The relationship between symbolic play and executive function in young children

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THE ROLE OF EXECUTIVE FUNCTION, specifically inhibitory control and generativity, in symbolic play was investigated in 20 children aged 48–89 months. Assessment of inhibitory control was via the Sun–Moon Stroop task, and generativity was assessed with the Semantic Fluency task, as well as a new object substitution task which required children to generate as many uses of toys as possible. Symbolic play ability was assessed under both structured conditions, using the Test of Pretend Play (Lewis & Boucher, 1997), and during free play. The results indicated that the ability to inhibit prepotent responses was associated with children's symbolic play skills, even after controlling for mental age. In contrast, generativity scores on both tasks were not correlated with symbolic play, indicating that only some aspects of executive function are implicated in symbolic play. The validity of the tasks used to measure executive function is discussed.

Introduction

As children develop, their play becomes more flexible and creative. It evolves from the exploration of the sensory properties of objects to simple repetitive play, to relational and constructive play with objects, to functional play, and finally to play that is symbolic in nature (Jordan, 2003; Piaget, 1962; Smilansky, 1968). In the study reported here, we explored the possibility that the emergence of symbolic play is related to the development of executive functions, which may account for its increasingly creative and flexible nature.

Symbolic play is often defined as children's deliberate distortion of reality in play when they act 'as if something is the case when it is not' (Leslie, 1987, p. 413; see also Fein, 1981; Jarrold, Boucher & Smith, 1993). Leslie (1987) contended that there are three fundamental forms: the substitution of one object for another, the attribution of absent/false properties, and the imagination of absent objects. However, it is generally accepted that this description is too narrow and that symbolic play can also involve the attribution of animacy (Jefree & McConkey, 1976; Lillard, 1993; Watson & Fisher, 1977), and role-play (Brown, Prescott, Rickards & Patterson, 1997).

Symbolic play typically emerges during the second year of life. Its frequency appears to be greatest during the late preschool years and begins to decline at around age six years (Fein, 1981). The ability to pretend gradually shifts from using the self as the agent to using another object (e.g. a doll) or person as the agent of the play. This has been called decentration (e.g. Fenson & Ramsey, 1980; Lovel, 1975; Watson & Fisher, 1977). In addition, the child becomes more and more able to use objects that are perceptually and/or functionally dissimilar to the objects they are meant to represent (decontextualisation; e.g. Elder & Pederson, 1978; Lytinen, 1991). A further developmental trend is the integration of multiple symbolic play acts into coordinated play sequences (Fenson & Ramsay, 1980; 1981; Nicolich, 1977). Harris (1993) has argued that this gradual progression in deliberate distortion of reality indicates that the child shifts from habitual responses that are driven by external physical reality to internally generated flexible and planned actions. The child correctly perceives the actual situation but pretends that a different reality exists and can discriminate between the two (Leslie, 1987).

This shift is likely to involve the development of executive functions, which is a broad term used to describe a set of self-regulatory abilities necessary for problem solving or the conscious control of thought and action (Hughes, 2002; Isquith, Crawford, Andrews Espy & Gioia, 2005; Turner, 1999; Welsh & Pennington, 1988; Zelazo & Müller, 2002; Zelazo, Müller, Frye & Maccovitch, 2003). Hughes, Russell and Robbins (1994) have described executive functions as ‘mental operations which enable the individual
to disengage from the immediate context in order to guide behaviour by reference to mental models or future goals’ (p. 477). These operations are especially critical in situations when a habitual response is inappropriate or undesirable (Turner, 1999).

Abilities such as planning ahead, working memory, inhibitory control, set-shifting and attentional flexibility are generally thought to be part of the set of executive functions, but some authors have also included the generation of novel ideas or behaviours, or generativity (Bishop & Norbury, 2005; Hill, 2004; Jarrold, Boucher & Smith, 1993; 1996; Turner, 1997; 1999). As Jarrold et al. (1996) have argued, generativity and inhibitory control seem to be mirror images of each other: when one response has to be inhibited, an alternative one usually has to be generated. Furthermore, Turner (1999) believes the capacity to generate new ideas or lines of behaviour is critical for executive control of spontaneous, volitional behavior, one example of which is symbolic play. However, to date there is no clear indication as to which executive functions may be involved in symbolic play, and little is yet known about how individual differences in executive function development relate to the onset and elaboration of symbolic play in typically developing children.

