The Development of Substitute Object Pretense:

The Differential Importance of Form and Function

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Abstract

Substitute object pretense is one of the earliest-developing forms of pretense, and yet it changes considerably across the preschool years. By 3½ years, children can pretend with substitutes that are highly dissimilar from their intended referents (Elder & Pederson, 1978), but even older children have difficulty understanding such pretense in others (Bigham & Bourchier-Sutton, 2007). The present studies had three aims: (1) to examine the relative influence of the form and function of substitute objects; (2) to replicate the age gap between pretense production and comprehension using a tightly-controlled procedure; and (3) to investigate whether preschoolers' comprehension of substitute object pretense is predicted by (a) theory of mind (ToM), because it involves reading pretender intent, and (b) executive function (EF), because it involves inhibiting the substitute object's identity. In Study 1, 3- to 5-year-old children performed at ceiling on a test of substitute object pretense production, whereas pretense comprehension improved considerably across this age range. Study 2 provided evidence that the function of a substitute object is more influential than its form in determining whether a child can comprehend pretense actions with the object. The results of Study 2 also provided support for the role of ToM in comprehending another's pretense. Finally, Study 3 replicated the results regarding form, function, and ToM in a sample drawn from a different community. The effects of EF on pretense comprehension were inconsistent across conditions and studies, suggesting that EF may not play a major role in the comprehension of pretense with substitute objects.

Keywords: pretense, substitute objects, theory of mind, executive function, inhibitory control

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One of the earliest forms of pretense to emerge in young children is the substitution of one object for another (McCune-Nicolich, 1981; Watson & Fischer, 1977). For example, a toddler might pretend that a block is a telephone or a pillow is a baby. This ability matures considerably through the preschool years as children begin to use a wider variety of objects as substitutes. Piaget (1962) and Vygotsky (1967) discussed the emergence of object substitute play as being linked to representational capacities. In pretense, "an object…becomes a pivot for severing the meaning of horse from a real horse" (Vygotsky, 1967, p. 15). Through play, a child develops the ability to recognize that a present object can represent an absent one.

The current studies investigate the developmental course of producing and comprehending pretense acts with different types of object substitutes, with the primary goal of elucidating the relative importance of a substitute object's form and function. These studies also examine the relation between production and comprehension of substitute object pretense, as well as the skills underlying both abilities.

Form and Function

Fein (1975) proposed that similarity between a substitute and its pretend referent enables the use of the substitute in pretense, by facilitating the mapping of the mentally represented pretend identity onto the substitute. Confirming this, several studies have shown that children first pretend with substitute objects that are similar to their referents before progressing to pretense with less similar substitutes. For example, 16-month-olds can imitate an adult's pretend actions only when similar substitutes are used, but 23-month-olds can do so with even the most dissimilar objects (Jackowitz & Watson, 1980). The ability to produce substitute pretense

without a model to imitate develops during the third and fourth years (Elder & Pederson, 1978; Pederson, Rook-Green, & Elder, 1981; Watson & Fischer, 1977; Watson & Jackowitz, 1984). For example, Elder and Pederson (1978) found that when children were asked to pretend that an object was something else, 2½-year-olds could do so only with similar objects, but by 3½, performance was at ceiling even with dissimilar objects. In sum, by 2 years of age, children imitate an adult's pretend actions with dissimilar substitutes, but have difficulty producing these actions without modeling. By 3½, children can pretend with all types of substitute objects.

Objects can be similar to each other in different ways; prior research has focused on form (the object's appearance) and function (how an object is generally used). The relative influence of these two dimensions on children's pretense with substitute objects has been the subject of some debate. Some studies support the idea that similarity of form and function are equally facilitative of children's ability to use and understand a substitute object (Bigham & Bourchier-Sutton, 2007; Jackowitz & Watson, 1980), but others suggest that function plays a larger role (Elder & Pederson, 1978). These stances render distinct predictions about how children might use substitute objects when form and function are pitted against each other. One goal of the current research was to test these predictions using a variety of substitute objects.

Production and Comprehension

The majority of the work on substitute object pretense has focused on children's own production of pretend actions. However, children frequently observe others pretending with substitute objects and must attempt to interpret those actions. In many other domains, such as language, comprehension develops prior to production. This makes sense because children receive large amounts of language input before they are capable of producing language themselves. The same could be said of pretense: Parents pretend in front of their infants and

toddlers from a very early age (Haight & Miller, 1993; Tamis-LeMonda & Bornstein, 1991). We might expect that through this early exposure, children would come to comprehend pretend actions before they can produce them.

