Task-Directed Behavior and Focused Attention in Infants' Exploratory Play: A Longitudinal Study

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Key Words: Exploratory play, attention, infancy, developmental changes.

Abstract

Objectives: To examine whether differences in task persistence and attention-related play behaviors could be identified between 10 and 14 months, a period of major developmental changes. **Method:** 60 typically-developing infants participated in a longitudinal study that included three home visits: at 10, 12 and 14 months. Play behavior was assessed using the Infants' Play Behaviors with Objects during Structured Tasks - POST, a 5-minute video-taped procedure that exposes infants to novel objects. **Results:** Attention, persistence and level of play behavior increased significantly with age; higher levels of attention and persistence were strongly associated with more sophisticated object play. Two trajectories were identified, each marking a different shift point: before or after 12 months of age. **Conclusions:** Findings suggest that 12 months was a focal point for tracing changes in the infant's ability to sustain attention and persist in exploratory play.

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Introduction

Exploratory object play during the first 2 years of life provides an opportunity for children to experiment in their interactions with the environment and develop more complex skills (e.g., Baranek et al., 2005). Many researchers describe the centrality of play in early childhood and emphasize that it is both essential to, and reflective of, development (e.g., Rigby & Huggins, 2003). Hence, the study of early play is of interest to researchers and practitioners of child development, and to occupational therapists in particular (e.g., Rigby & Rodger, 2006).

Infants provide themselves with information and stimulation that is constantly changing by actively manipulating and exploring objects. Observation of infants' exploratory object play can provide researchers with a basis for studying cognition, motivation, and learning during early development (Ruff & Saltarelli, 1993). A number of studies have examined developmental changes in attention-related play behaviors, noting age-related increases in the duration of focused attention (Ruff & Capozzoli, 2003) as well as the predictive relationships between early focused attention in infants and later cognitive abilities in preschoolers (Lawson & Ruff, 2004b).

The ability of the child to sustain attention during exploration and play has been described extensively in the literature because of its importance and contribution to learning. Attention occurs in the context of specific activities and particular goals (Ruff & Saltarelli, 1993), and is shaped by both endogenous and exogenous factors (Oakes, Kannass, & Shaddy, 2002). Researchers concur that in observing infants, it is important to distinguish between focused and casual attention. Ruff and Lawson (1991) describe a procedure they developed for assessing infants' focused attention during play with objects, in which they measure the duration of time that an infant looks at the object and simultaneously engages in some deliberate manipulation of it. They suggest that it is also helpful to include measures of inattention, such as the frequency with which the object is dropped, thrown, or pushed away. As opposed to focused attention, casual attention entails looking at toys with little engagement or evidence of interest in the toy (Lawson & Ruff, 2004b). Colombo (2001) points out that one aspect of attention involves the apparently volitional direction of attention as a function of the tasks in which the individual is engaged. The second aspect relates to the ability to sustain one's attention to the stimulus, event or task at hand - an ability often described as attention span, perseverance, or distractibility. Ruff and Rothbart (1996)

suggest that in order for infants to function and learn effectively, they must develop the ability to be selective and respond in a timely and appropriate fashion to important events as they occur. Moreover, they must learn to persist at tasks in order to complete them in spite of potential obstacles and frustrations.

Age-related changes in attention-related play behaviors have been documented in cross-sectional (e.g., Ruff, Capozzoli, & Saltarelli, 1996) as well as in longitudinal (e.g., Kannass & Oakes, 2008; Lawson & Ruff, 2004b; Ruff & Capozzoli, 2003; Ruff & Lawson, 1990) studies. For example, in a study of the development of sustained attention in children aged 1 to 5 years, Ruff and Lawson (1990) have shown that during free play with a number of age-appropriate toys, the duration of focused attention increased significantly with age. Similarly, in a study of attention and distractibility during the first 4 years of life, Ruff and Capozzoli (2003) found that younger children were more distractible than the older infants. In their longitudinal investigation of the development of attention from 9 to 31 months, Kannass and Oakes (2008) observed developmental differences in attention during two free-play tasks with both single as well as with multiple objects. However, the trend toward more focused attention with increasing age is not an absolute one; when objects are simple, older infants may show less overall focused attention because they are habituating or learning faster than younger infants (Ruff & Lawson, 1991). Longer durations of focused attention are likely to occur with novel (Oakes & Tellinghuisen, 1994), and multi-component objects (Oakes, Tellinghuisen, & Tjebkes, 2000). When objects are moderately complex and offer some feedback they are most likely to elicit focused attention (Parrinello & Ruff, 1988).