There is evidence that different executive functions emerge at different ages and their emergence seems to coincide with development in different areas of the frontal lobes (Diamond, 2002; 2006; Jacobs, Harvey & Anderson, 2007). While inhibitory control seems to develop early in the preschool years (Diamond, 2006; Diamond & Doar, 1989), more complex functions, such as planning and set-shifting, emerge later, some not until adolescence (Jacobs et al., 2007; see also Hill, 2004, for a review).

The evidence that inhibitory control appears to be the first executive function to emerge during the preschool years, when symbolic play is also at its peak, combined with the argument that inhibitory control and generativity are complementary executive functions, led us to investigate their relationship with symbolic play abilities. Some indication that both these functions may be involved in symbolic play comes from studies focusing on children with autism. For example, Rutherford and Rogers (2003) found a strong association between symbolic play and generativity for a combined sample of children with autism, typically developing children and children with other developmental disabilities. They did not test for a similar association with inhibitory control. Further, in a series of experiments, Jarrold et al. (1996) showed that generativity deficits may explain the reduced production of spontaneous symbolic play typically observed in children with autism. These children were able to generate more symbolic play acts when generativity was prompted with questions such as “What can you do with these?” compared to conditions when they were left to play by themselves. Jarrold, Boucher and Smith (1994) also found some evidence to suggest that children with autism, like control children, do not have difficulties inhibiting a habitual response to an object (e.g. a pencil) in order to pretend to use it as another object (e.g. a toothbrush). However, in these studies, Jarrold and his colleagues did not include independent measures of inhibitory control and generativity, and the association between symbolic play and children’s inhibitory and generativity abilities was not evaluated.

In our study, typically developing young children were tested for inhibitory control and generativity as well as for their symbolic play ability during structured and unstructured play. It was predicted that measures of inhibitory control and generativity would be associated with engagement in symbolic play.

One of the reasons for the lack of evidence on the development of executive functions and their relationship to symbolic play may have been the difficulties finding valid and reliable tests of executive function for preschool children (Hill, 2004; Isquith et al., 2005), especially tasks that measure distinct components of executive function (Hughes, 2002). Most of the available tests are appropriate only for older children and/or adults. However, some of these tests can be modified for use with young children. We chose to test inhibitory control with the Sun-Moon Stroop task (Archibald & Kerns, 1999). Although normed for seven- to 12-year-olds, this task is also suitable for younger children who are not yet reading (Archibald & Kerns, 1999), and we found that the children in our study were able to complete the task with ease. To measure generativity, we chose the Semantic Fluency task. However, because of criticisms that semantic fluency may merely measure memory for words of a particular category, rather than true generativity of ideas (Turner, 1999), another test was developed along the lines of the ‘Uses of Objects’ task (see Turner for a discussion). This Object Substitution task was also more appropriate in the play setting in which the children were tested. The children were asked to generate symbolic play acts when shown two functional and two non-functional objects (see also Jarrold et al., 1996). If this task is a test of generativity, performance should be associated with performance on the Semantic Fluency task and with engagement in symbolic play.

Method

Participants

The participants were 20 children (15 male, 5 female) aged between four and seven years (mean chronological age (CA) = 58.65; SD = 10.37; range 48–84 months). General cognitive functioning was determined by the Vocabulary, Information, Block Design, and Object Assembly subtests of the Wechsler Preschool and Primary Scale of Intelligence—Third Edition (WPPSI-III; Wechsler, 2002). All children were functioning within the normal range with a Mean FSIQ of 101.35 (SD = 9.16; range = 87–119). Overall Mental Age
was calculated by averaging the test-age equivalents of the raw scores (as specified in the WPPSI-III administration manual; mean mental age (MA) = 59.15; SD = 9.93; range 45–77 months). The majority of the children came from a middle-class (80%) and Caucasian (95%) background, with both parents present in their homes. Most of the females (73%) had a combined yearly income of AUS$ >50,000.