However, the opposite pattern occurs in the domain of motor development. Infants are better able to encode the goal of another's action after they gain experience producing goal-directed reaching themselves (Sommerville, Woodward, & Needham, 2005; Sommerville & Woodward, 2005). By this account, children may not comprehend pretend actions by others until they have experience producing those same actions for themselves. In support of this, Mitchell and Neal (2005) showed that children understood the role of knowledge in their own pretense before they could demonstrate the same understanding of others' pretense.

Previous research suggests that pretending follows the latter pattern, as children produce substitute object pretense actions before they can reliably interpret others' pretend acts. Children achieve near-ceiling performance at producing pretense with substitute objects by 3½ (e.g., Elder & Pederson, 1978). In contrast, the few studies conducted on pretense comprehension have shown that by 30 to 36 months, children are fairly good at identifying pretense enacted by adults when replica objects or other similar substitutes are used, but they are not at ceiling (performance is typically between 60% and 80%; Harris & Kavanaugh, 1993; Tomasello, Striano, & Rochat, 1999). One more recent study found that 3- and 4-year-old children were reliably correct at interpreting an experimenter's actions only when the experimenter used very similar substitutes; even the older children in this study (5-8 years old) had substantial difficulty with dissimilar objects, averaging only 67% correct (Bigham & Bourchier-Sutton, 2007).

Comprehension and production have not been directly compared in a single study. The existing studies were done in different laboratories in different countries with different objects

and actions. Furthermore, several decades separate the majority of the research on pretense

production and the more recent studies on pretense comprehension. The apparent discrepancy

between production and comprehension may be merely an artifact of these differences between

studies. A second main goal of the present research was to investigate whether this

developmental difference between production and comprehension would hold when the two

skills were compared directly in the same study.

Relation of Pretense to Other Skills

A third goal of the current research was to investigate other skills that develop during the

preschool years that could be involved in substitute object pretense, namely theory of mind

(ToM) and executive function (EF). Children make considerable gains in both of these abilities

between 3 and 5 years of age (Astington, Harris, & Olson, 1988; Garon, Bryson, & Smith, 2008;

Gerstadt, Hong, & Diamond, 1994; Wellman & Liu, 2004), and both are correlated with pretense

in young children (Albertson & Shore, 2008; Astington & Jenkins, 1995; Carlson, White, &

Davis-Unger, 2014; Taylor & Carlson, 1997; Youngblade & Dunn, 1995).

Theory of mind could be key to pretense comprehension because consideration of another

person's intentions may help to decipher their actions. In pretense production, by contrast,

children need only consider their own intentions. There is debate over whether children begin to

consider the mental representations of pretenders at a young age (Leslie, 1987; Onishi,

Baillargeon, & Leslie, 2007; Rakoczy, Tomasello, & Striano, 2004; Rakoczy & Tomasello,

2006) or not until late preschool (Lillard, 1993; Perner, 1991; Richert & Lillard, 2002; Sobel,

2007; see Friedman, 2013 for a review of this debate). Regardless of when it *typically* develops,

individual differences in the ability or tendency to consider a pretender's mental state may

contribute to differences in pretense comprehension. For example, if children observe an adult

banging a shoe on a table, they could interpret this action based only on its observable properties and conclude the adult is hitting something with a shoe. However, if they consider the mental state underlying the action (i.e., that the adult is *intending* to pretend and is *imagining* that the shoe is something else), they are more likely to conclude that the adult is pretending to hammer.

Pretending that one object is another also requires overriding the true identity and function of the substitute in order to focus on its pretend identity, as well as holding pretend and real identities in mind. Thus, pretense may rely on EF: a suite of abilities that includes inhibitory control, working memory (or updating), and task switching (Miyake et al., 2000). Inhibitory control (IC), the ability to suppress prepotent responses or ignore salient but irrelevant information, may be particularly important when substitute objects are involved.

EF is likely involved in both production and comprehension of substitute pretense; both involve suppressing reality in order to focus on a pretend scenario. However, the role of EF may differ since the two situations provoke different prepotent responses. In production, children must suppress the tendency to act on an object in its typical fashion in order to produce a pretend action; thus, objects that are strongly associated with particular manual actions (e.g., scissors) may be more difficult to pretend with than those that are not (e.g., a toy animal; Pederson et al., 1981). In comprehension, by contrast, children must suppress attention to properties of the substitute and instead focus on the performed action and the pretender's intentions.

