correlations between both types of variables using Pearson's correlation coefficients. The results indicated that single-object play was strongly correlated with the initiation of single-object sequences ($r = 640$, $p < .01$) and with the onset of multi-object sequences ($r = .800$, $p < .01$), as shown in Table 2.

Computing the correlation between the audio-vocal behaviors at initiation indicated strong correlations with symbolic output, such as single-object play with audible rattling ($r = .860$, $p < .01$) and multi-object sequences with babbling ($r = .787$, $p < .004$). However, none of the symbolic levels, aside from single-object play ($r = .670$, $p < .05$), were correlated with the first initiation of speech during symbolic play.

Initiation of babbling was related to the initiation of audio-vocal output, such as audible rattling ($r = 795$, $p < .01$); however, neither earlier behavior was related to age of initiation of speech during play. For instance, no significant correlation was found between audible rattling and speech ($r = .285$, $p =$ ns). This

Table 2
Pearson's correlations between play stages.

Play stage	Single-object play	Single-object sequences	Multi-object play	Multi-object sequences
Single-object play	1	.640*	.082	.800**
Single-object sequences	.640*	1	.474	.327
Multi-object play	.082	.474	1	.278
Multi-object sequences	.800**	.327	.278	1

* $p < 0.05$.
** $p < 0.005$.

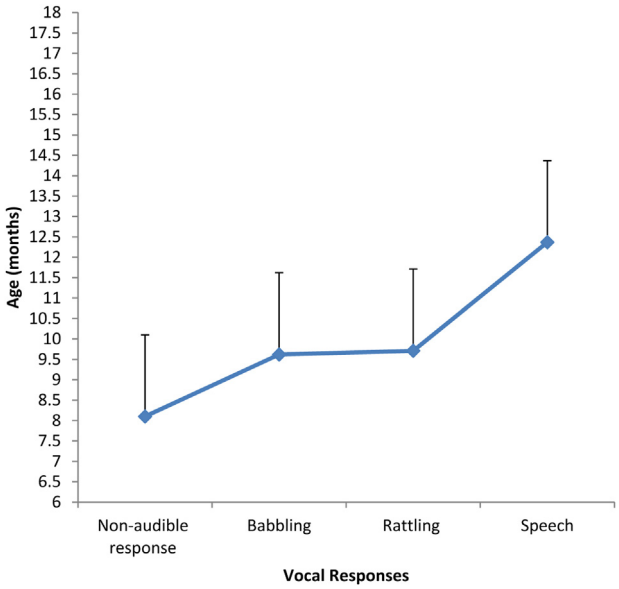

Fig. 8. Age of initiation for vocal output responses.

Table 3
Correlations between play stages and vocal factors.

	Single-object play	Single-object sequences	Multi-object play	Multi-object sequences
Babbling	.800**	.376	−1.151	.774*
Audible rattling	.860**	.689	.083	.575
Speech	.670*	.342	−.93	.606
No response	.970**	.717*	.191	.848**

* $p < 0.05$.
** $p < 0.005$.

tendency supported the direct-path hypothesis, according to which single-object play or babbling would generate the development of all other symbolic and audio-vocal behaviors.

Thus, we proceeded to an in-depth examination of the direct-path hypothesis, aiming to determine whether the initiation of single-object play or babbling would generate the development of the other types of symbolic and audio-vocal behaviors. Analysis of the correlation between the initiation of play behavior and audio-vocal responses indicated that single-object play was strongly correlated with the initiation of all types of audio-vocal behaviors, such as babbling ($r = .800$, $p < .003$), audible rattling ($r = .860$, $p < .006$), first speech ($r = .670$, $p < .05$), and nonverbal responses ($r = .970$, $p < .000$). Strong correlations were also found between nonverbal response and single-object sequences ($r = 717$, $p < .01$) and multi-object sequences ($r = .848$, $p < .001$). Multi-object sequences were also correlated with babbling ($r = .848$, $p < .004$). These results suggest that the ability to engage in single-object play is a basic requirement for the development of all other audio-vocal and symbolic play acts, and they, too, support the direct-path hypothesis (Table 3).