**Measures**

**Inhibitory control**

Inhibitory control was measured with the Sun-Moon Stroop task based on Archibald and Kern’s (1999) variation of Gerstadt, Hong, and Diamond’s (1994) Day-Night Stroop task. Children were shown a set of 16 cards with half of them picturing a yellow sun on a blue background, the other half a white crescent moon on a black background. In the ‘congruent condition’, children were taught to say ‘sun’ or ‘moon’ when shown the appropriate card. These responses were chosen over the traditional ‘day’/’night’ responses because of their more explicit stimulus-verbal response associations, as suggested by Archibald and Kerns (1999). To demonstrate understanding of task requirements, the children were required to provide one correct, unprompted response to each type of card. After this teaching session, the 16 cards were presented randomly and the children were instructed to respond appropriately (i.e. either ‘sun’ or ‘moon’) as quickly as possible.

Directly following the congruent condition, the children were instructed to switch responding to saying ‘sun’ when shown the moon picture card, and ‘moon’ when shown the sun picture card, thus requiring the inhibition of previously learned responses. After providing one correct, unprompted response to each type of card in this incongruent condition, the children were shown the 16 cards again and asked to respond according to this new rule as quickly as possible. The number of correct responses in the incongruent condition was recorded as a measure of inhibitory control.

**Generativity**

The ability to generate ideas was assessed with the Semantic Fluency task with two trials. Children were first asked to name as many examples of animals as they could within a period of 60 seconds. In the second trial they were required to name as many different things to eat or drink as they could within 60 seconds. If a child did not produce a correct response within the first 15 seconds of the trial, a prompt was provided in the form of an exemplar from the appropriate category (i.e. ‘a dog is a kind of animal’ for the ‘animals’ task and ‘you can eat an apple or you can drink milk’ for the ‘food/drink’ task). The total number of acceptable words generated over both trials (excluding repetitions) was scored.

A second test of generativity, the Object Substitution task, was developed specifically for this study. It was based on Turner’s (1999) description of the Uses of Objects task to measure generativity of ideas and on Jarrold et al.’s (1996) task designed to measure generativity in the symbolic play in children with autism. Children were presented with four objects, one at a time in a counterbalanced order, and asked to generate as many different object substitutions as possible (i.e. ‘what could you pretend this could be?’) within 45 seconds. Two of the objects (a plastic cup and a pencil) had a defined functional use, and two did not (a small wooden cube, and a long cardboard tube). Upon presentation of each object, the researcher modelled one example of object substitution: the cup was used as a hat, the wooden cube as an apple, the pencil as a magic wand and the tube as a snake. Children could demonstrate object substitution either verbally or through actions or both. The number of different object substitutions (excluding repetitions within and across objects) produced by each child for each item was scored. Two measures were derived from this task: the number of object substitutions generated for the functional objects and the number of object substitutions generated for the non-functional objects. As these numbers were strongly correlated with each other, the total number of generated object substitutions was used in further analyses.

**Symbolic play**

The verbal version of the structured component of the Test of Pretend Play (ToPP; Lewis & Boucher, 1997) was used to assess symbolic play in a structured (i.e. modelled, instructed, and elicited) condition. The ToPP is a standardised test of symbolic play which assesses the child’s ability to engage in the three main types of such play (i.e. object substitution, property attribution, and reference to absent objects). It also examines the child’s ability to combine symbolic actions into scripts, the child’s ability to use him/herself as the agent in symbolic play, and his/her ability to use others (e.g. a teddy) as the agent. In addition to good concurrent validity, the ToPP also displays good concurrent validity, construct validity, and reliability (Lewis & Boucher, 1997). Symbolic play ability raw scores for each participant were calculated using the ToPP scoring criteria. The raw scores were then converted into age-equivalent scores (in months) using the normative data published in the ToPP manual.