From a developmental perspective, variability in the child's ability to attend to objects and events has been linked to the development of two attention systems (Ruff & Rothbart, 1996). In the early attention system, attention is highly influenced by the novelty of objects available to the child for play and exploration. In the later system, self-generated and goal-oriented schemes and tasks shape sustained, focused attention. According to Ruff and Rothbart (1996), as at around 12 months of age children begin to habituate more readily to novel objects and events, the duration of attention based on the first system should decline thereafter. The major attentional and cognitive advancements at the end of the first year are reflected in infants' improvements in finding hidden objects and inhibiting the response to search for an object where it was previously found, known as the A-not-B/delayed response (e.g., Diamond, 2002).

In addition to age-related progression, consistent variations in the child's ability to focus and sustain attention have been associated with individual differences in motivation and self-regulatory behavior (DeGangi, 2000; Lawson & Ruff, 2004a) and in the quality and sophistication of object play (Vondra & Belsky, 1991).

The focus of the present investigation was on the period between 10 and 14 months, a time of major developmental changes (e.g., Biringen, Emde, Campos, & Applebaum, 1995; Corbetta & Bojczyk, 2002; Piaget, 1952). The objective was to examine whether, during the span of a few months prior to and after turning 1 year of age, significant changes in attention and in task persistence could be identified. The first hypothesis was that at 14 months infants' attention/persistence and level of play when exploring objects will be more advanced compared to 10 months. The second hypothesis referred to the positive associations between the quality of the play and the degree of attention and persistence in the task. The third hypothesis was that the level of object play at 12 months could serve as a marker for the trajectory and timing of the child's attention-related changes.

Method

Participants

Sixty "typically-developing" infants (30 boys and 30 girls), who took part in a longitudinal study from age 8 to 14 months, participated in this investigation. The families were primarily from a middle class background and lived in cities and villages in the northern part of Israel. Mothers ranged in age from 25 to 47 years (M= 32, SD = 4.3) with a mean education of 16 years (SD = 2.4). Recruitment was carried out through Mother and Child Health Care Centers, private nursery programs and day care centers. This study was part of a larger investigation that focused on sleep and developmental changes (see Scher & Asher, 2004). Mothers had volunteered to take part in a longitudinal "study on infant development" (approved by the Institutional Review Board). Participation criteria included informed parental consent, no identified developmental problems and two-parent Jewish families. The present report is based on data collected at 10, 12 and 14 months.

Instrument and Procedure

Infants' Play Behaviors with Objects during Semi-structured Tasks - POST (Schneider, 2005) is a procedure designed for measuring object play behavior

at tasks demanding purposeful exploration. Based on methods devised by Morgan, Maslin-Cole, Birigen, and Harmon (1991), Ruff and Lawson (1991), and Vondra and Belsky (1991), the POST enables observation of the level of infants' object play as well as their ability to focus and sustain attention and to persist at tasks demanding purposeful exploration. The task is applicable for infants in the second part of the first year throughout the second year.

A total of 5 minutes, divided into three play segments, are allotted for object play: 1.5 minutes for play with the first object (segment A), 1.5 minutes with the second object (segment B), and 2 minutes with multiple objects [the first, the second, and a third object] (segment C). The tasks are presented in the same order. Infants are free to explore and manipulate the objects at their will during the allotted time. Objects were chosen for their novelty, attractiveness, and appropriateness to the child's developmental level. At 10 and 12 months the same objects were used: **Play segment A** - *Fisher Price car with a doll inside* (from Fisher Price garage); **Play segment B** - *Plastic graded cylinder with a piece of cellophane paper (25 cm long) inserted inside [custom-made toy];* **Play segment C** - On completion of the 1.5 minutes, the examiner replaces the first object next to the cylinder and adds a *third object- a transparent plastic jar with an orange block inside closed with a red screw-on lid.* At 14 months, the original objects were replaced with different objects that have similar functions and manner of operation but are more challenging developmentally (for a detailed description of the toys, administration, and coding procedure, see Schneider, 2009). For the purpose of this report we present data pertaining to the child's object play with one object versus multiple objects.