To elaborate the direct-path hypothesis in terms of the role of single-object play, we explored the possibility that the frequency of the behaviors of interest would be correlated with each other at initiation. For this purpose, we computed the frequency of each audio-vocal and symbolic utterance from the total behaviors performed at each time point and analyzed the differences between the relative frequencies of use of each symbolic level at age of initiation. This analysis indicated that frequency at initiation increases in a linear fashion as the child progresses from one level of symbolic action to another: single-object play was the lowest at initiation, whereas multi-object sequences were the most frequent at initiation ($t[9] = -3.50$, $p < .01$ [$M = .62$;

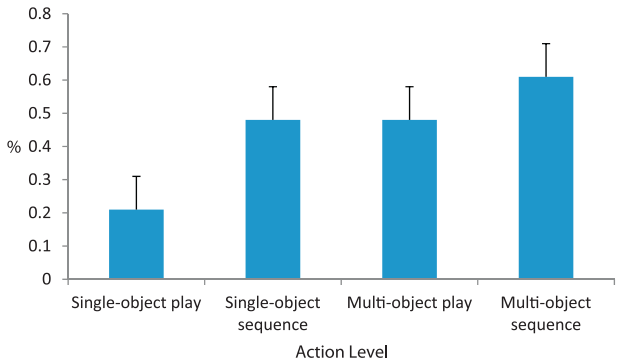

Fig. 9. The frequency in percentage of the symbolic action types.

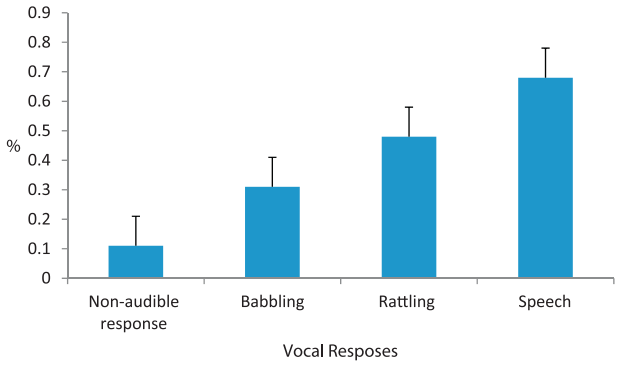

Fig. 10. The frequency in percentage of the vocal responses.

SD = .12]). No difference was found between the degree of single-object sequences and multi-object play at initiation ($t[8] = -3.9$, $p < .01$ [$M = .47$; $SD = .12$]). These findings suggest that the frequency of single-object play at initiation was correlated with the quantity of multi-object sequences, which emerges later in development (Fig. 9).

A similar pattern arose for audio-vocal output. The analysis indicated that the relative frequency of nonresponse was the lowest at initiation ($t[9] = 3.86$, $p < .01$ [$M = .12$; $SD = .09$]). Speech, which develops latest, was the most frequent at initiation ($t[7] = -4.88$, $p < .01$ [$M = .68$; $SD = .11$]). The relative percentage of the other audio-vocal outputs increased through development (Fig. 10).

Examining the correlations between the relative percentages of the eight audio-vocal and symbolic phenomena showed that the frequency of babbling at initiation was strongly correlated with the frequency of nonverbal response ($r = .766$, $p < .01$) and speech at initiation ($r = .732$, $p < .05$). Furthermore, strong correlations were found between the following symbolic act frequencies and audio-vocal outputs: the frequency of single-object play at initiation with that of babbling ($r = .806$, $p < .003$), speech ($r = .717$, $p < .05$), and nonverbal response ($r = .906$, $p < .000$), and the frequency of babbling with multi-object play ($r = .756$, $p < .05$), nonverbal response ($r = .730$, $p < .01$), and multi-object sequences ($r = .720$, $p < .05$). No correlation was found, however, between the frequencies of the different action levels. The correlations of single-object play and babbling with the other behaviors according to age of initiation are presented in Fig. 11, and according to frequency at initiation in Fig. 12.

The findings above provided additional support for the direct-path hypothesis. The findings indicate that the age of initiation, as well as the frequency of single-object play, contribute to the development of all later-emerging symbolic and communicative milestones. The frequency of babbling was also found to be correlated with speech and complex symbolic actions. These findings partly support the indirect-path hypothesis regarding babbling.