Spontaneous symbolic play was assessed via a videotaped 20-minute unstructured free play session that followed the ToPP session. In addition to all of the items from the ToPP session, 15 new toys and junk items (for example, a toy truck, cup and plate, cardboard box, wooden blocks, cotton reel) were made available and the child was told that s/he could play with ‘anything you like’. To control for the effects of partner interaction and assistance, the researcher was the play partner, providing general praise (e.g. ‘wow, that looks great’, ‘nice idea’ etc.), following any specific instructions the child issued and clarifying play acts when the content was unclear (e.g. by saying ‘what’s happening...')
now?'). She was careful, however, not to elicit or provide any instructions for play. Frequency of symbolic play acts was coded from the videotape using the coding scheme described in the Appendix. Only one symbolic play act was recorded per 10-second interval. Since a few of the children did not engage in any free play for the entire 20 minutes, frequency scores were converted into percentage of time spent in symbolic play. The primary coder of all tasks was the first author. A trained second observer independently coded approximately 20 per cent of the free play sessions. There was a high level of inter-rater reliability (0.97) as indicated by an intra-class correlation recommended by Shrout and Fleiss (1979) for situations where each target is rated by the same two judges.

Procedure

The children were tested in a laboratory playroom with only the experimenter present. The shortened version of the WPPSI-III (Wechsler, 2002) was administered first, followed by the tests of symbolic play. To assist with the establishment of rapport and the creation of an atmosphere for pretence, each participant was administered the ToPP prior to the free play session. The Object Substitutions task was presented after the free play session in order not to influence spontaneous symbolic expression during play. The order of presentation of the Sun-Moon Stroop task and the Semantic Fluency task was counterbalanced so that half of the children completed the Sun-Moon Stroop task at the start of the session and the Semantic Fluency task at the end, and the remaining half completed the tasks in reverse order. In total, the testing session lasted approximately 90 minutes, with frequent short breaks. All tasks were videotaped for later coding of behaviour.

Results

Children's mean scores on each of the executive function and symbolic play measures are presented in Table 1. Pearson Product-Moment Correlations (2-tailed) were used to explore the relationship between CA and MA and the measures of executive function and symbolic play. Given the small sample size, correlations of 0.32 or greater were considered to be meaningful, regardless of whether they were significant or not, as this value accounts for approximately 10 per cent of the variance. As seen in Table 2, both CA and MA were correlated to the executive function and play variables, with r-values for MA being the highest for most variables. The correlations between the executive function and symbolic play variables are shown in Table 3, together with Partial Correlations controlling for the effect of MA. Because MA seems to explain much of the variance in the relationship between executive function and symbolic play, the partial correlations will be discussed in what follows.

Table 1: Descriptive Statistics for the Executive Function and Play Variables (n = 20)

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun-Moon Stroop</td>
<td>12.90</td>
<td>1.74</td>
<td>9–16</td>
</tr>
<tr>
<td>Semantic Fluency</td>
<td>14.60</td>
<td>5.32</td>
<td>6–25</td>
</tr>
<tr>
<td>Object Substitutions</td>
<td>15.90</td>
<td>7.25</td>
<td>7–31</td>
</tr>
<tr>
<td>ToPP</td>
<td>64.15</td>
<td>8.33</td>
<td>50–77</td>
</tr>
<tr>
<td>% time in spontaneous</td>
<td>48.10</td>
<td>28.47</td>
<td>8–99</td>
</tr>
</tbody>
</table>

Table 2: Pearson Product Moment Correlations (2-tailed) between chronological age (CA), mental age (MA) and the Executive Function and Symbolic Play Variables

<table>
<thead>
<tr>
<th></th>
<th>CA</th>
<th>MA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mental age</td>
<td>0.84**</td>
<td></td>
</tr>
<tr>
<td>Sun/Moon Stroop</td>
<td>0.43</td>
<td>0.53*</td>
</tr>
<tr>
<td>Semantic Fluency</td>
<td>0.71**</td>
<td>0.81**</td>
</tr>
<tr>
<td>Object Substitutions</td>
<td>0.48*</td>
<td>0.41</td>
</tr>
<tr>
<td>ToPP</td>
<td>0.38</td>
<td>0.63**</td>
</tr>
<tr>
<td>% time in spontaneous</td>
<td>0.45*</td>
<td>0.51*</td>
</tr>
</tbody>
</table>