Every infant was visited in their home on three occasions: at the age of 10, 12 and 14 months. The team examining play behaviors included the first author and three research assistants. The POST was administered with the infants seated on their mothers' knees on a chair positioned at an appropriate height at a kitchen/dining room table that was free of distracting stimuli. Infants played with the designated objects on a specially-designed wooden tray (Schneider, 2006). The session was video recorded; a digital format served for coding.

Three scores served the present report: (a) *attention:* using Ruff and Lawson's (1991) criteria as guidelines, we measured the percentage of time the infant was engaged in focused attention - the duration of time that an infant looks at the object and simultaneously engages in some deliberate manipulation of it; (b) *persistence and task-directed behavior:* using Morgan et al.'s (1991) scale, the child's behavior was rated from 1 to 9, with higher scores

reflecting more task persistence and engrossment; (c) *level of object play* was scored according to the 14 categories described in the Developmental Scale of Infant Play (Vondra & Belsky, 1991) that divides play into several categories according to levels of developmental progression: undifferentiated exploration includes mouthing (level 1) and simple manipulation (level 2); functional play is level 3. Transitional play includes three levels: juxtaposition (level 4); functional - relational (level 5) and enactive naming (level 6). Rudimentary symbolic play includes pretend self (level 7); pretend other (level 8) and substitution (level 9). These levels were the most relevant developmentally with regard to the age of the participants. The lowest, highest and most frequent play levels were noted. For the purpose of the present report the most frequent level of play will be used.

The first author coded all of the POST segments for each child at every age. Two coders, who had not been involved in the data collection and were blind to the research questions and hypotheses, assisted in establishing inter-rater reliability. After intensive training in scoring procedures, the first author and two coders scored the play behaviors of 20 different children in each age group. Inter-rater agreement on the scoring criteria ranged from 87%-95%.

Results

The means and standard deviations on the measures of attention, persistence and level of play at 10, 12 and 14 months when exploring a single toy and multiple toys are presented in Table 1. Age-related significant increases in overall attention, ($F\ [2,110] = 9.13$, $p<.001$) and in persistence across the two conditions ($F\ [2,110] = 8.19$, $p<.001$) were found using multivariate analyses. Paired t-tests showed that the percentage of attention was consistently significantly higher in the multiple toy condition as compared to the single toy: at 10 months, $t\ (59) = 3.89$, $p<.001$; at 12 months, $t\ (57) = 3.06$, $p<.01$; at 14 months, $t\ (57) = 3.46$, $p<.001$. In a similar fashion, paired t-tests showed that at all ages, the mean scores on task persistence were significantly higher on the multiple as compared to the single toy: at 10 months, $t\ (59) = 3.49$, $p<.001$; at 12 months, $t\ (57) = 3.13$, $p<.01$; at 14-months, $t\ (57) = 3.11$, $p<.01$.

Table 1
Age-Related Changes in Attention, Persistence, and Level of Play When Playing with Single and Multiple Objects.

Measures	**10 months (N=60)**		**12 months (N=58)[a]**		**14 months (N=58)[b]**	
	M	(SD)	M	(SD)	M	(SD)
Attention						
Single	34.37	(18.80)	48.46	(19.35)	48.34	(19.73)
Multiple	44.30	(18.71)	56.38	(18.68)	59.29	(19.60)
Persistence						
Single	3.73	(1.65)	4.96	(1.81)	5.02	(1.93)
Multiple	4.62	(1.81)	5.71	(1.79)	5.95	(1.84)
Level						
Single	1.65	(1.07)	3.12	(1.79)	3.55	(1.71)
Multiple	2.50	(1.85)	3.90	(1.71)	3.45	(1.61)

[a] n= 58 since 2 of the 60 infants did not cooperate and play at the 12 months visit; [b] n= 58 since 2 infants (different infants than the 2 who didn't cooperate at 12 months) were not visited at 14 months.