The present studies investigated several aspects of the development of production and comprehension of substitute object pretense with different types of objects. Study 1 investigated how similarity between substitute and referent affects children's abilities to comprehend and produce pretend actions, using a closely-matched procedure to evaluate the prediction that production of substitute pretense develops before comprehension. This study also examined

whether ToM and IC predict children's performance on these tasks. Study 2 included a wider array of types of substitute objects to test the relative roles of form and function and further probed the role of ToM and EF using a larger battery of tasks. Finally, Study 3 replicated the results of Study 2 in a sample of children drawn from a different community with an additional control for receptive language ability.

<div align="center">**Study 1**</div>

Method

      Participants. The sample consisted of 71 children (36 girls) in three age groups (24 three-year-olds: $M = 42.87$ months, $SD = 3.18$; 24 four-year-olds: $M = 52.02$, $SD = 3.55$; 23 five-year-olds: $M = 66.79$, $SD = 3.45$). Five additional participants were tested and excluded: four were too shy or uncooperative to complete the study, and one had a severe speech delay. Participants were recruited from the community in a university town and, reflecting the local demographics, were primarily white and from middle-class backgrounds.

      Materials and procedure. Participants were randomly assigned to either the production ($n = 35$) or comprehension ($n = 36$) condition. All participants completed nine trials with a different object on each trial (see supplemental materials). Three target actions (hammering, writing, pouring) were crossed with three object similarity levels: The easy objects (toy hammer, toy teapot, and marker) were similar to the targets in form and function, intermediate objects (toothbrush, vase, drumstick) were similar in form but dissimilar in function, and difficult objects (shoe, softball, padlock) were dissimilar on both dimensions. Objects of the same similarity level were blocked together such that children saw the three objects at a given level on consecutive trials. The order of items within the blocks (hammering object, writing object, pouring object) and the order of the blocks (easy, intermediate, difficult) was systematically varied to create

three possible trial orders (see online supplemental materials). Children never saw the same action (hammering, writing, or pouring) on back-to-back trials.

Pretend task. The procedure always began with a training phase to introduce children to the target objects (realistic toy hammer, glass pitcher, pencil). For each object, the experimenter asked the child its name and what it was for. Corrective feedback was provided when necessary. The experimenter then asked the child to demonstrate how the object was used.

Production condition. After the training, children received one trial where they were asked to pretend to saw with a realistic toy saw. This trial was included to ensure that all children began the task with an easy object. No feedback was given on this trial and it was not included in the analyses. On each subsequent trial, the experimenter handed the child a test object and said, "Pretend that you are writing/hammering/pouring with this." This was modeled on the phrasing used in previous work (Elder & Pederson, 1978; Jackowitz & Watson, 1980; Pederson et al., 1981; Watson & Jackowitz, 1984); for example, Jackowitz and Watson (1980) told children to "pretend to talk into the telephone". The procedure was repeated for all nine objects.

Comprehension condition. In this condition, the child observed the experimenter performing a pretend action with each object. The experimenter would take out the test object and pantomime writing, pouring, or hammering for a few seconds before asking, "What am I pretending to do?" As in the production condition, the phrasing of this question is consistent with previous work in this area (Bigham & Bourchier-Sutton, 2007). The initial training trial always involved sawing with the toy saw; subsequent trials used the remaining nine test items.

Coding. Coding was done from video by trained research assistants. For the production condition, a correct response matched the action the child performed for the corresponding target object during the initial training phase. In the comprehension condition, children were coded as

correct if they stated the correct action (hammering, writing, pouring) or an appropriate synonym ("banging in a nail", "coloring"). A second coder, blind to the study hypotheses, recoded 20% of participants for reliability; there was 100% agreement between the two coders.

Coders also categorized children's incorrect responses in the comprehension condition. Responses were coded as functional (referring to the true identity of the substitute object; e.g., "brushing your teeth"), action-based (describing the experimenter's physical action; e.g., "turning the ball"), or irrelevant (not fitting into either of the other categories; e.g., "ironing"). This coding scheme was modeled on Bigham and Bourchier-Sutton (2007), who coded the majority of errors (67%) as irrelevant.