Table 3: Pearson Product Moment (PPM) and Partial Correlations (2-tailed) between the Executive Function and Symbolic Play Variables

<table>
<thead>
<tr>
<th></th>
<th>Semantic Fluency</th>
<th>Object Substitutions</th>
<th>ToPP (structured symbolic play)</th>
<th>% time in spontaneous symbolic play</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPM</td>
<td>Partial</td>
<td>PPM</td>
<td>Partial</td>
<td>PPM</td>
</tr>
<tr>
<td>Sun-Moon Stroop</td>
<td>0.43</td>
<td>0.00</td>
<td>0.24</td>
<td>0.03</td>
</tr>
<tr>
<td>Semantic Fluency</td>
<td>0.54*</td>
<td>0.39</td>
<td>0.49*</td>
<td>-0.05</td>
</tr>
<tr>
<td>Object Substitutions</td>
<td>0.24</td>
<td>-0.03</td>
<td>0.37</td>
<td>0.20</td>
</tr>
<tr>
<td>ToPP</td>
<td></td>
<td></td>
<td>0.64**</td>
<td></td>
</tr>
</tbody>
</table>

*p < 0.05  **p < 0.01

A u s t r a l a s i a n  J o u r n a l  o f  E a r l y  C h i l d h o o d
There was no apparent relationship between the Sun-Moon task, measuring inhibitory control, and the Semantic Fluency or Object Substitutions tasks, measuring generativity. However, the correlation between the two generativity tasks was of moderate positive strength. This result confirms that the Sun-Moon task does indeed measure a different construct of executive function from that of the other two tasks. It also suggests that the Object Substitution task may be an alternative measure of generativity to the Semantic Fluency task. There was also a moderately strong positive relationship between the two play variables, suggesting that symbolic play abilities are similar under structured and spontaneous conditions. Interestingly though, while performance in the Sun-Moon task was related to symbolic play ability, semantic fluency and object substitutions were not, suggesting that the ability to engage in symbolic play may be affected by the ability to inhibit prepotent responses, but not by the ability to generate alternative ones.

Discussion

The aim of this study was to explore the role of executive function, specifically inhibitory control and generativity, in the development of symbolic play by young children. The results indicated that the ability to inhibit prepotent responses to a situation is indeed related to the production of symbolic play, with greater inhibitory control being associated with more symbolic play, explaining 16 per cent to 30 per cent of the variance. To our knowledge this is the first study to show this association with typically developing children. Jarrold et al.'s study (1994) did indicate that children with and without disabilities are able to inhibit a habitual response to an object with a common purpose, but they did not include an independent assessment of inhibitory control in their study, and the children were not engaged in play but in an experimental task in which pretence actions were elicited under very controlled conditions. In our study, children's pretence ability was assessed during both structured and spontaneous play sessions and there was an independent assessment of inhibitory control using the Sun-Moon Stroop task.

In contrast, the ability to generate multiple uses of an object does not seem to be involved in the production of symbolic play, as there was no relationship with semantic fluency and object substitution scores. This finding is different from those of Jarrold et al. (1996) and Rutherford and Rogers (2003). However, once again, Jarrold et al. had no independent measure of generativity but inferred it from increases in the symbolic play of children with autism when they were prompted as against when no prompts were provided, arguing that reduced spontaneous symbolic play in autism could be explained by a generativity deficit. Rutherford and Rogers (2003), on the other hand, did use a separate measure and found that generativity accounted for a significant 27 per cent of the variance in symbolic play when mental age was controlled for in their mixed sample of children with and without autism. There are several possible explanations for the difference between these results. Apart from the obvious difference in the composition of their sample, the children participating in their study were younger (MA < 24 months) and age was much less variable than in ours. Moreover, their measures of symbolic play and generativity were very similar in format and in the way they were scored. The Fewell Play Scale (Fewell, 1986) was used to assess symbolic ability, where children are asked to demonstrate what they can do or how they can play with a specific set of toys. Similarly, for the generativity test, four new toys were presented to the children with comments like ‘Here is a new toy’ (p. 295).