Univariate analyses of variance indicated significantly higher levels of play with increasing age, with respect to both the single toy ($F [2,110] = 26.69$, $p<.001$) and the multiple toy condition ($F [2,110] = 14.48$, $p<.001$). Subsequent paired comparisons indicated that in the single toy condition, significant differences were found between 10 and 12 months ($t [57] = 6.01$, $p<.001$) and between 10 months and 14 months ($t [57] = 7.88$, $p<.001$). No significant differences were found between the play levels at 12 and 14 months. Similarly, in the multiple condition, significant differences were found between play levels at 10 and 12 months ($t [57] = 4.79$, $p<.001$) and between 10 and 14 months ($t [57] = 3.73$, $p<.001$), but no differences were indicated when comparing play levels at 12 and 14 months.

Table 2 presents the associations between the level of play and the child's attention and persistence. As shown, significant positive correlations, ranging from $r=.36$ to $r=.62$, were found consistently between the frequent play level demonstrated by the child and the attention and persistence measures.

Table 2
Spearman Coefficients of Level of Play with Attention and Persistence.

	Play level	Attention	Persistence
Single			
	10	.42**	.38**
	12	.43**	.41**
	14	.40**	.46***
Multiple			
	10	.62**	.62**
	12	.48**	.53**
	14	.36**	.37**

* p<.05; **p<.01; ***p<.001

In order to further address the relationships between developmental attainments, as defined by the level of play, and the ability to focus attention, we divided the sample into two groups based on the frequent level of play displayed by the child on the multiple conditions at age 12 months. Group 1 (LOW) included children whose frequent level was undifferentiated exploration or simple manipulation [levels 1 and 2] (n=16). Group 2 (HIGH) included infants whose frequent level of play was transitional play [levels 4 and 5] (n=40). The change in attention over time for each group is depicted in Figure 1. A repeated measures analysis showed a tendency for interaction effect (F (1,54) = 3.70, p=0.06); the test of within subjects contrast showed a quadratic effect. In the HIGH group (71% of the infants), attentive behavior increased from 10 months (M=40.63, SD=14.32) to 12 months (M=50.65, SD=13.86), and remained stable from 12 to 14 months (M=49.17, SD=13.47). In contrast, in the LOW group (29% of the infants), the significant change in the child's ability to focus attention occurred after 12 months, that is, between 12 to 14 months. For this latter group, at 10 months the percentage of attention was M=34.38 (SD=13.26), at 12 months, M=36.69 (SD=9.30) and at 14 months, M= 42.40 (SD=11.64). The WALD test, which allows testing the significance of a set of explanatory variables, was significant (Wald =8.83, p<0.001).