Next, we turned to mothers' responsiveness toward their babies. Our aim in this regard was to explore the following topics: whether the total production of symbolic actions related to the degree of mothers' responsiveness and to the degree of infants' requests for response; whether there are associations between the type of maternal response (e.g., vocal response from a distance; smiling; mimicking; eye contact; touching); and symbolic play development. For this analysis, we selected a subset of babies ($n = 10$: five boys and five girls) who had the richest data recordings. There was high correlation between the total number of symbolic acts produced by the infants and the rate of infants' request for maternal response ($r = 860$, $P < .001$). There were also multiple relations between almost all types of maternal positive behavior (i.e., touch, smile, maintaining eye contact and taking an active part in symbolic play) with the infants' more complex symbolic actions, namely sequence actions with single or multiple objects ($r = .855$, $p < .002$). In addition, maternal smile and touch were correlated with the rate of symbolic play production ($r = 776$, $p < .008$) (Table 4).

4. Discussion

Symbolic ability stands at the heart of people's ability to think and communicate. This study aimed to explore prospectively and longitudinally the "chicken or the egg" question of how play and audio-vocal acts drive each other as symbolic capacity

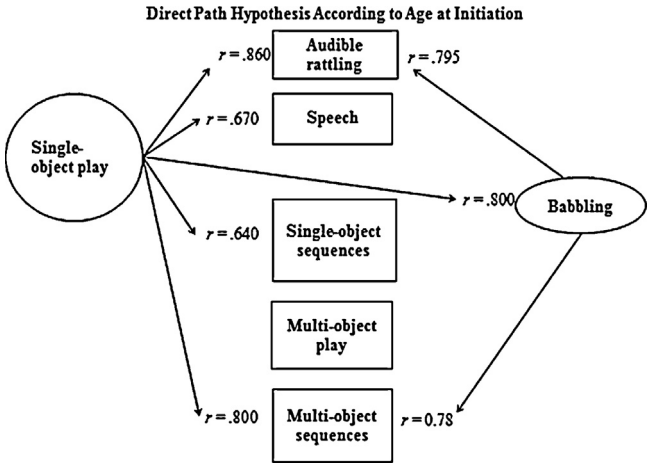

Fig. 11. The correlations of single-object play and babbling with vocal responses and action types according to age of initiation.

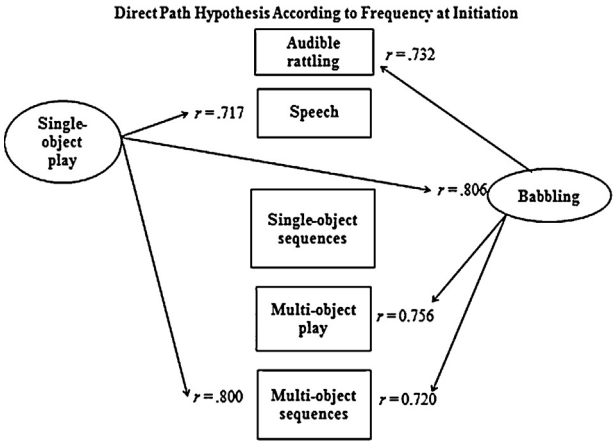

Fig. 12. The correlations of single-object play and babbling with vocal responses and action types according to frequency at initiation.

develops. Three alternative hypotheses were postulated: the direct path (single-object play or babbling will be linked to all language and play outputs), indirect path (single-object play will be linked to all play acts and babbling, and babbling will be linked to speech), and dual-path hypotheses (simple forms in language will develop in parallel to basic forms in symbolic play, while complex symbolic forms will develop in parallel to the emergence of language).

Overall, current data support the direct-path hypothesis. The key finding of this study is the primary role played by the initiation of single-object play in the long-term progression of all symbolic and audio-vocal milestones that arise thereafter. Single-object play appears to be associated with the development of two essential abilities for babies that promote their abstract thought: language and complex symbolic play. The age of initiation of single-object play and its frequency at initiation were strongly correlated with almost all types of symbolic action and audio-vocal output.