Individual difference measures. Each child also completed measures of theory of mind and inhibitory control, in that order.[1] Half of participants in each condition were given these tasks before the pretense task and half afterwards. Theory of mind was tested using an unexpected contents false belief task (Perner, Leekam, & Wimmer, 1987); children were asked about another's false belief as well as their own prior false belief, for a possible score ranging from 0 to 2 (Cohen's κ = .96). Inhibitory control (IC) was measured using the grass/snow task (Carlson & Moses, 2001). Children were told to point to a green square when the experimenter said "snow" and to a white square for "grass." Possible scores ranged from 0 to 16 (Cohen's κ = .89). The data for six participants were dropped from grass/snow: Five did not complete all 16 trials, and equipment failure led to the loss of data for one child. Additional details about these tasks can be found in the supplemental materials.

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[1] Children also completed two additional measures: A functional fixedness measure (German & Barrett, 2005) and the Moe task (adapted from Lillard, 1993). There were no significant results involving functional fixedness, and its inclusion did not affect any other analyses. The percentage of children who passed the Moe task was very low (13% of 3-year-olds, 17% of 4-year-olds, and 38% of 5-year-olds), and therefore this variable was not included in any analyses.

Results

Data were analyzed using mixed effects logistic regression predicting the log-odds of a correct response on a given trial of the pretend task. This technique is appropriate for two reasons: (1) The binary nature of the data (i.e., each trial was scored as either correct or incorrect) necessitates the use of logistic regression, and (2) Mixed-effects models are necessary for repeated measures designs to avoid inducing bias by violating the independent errors assumption (see Jaeger, 2008). All of our models include random intercepts for individual participants and specific objects used. Model selection was conducted according to the procedures outlined by Hosmer and Lemeshow (2000). Because many of the variables were correlated, variance inflation factors (VIF) were checked at each step. All VIF values were less than 6; VIF values under 10 indicate that multicollinearity is not an issue (Hair, Anderson, Tatham, & Black, 1995; Marquardt, 1970).

The dependent variable for all models was a binary variable representing whether the response given on a particular trial of the pretend task was correct or incorrect. Child's age, trial order, task order, object difficulty, ToM scores ($M = 1.12$, $SD = 0.85$), and IC scores ($M = 11.61$, $SD = 4.59$; centered) were evaluated as possible predictors. For ease of interpretation, mean number of correct trials are sometimes presented along with the regression results, but only the binary correct/incorrect variable was used in the logistic regression analyses.

Preliminary analysis showed that, as predicted, production was easier than comprehension. Children performed significantly better in the production condition ($M = 8.69$ out of 9, $SD = 0.72$) than the comprehension condition ($M = 4.92$, $SD = 1.30$), $t(69) = 14.86$, $p < .001$, $d = 3.58$. Because of this statistically significant difference between conditions, separate regression models were fitted for each condition.

Production condition. There were no significant predictors for the production condition. Children performed at ceiling across all ages and object types (96.5% correct).

Comprehension condition. Table 1 shows the final, best fitting model for this condition. This final model predicted correct responding on each trial of the pretend task from age, object difficulty, and IC score, as well as Age x Object Difficulty and Age x IC Score interactions.

Table 1

Study 1: Final Mixed Effects Logistic Regression Model for the Comprehension Condition

Predictor	β	*SE*	*z*	*p*
Intercept	-2.36	0.75	-3.15	< .01
Age	0.00	0.05	0.06	.96
Object Difficulty				
Intermediate Objects	3.18	1.00	3.17	< .01
Easy Objects	6.31	1.12	5.64	< .001
IC Score	-0.25	0.07	-3.41	< .001
Age x Object Difficulty				
Age x Intermediate Objects	0.13	0.06	2.13	< .05
Age x Easy Objects	0.11	0.07	1.43	.15
Age x IC Score	-0.02	0.01	-2.34	< .05

Note. Final beta coefficients are reported. The intercept represents participants at the mean age of the sample, with the mean score on the IC task, on trials using the difficult substitute objects. VIF for all predictors was less than 5.