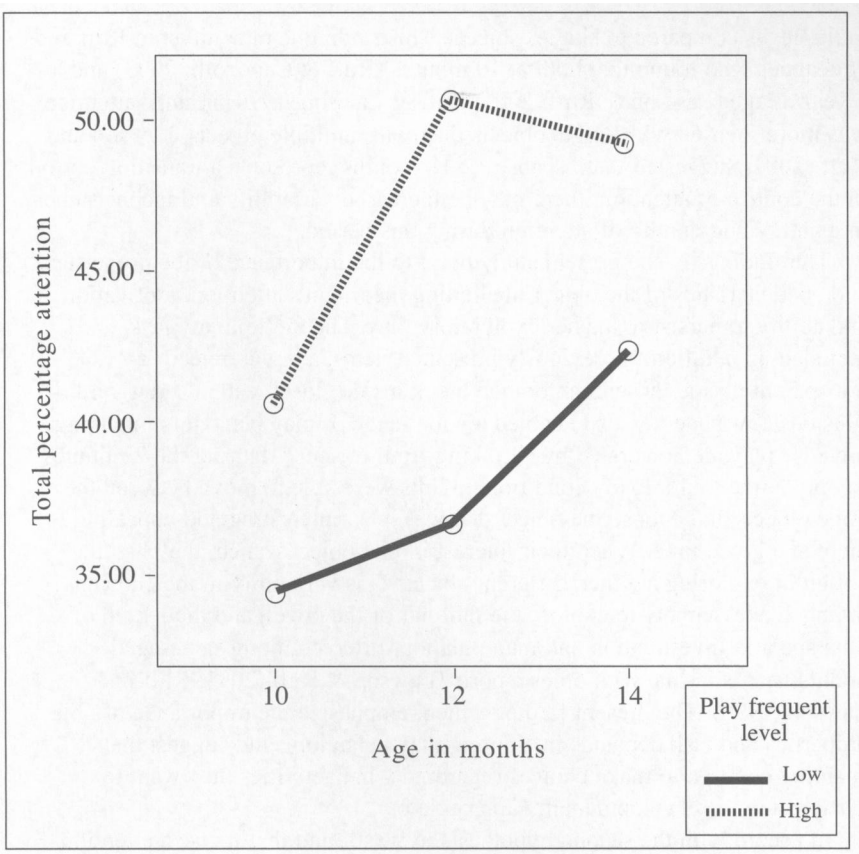

Figure 1
Changes in Attention Across Time in Children Demonstrating High versus Low Play Levels at 12 Months.

Discussion

In line with previous research on age-related changes in attention and distractibility (Ruff & Lawson, 1990; Ruff & Lawson, 1991; Ruff & Capozzoli, 2003), the present data set demonstrated that attention and task persistence increased, as predicted, from 10 to 14 months of age. It was also found that at 10, 12 and 14 months, infants consistently showed a greater percentage of attention and more persistence and task-directed activity when playing with

multiple, as compared to single, objects. This finding is in contrast to Ruff and colleagues who found that both at 10 months (Ruff & Capozolli, 2003) and at 1 year of age (Lawson & Ruff, 2001; Ruff & Lawson, 1990) infants' attention was more focused with single objects than with multiple objects. Lawson and Ruff (2001) suggested that because 12-18 months represents a transition period in the control of attention, there may be increased variability and inconsistency in quantity and quality of attention during this period.

The findings of the present study point to the importance of the properties and characteristics of the object in eliciting the infant's attention, motivation and ability to persist in his/her exploratory play. The multiple toy task included, in addition to previously presented items, a novel object - a transparent plastic jar with an orange block inside closed with a screw-on lid. This custom-made toy also enabled a wide range of play behaviors including pretense play, demonstrated by "drinking from the cup". During the 2 minutes of play in the multiple toy condition, infants were able to move between the three objects and choose the object that was most interesting and appealing to them at a given time. When their interest in that object waned, they had the option of exploring another, different object. This variability in the choices infants made, namely to explore the familiar or the novel, and the length of time spent in investigation and manipulation differed among same-aged infants, and is in line with other reports (Lawson & Ruff, 2001; Ruff & Lawson, 1990). The present findings, then, emphasize the importance of object properties and task demands in eliciting play behaviors, and suggest that enabling children to make choices regarding what activities they want to participate in is developmentally appropriate.

In accord with the second hypothesis, it was found that focused attention and more persistence and engrossment in manipulating and exploring the objects was consistently linked to higher levels of play, as defined by Vondra and Belsky (1991). In the present study, the increasing ability to sustain attention and persist at the task-directed activity was more typical when engaging in sophisticated object play behavior. Other studies on infant attention during solitary play have demonstrated that infants who sustained attention for longer periods spent more time in both non-symbolic play actions and symbolic play actions at a later age (e.g., Tamis-LeMonda & Bornstein, 1996). This pattern of association between level of play and attention corroborates Ruff's previous findings (Ruff & Lawson, 1990; 1991).