Thus, these data seem to support the direct-path hypothesis, particularly in view of the two alternative hypotheses. The assumption that babbling will be linked with symbolic progression is partially supported: the frequency of babbling was found to be correlated with symbolic phenomena, but not its age of initiation. Thus, neither of the other two alternative hypotheses (i.e., indirect path or dual path) is supported by our results.

In examining the three hypotheses, it seems that the results point mostly to the direct-path hypothesis by shedding light on the two main behaviors, single-object play and babbling, as primary behaviors that connect to symbolic development during the first two years of life. It is therefore important to explore what elements in their architecture may possibly drive those behaviors to have such association with babies' development.

4.1. Architecture of single-object play and its role in development

The most intriguing findings of this study centered on single-object play, the act of grasping a single-object to perform a single symbolic action. Single-object play was found to be strongly correlated with all symbolic action levels and audio-vocal outputs. This finding raises the following question: How can single-object play be linked to the development of complex actions that require advanced cognitive and motor demands (Ryou & Wilson, 2004), and can this also be linked to the development of communicative behaviors, which are part of a different system?

We assume that single-object play serves as a major milestone in the development of symbolic and lingual behaviors because of the motor and mental skills required to perform such tasks. Two types of movement are involved in the execution

Table 4
Correlations between mother responsiveness's factors and production of symbolic act.

	Single-object play	Single-object sequences	Multi-object play	Multi-object sequences	Total symbolic act
Infant behavior					
Asking for Response	.681*	.731*	.752*	.762*	.860**
Mother behavior					
Displays vocal response from a distance	.357	.368	.401	.237	.412
Smiles	.498	.855**	.560	.738*	.776**
Takes an active part	.305	.724*	.412	.746*	.617
Keeps eye contact	.297	.736*	.426	.746*	.619
Touches the infant	.347	.808**	.473	.750*	.676*

* $p < 0.05$.
** $p < 0.005$.

of single-object play: reaching out with the arm and grasping the object. These movements require babies to have sufficient control over their arms and hand movements and the ability to take into consideration information beyond the object concept (Longo & Bertenthal, 2006; Mash, Keen, & Berthier, 2003). Furthermore, these movements generally arise in tandem with audible rattling and babbling initiation, both of which are strongly correlated with rhythmic arm movement (Cobo-Lewis, Oller, Lynch, & Levine, 1996; Iverson et al., 2007; Locke, Bekken, McMinn-Larson, & Wein, 1995; MacNeilage & Davis, 2000; Petitto et al., 2004; Thelen, 1979; Vihman, 1996). It is plausible that single-object play may be associated with the development of more advanced motor behaviors. This notion is congruent with the literature that argues that first-level action experience is important for the creation of the capacity for complex behaviors in the same system (Angulo-Kinzler, Ulrich, & Thelen, 2002), and consistent with the claim that first-level actions are the base for representational behavior and understanding (McCune, 2010; Piaget, 1952; Sommerville & Woodward, 2005; Tomasello, 1999).

The motor component in single-object play is an outcome of mental processes that stem from the use of representation. Representation requires the use of one element to stand in for another, an essential factor in all symbolic behavior, including speech (McCune, 2010; Piaget, 1962). The correlation between single-object play and babbling (both a lingual and a motor form of behavior), however, indicates that single-object play involves another phenomenon that is more important for the development of other symbolic and pre-symbolic behaviors. It seems that single-object play emergence and continual training contribute to babies' control mechanisms. Control mechanisms located in the left hemisphere are involved in the production of rhythmic activity, such as reduplicating babbling and audible rattling (Locke et al., 1995). These behaviors require synchronization between hand movements and sound effects, namely, synchronizing between vocal and motor activities. The ability to coordinate the two systems indicates increasing brain specialization and maturation of control mechanisms (Hiscock & Kinsbourne, 1978; Iverson et al., 2007; Locke et al., 1995; Thelen, 1979). Single-object play, as a representative behavior, may support such mechanisms because it requires not only transforming an innate goal into an imitative action, but also inhibiting irrelevant visual information during object substitution. From this perspective, it seems that single-object play has a mental dimension, as well as a motor dimension, and it may contribute to the control mechanisms required in all symbolic and pre-symbolic behaviors.