Object difficulty. As predicted, performance on both easy (*M* = 2.86 out of 3, *SD* = 0.35) and intermediate difficulty (*M* = 1.75, *SD* = 0.77) substitute objects was significantly better than performance on difficult objects (*M* = 0.36, *SD* = 0.76). A post-hoc comparison showed the mean number of trials correct was also significantly higher for easy objects than for intermediate

objects: $t(70) = 7.88$, $p < .001$, $d = 1.88$. The odds of a correct response for an easy object were

22.87 times the odds of a correct response for an intermediate object, which, in turn, were 24.05

times the odds of correct response for a difficult object.

   Age x Object Difficulty. The effect of age was significantly larger for intermediate than

for difficult objects, but did not significantly differ between easy and difficult objects (Figure 1).

In separate logistic regressions for each object type, age significantly predicted the likelihood of

correct responding for the intermediate objects only ($\beta = 0.14$, $p < .01$).
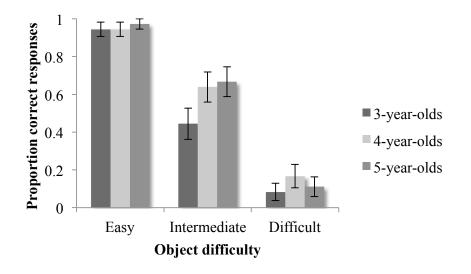

Figure 1. Age x Object Difficulty interaction in the comprehension condition of Study 1. Error
bars represent ±1 standard error. The effect of age was statistically significant only for the
intermediate objects.

   Age x IC Score. There was a negative main effect of IC score, but this cannot be

interpreted without also considering the significant interaction between IC and age: There was a

positive effect of age on performance on the pretend task for children with lower IC scores, but

not for children with higher IC scores.

Finally, the majority (57.1%) of incorrect responses about the experimenter's action were functional ("brushing your teeth" when the experimenter pretended to hammer with a toothbrush), 18.6% were action-based ("turning the ball"), and 24.3% were irrelevant.

Discussion

These findings replicate in a single study with a single set of actions and stimuli what more disparate studies loosely suggest: Although children as young as 3 years old produce substitute pretense actions with dissimilar substitute objects, the comprehension of others' pretense actions is still developing. Even the 5-year-olds in our sample sometimes failed at interpreting another's pretense with a substitute that was dissimilar on one or both dimensions. The finding that production precedes comprehension is consistent with work on the development of goal-directed action (Sommerville et al., 2005; Sommerville & Woodward, 2005): Through repeated production of their own substitute pretense actions, where the mental representations and intentions underlying the pretense are transparent to them, children may come to better understand those same actions produced by others.

One alternative explanation is that the comprehension task was more difficult because it involved a verbal response as opposed to the manual response required in the production condition. Prior studies (Rakoczy et al., 2004; Rakoczy, Tomasello, & Striano, 2006) have suggested a delay between children's implicit understanding of the mental underpinnings of pretense (as demonstrated by their actions) and an explicit understanding (demonstrated through verbal responses). On the other hand, Harris and Kavanaugh (1993) found similar rates of accuracy by 2-year-olds on explicit and implicit comprehension tasks more like the ones used here: Children were able to perform an appropriate reaction in response to a pretend action (e.g., correctly "drying" the animal that had pretend tea poured on it; Experiment 5), and they

responded correctly when asked explicitly to identify a pretend action (Experiment 7). Furthermore, even the youngest children in the comprehension condition in the current study were near ceiling on the easy objects, suggesting that providing an explicit verbal response for this task was not too difficult for children in this age range.

We hypothesized that IC would be related to both production and comprehension of substitute pretense, but ceiling effects in the production condition did not allow us to test the role of IC. Effects of IC could potentially be observed in a sample of younger children who had not yet mastered the production task. The effect of IC on comprehension is unclear. In the comprehension condition, there was a statistically significant interaction between age and IC: For children with low IC scores, there was a positive effect of age on the pretend task, but age made little difference for the performance of children with higher IC scores. Among older children, those with lower IC did better on the pretend task than those with higher IC, which was counter to expectations. Because these interactions are difficult to interpret, a more comprehensive battery of executive function tasks was used in Study 2.

It was also hypothesized that ToM would predict pretend comprehension because an ability to understand a pretender's intentions would help determine the meaning of their pretend actions. The null findings for ToM may be because a single false-belief task was not sensitive enough to capture individual differences. Thus, a wider range of ToM tests was used in Study 2.