Finally, the present data identified two trajectories, each marking a different shift point: before or after 12 months of age. Whereas most infants (71%)

showed a significant change in attention and task persistence between 10 and 12 months, for a subgroup (29%), the significant change occurred between 12 and 14 months. This latter group differed in the quality of play at 12 months: they demonstrated a lower level of object play compared with the infants whose focused attention did not increase significantly from 12 to 14 month. As infants have more endogenous control over attention allocation (Oakes et al., 2002), the level and complexity of their play activity appears to increase as well. Ruff and Rothbart (1996) suggested that a second system of higher level of attention develops gradually with increasing cognitive sophistication and improved self-regulatory skills. The declining control of the first attentional system and the gradual increased influence of the second system create a period in which sustained and focused attention is low relative to both the earlier infancy period and later preschool years. They further propose that measures of focused attention at 12 months may therefore be affected by the transitions in attention and other processes occurring at this age.

Limitations of the Study and Suggestions for Future Research

A number of limitations of the present study should be noted. First, the objects used with the 14-month-old infants were slightly different from objects used at the two previous visits. While the age-related adaptation in stimuli and tasks is commonly practiced (e.g., Messer et al., 1986; Oakes et al., 2002), it is not clear if the change masked or amplified the developmental shift. As our findings did not yield significant differences between 12 and 14-month-old infants in their attention and persistence during object play, further investigation of these age groups is warranted. A second limitation pertains to the home context. Notwithstanding the importance of the naturalistic settings for a valid assessment of play, unexpected distracting stimuli which may have affected attention had occurred, albeit, infrequently.

Similar to other longitudinal studies that rely on parental interest and cooperation (e.g., Tamis-LeMonda & Bornstein, 1993), our participants were from educated, middle-class families. As the study focused on changes occurring within each child, a relatively homogeneous demographic background was considered satisfactory for documenting change over time. However, more studies across a wider range of populations are warranted. The POST procedure provided a semi-structured setting in that the infant was able to self-direct and regulate his/her play behavior, albeit with specific, predetermined objects. Future investigations measuring play behaviors should consider free-play settings with more diversity in play objects as well as follow-up studies at a later age.

Finally, whereas the results of the present study showed that infants at 10, 12 and 14 months consistently demonstrated a greater percentage of attention and more persistence and task-directed activity when playing with multiple objects than in play with single objects, other studies reported that infants' attention was more focused with single objects than with multiple objects (Lawson & Ruff, 2001; Ruff & Capozolli, 2003). This discrepancy should be re-examined, and more studies should address this issue, as there are important theoretical implications, as well as practical applications, for caregivers and educators.

Conclusions and practical implications

Results of the present study support the contention that manipulating, exploring, and playing with objects is a multidimensional phenomenon. Infants' exploratory play with age-appropriate objects provided information on aspects of cognitive-motivational development, reflected in the variability in attention, persistence and exploration of different objects. Within a time span of four months (10 to14 months), significant differences were noted in the infant's ability to focus and sustain attention while attending to novel toys. Notable developmental progress in the level of object play were also demonstrated. Importantly, it was shown that more advanced play at 12 months discriminated between the timing of presumed shift in attention regulation. In infants who demonstrated sophisticated play at 12 months the shift in attentive behavior occurred by the end of the first year, whereas for the less advanced sub-group the significant change in attention and task persistence occurred only after turning 1 year of age. Significant differences found in the level of the infant's play behaviors with the different objects point to the importance of object properties and characteristics in eliciting the infant's attention, motivation and ability to persist in exploratory play.

The present findings provide further evidence stressing the importance of observing the child's play behavior in different situations and environmental contexts, including the home setting, during free play or more structured play settings. Information obtained regarding the infant's object play behaviors has significant implications for understanding and assessing the child's development. For example, a child who engages in relatively little sustained focused attention and purposeful task-directed activity may learn less about objects and their properties and develop fewer strategies for attaining more information. Children demonstrating poor attentiveness, little persistence and ineffective problem-solving strategies during play experiences, can be encouraged to become more attentive, directed and focused with appropriate help and mediation from an adult, optimally, a parent.

Continuing research that will shed light on discovering the characteristics of the child and the environment that may enhance or hinder development of the child's play, exploration, and feeling of mastery and competence, is a necessary and compelling challenge for parents, educators, clinicians and researchers. Occupational therapists have a unique and crucial role to play in increasing parental awareness regarding the importance of play. Furthermore, through providing anticipatory guidance, occupational therapists can promote an understanding of what factors and experiences are likely to affect the child's play behavior and well-being.

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