This assumption is in line with McCune's (2010) notion that a "simple" behavior that reaches beyond the immediate perceptual situation and sensory experience is the basis for higher-order symbolic behaviors. Supporting this assumption, other research has shown high levels of representative behaviors among chimpanzees trained to communicate with others via special symbolic features (Lyn, Greenfield, & Savage-Rumbaugh, 2006). In our research with human babies, we found that single-object play serves as a basic level of symbolic play that generates advancements in the development of symbolic actions and also in language due to training of motor and mental control.

4.2. Architecture of babbling and its role in development

The direct-path hypothesis indicated that the age of initiation of babbling would be associated with all vocal outputs and with all symbolic types of action. This notion was partially supported by the current data. Babbling was found to be partially correlated with vocal and motor outputs, mainly when examining the frequency of a given output at initiation. The frequency of babbling at initiation is strongly correlated with the frequency of speech, such that those who babble more at the initiation of this behavior also speak more at the initiation of speech. This may indicate that the quantity of babbling is an important factor in the development of speech.

There is a vast body of literature documenting a significant relationship between babbling and speech in terms of quantity and quality (Fasolo, Majorano, & D'Odorico, 2008; Majorano & D'Odorico, 2011). Our data are consistent with the assertion of a substantial relationship between the quantity of babbling at initiation and quantity of speech.

The intriguing findings regarding babbling relate to its correlation with complex symbolic action. The frequency of babbling at initiation is found to be strongly correlated with the frequency of multi-object play and multi-object sequences, both of which emerged several months after babbling. We assume that babbling training improves the correspondence between differing systems, which may explain the strong correlation between babbling and multi-object play and multi-object sequences. Iverson et al. (2007) concluded that "babbling has far-reaching consequences that extend to other developing systems, providing opportunities for increasingly complex learning about correspondences between articulatory movement and their auditory consequences."

More specifically, complex action production seems to require the ability to hold an object in each hand with adequate manual control between these hands until a certain auditory output is achieved (such as the sound of mixing). In other words, a complex motor act requires the integration of motor-visual and auditory information, which can be improved by babbling training. This integration of motor-visual and auditory information, according to Iverson et al. (2007), co-opts to produce gesture-speech coordination. Current data seem to show that babbling may also co-opt to produce complex actions.

4.3. Alternative hypotheses

This natural environment micro-analytic study also considered two alternative developmental paths aside from the direct path described above: the indirect-path and dual-path hypotheses. Data do not support the indirect path. As mentioned above, we observed that babbling is indeed linked to speech, but the assumption that speech will be linked to symbolic action is not supported in the current research, neither by analyzing age of initiation nor by examining frequency of generation.

The dual-path hypothesis is also not supported. Our data show a significant correlation between the basic forms of behaviors and more complex forms. This tendency is not consistent with the well-established assertion of analogous connections between symbolic play and language (McCune, 2010; Piaget, 1962). The emergence of speech is found to be related to the onset of babbling and single-object play but is not found to be linked to multi-object sequences, as would be expected by the dual-path hypothesis.

4.4. Mother responsiveness

The current findings, with regard to mothers' responsiveness, provide additional important information about the development of symbolic ability. Venuti, De Falco, Esposito, and Bornstein (2009) found that mothers contribute to the development of their children's play by adapting to their children's potential. Research shows that mothers tend to be attuned to their child's play level and be synchronized with the child's activity without being controlling or restrictive (Feldman, 2007). Through this, mothers provide scaffolding to their children's behavior in manners that helps them concentrate more on play (Venuti et al., 2009). In the current study, we found that even early on, when mothers respond to their infants by taking an active role (e.g., pretending to eat while saying: "very tasty food, yummy, yummy") and by showing positive affect (smiling) or positive physical touch (hugging, cuddling), infants tend to increase the production of symbolic acts. Further, mother's responsiveness was found to be related to the production of more complex symbolic acts, namely a sequence of actions with a single or multiple objects. Sequence of action (mixing, pouring and feeding) may reflect the infant's intention in a clearer fashion. The ability to understand and monitor their infant's goals may encourage mothers to take active roles and be responsive in several ways, this in turn may be related to the infant's increase in production of action sequences. Furthermore, the results of the current study show that infants also take an active role in this interaction. Specifically, the number of requests that infants direct toward their mother is associated with their total production of symbolic acts. This finding is in line with previous research about the role of child–mother mental-state talk on social symbolic play development (Osório et al., 2012). Osório et al. (2012) found that children's own use of desire-state talk in shared pretense play was a better predictor of social symbolic play than mothers' mental-state talk. Taken together, these findings support the notion that the infant plays an active role in their own development, and endorse the assertion that having mothers as a play partner augments play activity and associates play behavior with cognitive development.