Finally, these results support past findings of a sequence of substitute object difficulty based on the similarity of form and function between substitute and referent. Like past studies (Bigham & Bourchier-Sutton, 2007; Jackowitz & Watson, 1980), children performed best when the substitute was similar in form and function to its referent and worst when both dimensions were dissimilar; objects similar in form but dissimilar in function were of intermediate difficulty.

This supports Fein's (1975) theory that some similarity is necessary for the mapping of developing mental representations of objects onto physical substitutes; although similarity facilitates this mapping, dissimilarity interferes, and the interaction of the two determines the difficulty of the process (Jackowitz & Watson, 1980).

Dependence on similarity decreases with age, as shown by the Age x Difficulty interaction in the comprehension condition. Comprehension of pretense with highly similar substitutes seems to be mastered prior to age 3, whereas comprehension of pretense with highly dissimilar substitutes is still challenging even for 5-year-olds. The ability to comprehend pretense with intermediate difficulty objects is developing during this time window. However, the precise contributions of form and function are not yet clear, since the objects used in this study did not fully distinguish between the two. This issue was addressed in Study 2.

Study 2

The first goal of Study 2 was to investigate the relative importance of the form and function of substitute objects to children's comprehension. Some researchers have argued that both dimensions are equally influential (Bigham & Bourchier-Sutton, 2007; Jackowitz & Watson, 1980). However, others have suggested that function may play a larger role than form in determining children's ease at using substitute objects (Elder & Pederson, 1978). Consistent with this latter view, children in Study 1 made functional errors more than half of the time, suggesting that they were in fact distracted by the true functions of the substitute objects.

Jackowitz and Watson (1980) predicted a developmental sequence of substitute objects based on their hypothesis that similarity in either dimension facilitates pretense, whereas dissimilarity in either dimension interferes with it. They predicted that similar form/dissimilar function and dissimilar form/similar function objects would be equally difficult for children

because both provide one dimension that facilitates and one that interferes. Dissimilar

form/unknown function objects would be harder because there is interference from form and no

facilitation from function. However, examining the performance of their 23-month-olds shows

that an equal proportion of children succeeded at similar form/dissimilar function and dissimilar

form/unknown function objects, despite the fact that the former was predicted to be easier.

Younger children in Bigham and Bourchier-Sutton (2007) also performed similarly on these two

substitute object types, averaging 1.32 out of 3 correct for similar form/dissimilar function

objects and 1.42 out of 3 correct for dissimilar form/unknown function objects.

These two object types thus provide a useful test case for distinguishing the two

hypotheses regarding the relative influence of form and function. If both dimensions are equally

influential, then similar form/dissimilar function objects, where the positive effect of form and

the negative effect of function balance each other out, should be easier for children than

dissimilar form/unknown function objects, where form has a negative effect and function is

neutral. However, these two types of substitute object should be of similar difficulty if function

carries more weight: If the negative effect of dissimilar function outweighs the positive effect of

similar form, then the net effect for similar form/dissimilar function objects will be one of

interference, as with dissimilar form/unknown function objects. The data from previous studies

(Bigham & Bourchier-Sutton, 2007; Jackowitz & Watson, 1980) is more consistent with this

latter view that function carries more weight than form. To confirm this hypothesis and more

fully test the respective roles of form and function in Study 2, we used substitute objects from all

cells in a 2 (Form: similar, dissimilar) x 3 (Function: similar, unknown, dissimilar) design.

The second goal of Study 2 was to further examine potential individual difference

contributions to pretense comprehension using more sensitive measures, including a 5-point

ToM scale and a set of EF tasks that tapped working memory, IC, and shifting. We focused on 4-year-olds and used only the comprehension condition, because the results of Study 1 indicated that, for this age group, the comprehension task may represent a transitional point where individual difference effects would be most apparent.

Method

      Participants. The sample consisted of 36 children (17 boys and 19 girls) between 48 and 60 months of age ($M = 54.01$ months, $SD = 3.81$ months). Seven additional children were tested but not included in the final sample: three because of experimental error and four for being unable to complete the study. Participants were recruited from the same community as in Study 1 and, reflecting local demographics, were primarily white and from middle-class backgrounds.

      Materials and procedure. Eighteen different objects were used: There were six types of substitutes for each of three different actions (sawing, coloring, or wiping). Objects were either similar or dissimilar in form to their referents, and either had either similar, dissimilar, or unknown functions (see supplemental materials). Unknown-function objects were generic wooden or styrofoam shapes.