The fact that the four objects were introduced as toys would have cued the child to play, especially since this task followed the Fewell play task. Both tasks were scored in terms of whether or not the child used the toys in a pretend fashion. This lack of independence of the two tasks is likely to have contributed to the high correlation between the scores. In our study the two generativity tasks were quite different from the two play tasks and can therefore be considered as independent tests of the two constructs. For these reasons, we are inclined to conclude that the executive function of generativity is not involved in the ability of young typically developing children to play symbolically.

It is, of course, possible that the two tasks used here do not assess generativity but some other cognitive or metacognitive construct. It has been argued that the Semantic Fluency task, in particular, is more a test of memory for words of a particular category than a test of children's ability to generate novel and creative responses (Turner, 1999). Memory for words, as ability to generate new ideas, is to a large extent determined by age and cognitive ability in children (e.g. Gathercole, 2002) and our results show that the amount of variance in production of words explained by CA and MA was very large (50% and 66%, respectively) with older children able to produce more words. In consideration of Turner's criticism we introduced the Object Substitution task as a new measure for generativity. However, this task has not yet been validated as a true measure of this construct. The finding that responses in this task correlated with semantic fluency suggests that it may suffer from the same problems, i.e. measuring memory for what one can do with objects rather than true generativity of ideas. However, this correlation was modest once MA was partialled out, suggesting that (an)other construct(s) must contribute

1 A prepotent response is the dominant, almost automatic response that is triggered in the presence of a stimulus, e.g., the prepotent response when presented with a written word is to read the word. Executive function is thought to be important to prevent this response.
to children's ability to name different uses for the same object. Whether one of these is generativity is likely, but remains to be evaluated in further studies.

Another possible construct involved in Object Substitution could be inhibitory control. Turner (1999) argued that, in order to produce new imaginative uses of objects, one has to inhibit reference to their conventional use. Inhibition can be discounted if the object is non-functional, as was the case with half of the objects in this study. However, the results for functional and non-functional objects did not differ and were therefore combined for analysis. It seems unlikely, therefore, that inhibitory control played a role in the Object Substitution task. If it had, one would have expected an improved relationship between Object Substitution and symbolic play, given our finding that inhibitory control, as assessed by the Sun-Moon task, is associated with symbolic play.

In conclusion, our findings indicate that executive function does appear to play a role in the symbolic play of young children. In particular, the ability to inhibit a prepotent response to a given situation or object in order to pretend a different reality, as assessed by the Sun-Moon Stroop task, is related to the production of symbolic play. However, we found no evidence that the ability to generate novel ideas is involved in young children's symbolic play.

The limitations of the correlational analyses relied on in this study also need to be acknowledged. In addition to failing to detect the causal direction of relationships, they do not preclude the possibility that associations between the variables of interest are determined by other executive functions, such as set-shifting or planning. However, the findings that these abilities do not emerge until after the preschool years speak against this possibility. Theory of mind is another construct that should be considered in this context, as it has previously been found to be associated with both symbolic play (e.g. Astington & Jenkins, 1995; Nielsen & Dissanayake, 2000; Youngblade & Dunn, 1995) and executive function (e.g. Carlson, Mandell & Williams, 2004; Carlson & Moses, 2001; Carlson, Moses & Claxton, 2004). Thus more complex models should be considered in the future.

References


**Appendix**

**Coding scheme for the spontaneous free play session**

**Symbolic play** — the child displayed a symbolic play act:
- the use of one object to represent another (‘object substitution’) (e.g. pretending that a banana is a telephone)
- the attribution of absent/false properties (e.g. pretending that puppy is dirty)
- the imagination of absent objects (e.g. miming the use of a spoon)
- the attribution of animacy (e.g. pretending that teddy can walk or talk)
- role-play (e.g. the child pretending that s/he is a doctor).

To code a play act as ‘symbolic’, clear evidence of symbolic play needed to occur (the child’s verbalisation indicated that he acted symbolically, e.g. ‘the tea is hot’), or the child used non-verbal behaviours that indicated he was acting symbolically (e.g. waved hand over cup as though the contents were hot).

**No symbolic play** — a symbolic play act was not displayed.