5. Conclusions

Bi-weekly follow-up and micro-analysis of inter-relations between motor and verbal behaviors may have helped to deepen our understanding of the vital relationship between motor and verbal development. The present results support the impressive association between single-object play and babbling and the development of symbolic play. Single-object play provides a link between the representational and motor systems, whereas babbling provides a link between the motor and lingual systems. Both single-object play and babbling, thus, allow these differing systems to be better integrated (Iverson et al., 2007; McCune, 2010; Zittoun, 2010), which is a crucial process for acquiring further symbolic forms.

Overall, the present study provides support for a new perspective on symbolic play. This perspective places more emphasis on the first steps of symbolic representation using a single toy and highlights its potential relations with symbolic development and linguistic development through the first 18 months of life.

5.1. Limitations and future research

The current study used a longitudinal natural environment repeated-measures paradigm to examine the correlation between symbolic play and language, by following the age and frequency at initiation of such behaviors. It may be important to examine a comparable sample in a standardized environment and with a unified adult mediation to highlight the potency of an ecologically sound environment.

Further research in the field is recommended to examine other developmental systems, as well as their contribution to learning ability in various populations and domains. Further work with other species (e.g., chimpanzees) might extend our understanding of the mechanisms that characterize human symbolic development. An important question that could be explored in the context of chimpanzee behavior would be whether a complex action requiring the grasping two objects and performing a sequence of actions is possible without acquiring language.

Acknowledgements

This paper is based in part on a doctoral research study conducted at the School of Education, Bar Ilan University, Ramat Gan, Israel, 2008, and supervised by Dr. R. Glaubman. The authors are grateful to Dr. Yana Gavrilov and Ms. Jessica Schreiber for their linguistic editing and for Prof. Gil Diesendruck for their advice during the pilot stages of this work. We are grateful to the parents and babies who participated in this longitudinal study.

Appendix A. List of stimuli objects

Four types of dolls, four types of jars, a small pot and cover, a pacifier, a bottle, a teaspoon, a bowl, a plate, a cone, a silver-colored shell, a bead napkin wrap, plastic bracelets, plastic hoops, wooden blocks, a telephone, a plastic stick, wooden sticks, a hairbrush, pieces of soft linen, a strainer, a transparent placemat, duplicates of glasses, and a plastic jug.

Appendix B. Types of dolls

Type of object	Texture	Size (cm)	Weight (g)
1st doll	Stiff plastic	50 × 6	600
2nd doll	Stiff plastic	25 × 6	400
3rd doll	Soft linen	40 × 8	300
4th doll	Stiff plastic	15 × 4	250

References

Angulo-Kinzler, R. M., Ulrich, B. D., & Thelen, E. (2002). Three-month old infants select specific motor solutions. *Motor Control: 6.*, (1), 52–68.

Baldwin, D. A., Baird, J. A., Saylor, M. M., & Clark, M. A. (2001). Infants parse dynamic action. *Child Development: 72.*, (3), 708–717.

Bates, E., Benigni, L., Bretherton, I., Camaioni, L., & Volterra, J. (1979). *The emergence of symbols: Communication and cognition in infancy*. New York: Academic Press.

Bejarano, T. (2011). *Becoming human: From pointing gestures to syntax*. Netherlands: John Benjamins Publishing Company.

Cobo-Lewis, A. B., Oller, D. K., Lynch, M. P., & Levine, S. L. (1996). Relations of motor and vocal milestones in typically developing infants and infants with Down syndrome. *American Journal of Mental Retardation: 100.*, (5), 456–467.

DeLoache, J. S. (2002). Early development of the understanding and use of symbolic artifacts. In U. Goswami (Ed.), *Handbook of childhood cognitive development* (pp. 206–226). Oxford: Blackwell.

Deutsch, K. M., & Newell, K. M. (2005). Noise, variability, and the development of children's perceptual-motor skills. *Developmental Review: 25.*, (2), 155–180.

Fasolo, M., Majorano, M., & D'Odorico, L. (2008). Babbling and first words in children with slow expressive development. *Clinical Linguistics & Phonetics: 22.*, (2), 83–94.

Fein, G. G. (1981). Pretend play in childhood: An integrative review. *Child Development: 52.*, 1095–1118.

Feldman, R. (2007). On the origins of background emotions: From affect synchrony to symbolic expression. *Emotion: 7.*, (3), 601.

Frick, T., & Semmel, M. I. (1978). Observer agreement and reliabilities of classroom observational measures. *Review of Educational Research: 48.*, (1), 157–184.

Garvey, C. (1990). . *Play : Vol. 27.* (Vol. 27) Harvard University Press.

Hiscock, M., & Kinsbourne, M. (1978). Ontogeny of cerebral dominance: Evidence from time-sharing asymmetry in children. *Developmental Psychology: 14.*, (4), 321.

Huttenlocher, J., Waterfall, H., Vasilyeva, M., Vevea, J., & Hedges, L. V. (2010). Sources of variability in children's language growth. *Cognitive Psychology: 61.*, (4), 343–365.

Iverson, J. M., Hall, A. J., Nickel, L., & Wozniak, R. H. (2007). The relationship between reduplicated babble onset and laterality biases in infant rhythmic arm movements. *Brain & Language: 101.*, 198–207.

Leslie, A. M. (2002). Pretense and representation revisited. In *Representation, memory, and development: Essays in honor of Jean Mandler*.

Lewis, M., & Ramsay, D. (2004). Development of self-recognition, personal pronoun use, and pretend play during the 2nd year. *Child Development: 75.*, (6), 1821–1831.

Lillard, A. S., & Witherington, D. C. (2004). Mothers' behavior modifications during pretense and their possible signal value for toddlers. *Developmental Psychology: 40.*, (1), 95.

Locke, J. L., Bekken, K. E., McMinn-Larson, L., & Wein, D. (1995). Emergent control of manual and vocal-motor activity in relation to the development of speech. *Brain & Language: 51.*, 498–508.

Longo, M. R., & Bertenthal, B. I. (2006). Common coding of observation and execution of action in 9-month-old infants. *Infancy: 10.*, (1), 43–59.

Lyn, H., Greenfield, P., & Savage-Rumbaugh, S. (2006). The development of representational play in chimpanzees and bonobos: Evolutionary implications, pretense, and the role of interspecies communication. *Cognitive Development: 21.*, (3), 199–213.

MacNeilage, P. F., & Davis, B. L. (2000). On the origin of internal structure of word forms. *Science: 288.*, 527–531.

Majorano, M., & D'Odorico, L. (2011). The transition into ambient language: A longitudinal study of babbling and first word production of Italian children. *First Language: 31.*, (1), 47–66.

Mash, C., Keen, R., & Berthier, N. E. (2003). Visual access and attention in two-year-olds' event reasoning and object search. *Infancy: 4.*, (3), 371–388.

McCune-Nicolich, L. (1981). Toward symbolic functioning: Structure of early pretend games and potential parallels with language. *Child Development: 52.*, 785–797.

McCune, L. (1995). A normative study of representational play at the transition to language. *Developmental Psychology: 31.*, (2), 198–206.

McCune, L. (2010). Developing symbolic abilities. In B. Wagoner (Ed.), *Symbolic transformation: The mind in movement through culture and society* (pp. 173–192). London: Routledge Press.

Molemans, I., Van Den Berg, R., Van Severen, L., & Gillis, S. (2012). How to measure the onset of babbling reliably? *Journal of Child Language: 39.*, (3), 523–552.

Molteno, C. D., Jacobson, S. W., Carter, R. C., & Jacobson, J. L. (2010). Infant symbolic play as an early indicator of fetal alcohol-related deficit. *Infancy: 15.*, (6), 586–607.

Osório, A., Meins, E., Martins, C., Martins, E. C., & Soares, I. (2012). Child and mother mental-state talk in shared pretense as predictors of children's social symbolic play abilities at age 3. *Infant Behavior and Development: 35.*, (4), 719–726.

Petitto, L. A., Holowka, S., Lauren, E. S., Levy, B., & Ostry, D. J. (2004). Baby hands that move to the rhythm of language: Hearing babies acquiring sign languages babble silently on the hands. *Cognition: 93.*, (1), 43–73.

Piaget, J. (1952). *The origins of intelligence in children*. New York: International Universities Press.

Piaget, J. (1962). *Play, dreams and imitation in childhood* (C. Gattegno & F. M. Hodgon, Trans.). NY: W.W. Norton.

Piek. (2002). The role of variability in early motor development. *Infant Behavior and Development: 25.*, 452–465.

Piek, J. P., Dawson, L., Smith, L. M., & Gasson, N. (2008). The role of early fine and gross motor development on later motor and cognitive ability. *Human Movement Science: 27.*, (5), 668–681. http://dx.doi.org/10.1016/j.humov.2007.11.002

Ryou, J. W., & Wilson, F. A. W. (2004). Making your next move: Dorsolateral prefrontal cortex and planning a sequence of actions in freely moving monkeys. *Cognitive, Affective, & Behavioral Neuroscience: 4.*, 430–443.

Shore, C., O'Connel, B., & Bates, E. (1984). First sentences in language and symbolic play. *Developmental Psychology: 20.*, (5), 872–880.

Smith, L. B., & Jones, S. S. (2011). Symbolic play connects to language through visual object recognition. *Developmental Science: 14.*, (5), 1142–1149.

Sommerville, J. A., & Woodward, A. L. (2005). Pulling out the intentional structure of action: The relation between action processing and action production in infancy. *Cognition: 95.*, 1–30.

Tamura, T., Gunji, A., Takeichi, H., Shigemasu, H., Inagaki, M., Kaga, M., et al. (2012). Audio-vocal monitoring system revealed by mu-rhythm activity. *Frontiers in Psychology*, 3.
Thelen, E. (1979). Rhythmical stereotypies in normal human infants. *Animal Behavior: 27.*, 699–715.
Thelen, E., Schöner, G., Scheier, C., & Smith, L. (2001). The dynamics of embodiment: A field theory of infant perseverative reaching. *Behavioral & Brain Sciences: 24.*, 1–86.
Tomasello, M. (1999). Having intentions, understanding intentions and understanding communicative intentions. In P. D. Zelazo, J. W. Astington, & D. R. Olson (Eds.), *Developing theories of intention: Social understanding and self-control* (pp. 63–75). Mahvah, NJ: Lawrence Erlbaum Associates.
Tomasello, M. (2006). Acquiring linguistic constructions. In D. Kuhn, & R. S. Siegler (Eds.), *Handbook of child psychology: Vol. 2. Cognition, perception, and language* (pp. 255–298). New York: Wiley.
Venuti, P., De Falco, S., Esposito, G., & Bornstein, M. H. (2009). Mother–child play: Children with Down syndrome and typical development. *American Journal on Intellectual and Developmental Disabilities: 114.*, (4), 274–288.
Vihman, M. M. (1996). *Phonological development*. Cambridge, MA: Blackwell.
Woolley, J. D. (1995). The fictional mind: Young children's understanding of imagination, pretense, and dreams. *Developmental Review: 15.*, (2), 172–211.
Zittoun, T. (2010). How does an object become symbolic? Rooting semiotic artifacts in dynamic shared experiences. In B. Wagoner (Ed.), *Symbolic transformation: The mind in movement through culture and society*. London: Routledge.

Glossary

Symbolic development: The ability to use one element as a signifier to represent another element. The transition from basic to advanced forms is shown by the increasing number of representational units that an infant can combine to create a coherent symbolic act
Play: All postnatal motor activity performed that appears to be pleasurable and enjoyable and intrinsically motivated
Babbling: Vocalizations consisting of syllable repetition, e.g., "bababa"
Speech: Production of single-word utterances
Mother responsiveness: Mothers attuned and synchronized with the child's activity by showing positive affect and taking the appropriate role during play without being controlling or restrictive