      To begin the task, the experimenter explained that they were going to "play a pretend game" where the child would have to guess what the experimenter was doing. On each trial, the experimenter showed the child an object and then pantomimed either sawing, coloring, or wiping the table and asked, "What am I pretending to do?" The first three trials always used the three target objects: saw, marker, and sponge. After that, objects at the same substitute level were blocked together and the order of the blocks was varied in three predetermined orders (see supplemental materials). The same action was never repeated on adjacent trials.

Coding. Coding was done from video by trained research assistants. Each trial was coded as correct if the child provided the correct action ("sawing", "coloring", or "cleaning") or an appropriate synonym (e.g., "cutting", "drawing", "wiping"). A second coder who was blind to the study hypotheses recoded 20% of participants for reliability (Cohen's κ = .96). As in Study 1, coders noted whether incorrect answers were functional, action-based, or irrelevant.

Individual difference (ID) tasks. As in Study 1, half of participants completed the pretend task before the ID tasks and half afterwards. The ID measures were always administered in the same order: ToM, digit span (forwards and backwards), head-toes-knees-shoulders (HTKS), and day/night (see supplemental materials for more details).[2] Theory of mind was measured using a five-item scale adapted from previous research (Wellman, Fang, Liu, Zhu, & Liu, 2006; Wellman & Liu, 2004); ToM score was the number of tasks passed, with a possible range of 0 to 5 (inter-rater agreement was 100%).

Forwards and backwards digit span assessed working memory. Children were asked to repeat back lists of numbers of increasing lengths; scores were the sum of the length of the longest list recalled in the forwards direction and the length of the longest list recalled in the backwards direction (Cohen's κ = .97).

In the head-toes-knees-shoulders task (HTKS; Cameron Ponitz et al., 2008; Cameron Ponitz, McClelland, Matthews, & Morrison, 2009), children are told to touch their toes when the experimenter says, "Touch your head," and vice versa. There were three phases of increasing difficulty where rules were added or changed. Scores for the HTKS task equaled the total points accumulated across all phases, with a possible range from 0 to 60 (Cohen's κ = .84). This task

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[2] As in Study 1, the Moe task (Lillard, 1993) was also administered, but because only 14% of children passed, this task was not used in any analyses.

taps all three EF components: working memory (holding the rules in mind), shifting (when the

rules change between phases), and IC (following the opposite of the spoken commands).

Finally, children completed the day/night task (Gerstadt et al., 1994), which follows

similar logic as the grass/snow task used in Study 1: Children have to say "day" when they see a

picture of the moon and "night" when they see a picture of the sun. Possible scores ranged from

0 to 16 (Cohen's κ = .97). Day/night primarily assesses IC, but there is an element of working

memory, as the child must hold the rule in mind throughout all 16 trials.

Results

As in Study 1, data were analyzed using mixed-effects logistic regression, including

random intercepts for participants and objects. Similar function objects were left out of all

analyses because: (1) for those with similar form, children were near ceiling (97.2% accurate);

and (2) for those with dissimilar form, the responses were difficult to interpret. For example,

when the experimenter pretended to clean the table with a towel, children did not need to

understand that the experimenter was pretending that the towel was a sponge in order to correctly

answer that she was pretending to clean; they could simply think she was pretending to clean

with the towel. These objects were employed for consistency with past research, but because of

this ambiguity were excluded from our analyses.

Scores on HTKS (M = 27.86, SD = 18.65), digit span (M = 5.98, SD = 1.45), and

day/night (M = 11.72, SD = 4.96) were significantly correlated with each other after partialling

out age (rs =.44 - .48, p < .01), Cronbach's α = .73. The three measures were converted to z-

scores and summed to create a composite EF variable. The ToM scale (M = 3.61, SD = 0.86) was

centered on the sample mean prior to analyses. The best fitting model can be seen in Table 2. It

included age, task order, form, function, ToM, and EF as well as Form x Function, Function x

ToM, Task Order x EF, Age x EF, and Age x Task Order interactions.

Table 2

Study 2: Final Results of Mixed Effects Logistic Regression Model

Predictor	β	SE	z	p
Intercept	-1.61	0.35	-4.59	< .001
Age (centered)	-0.11	0.07	-1.44	.15
Task Order (pretense second)	1.07	0.39	2.72	< .01
Form	3.32	0.39	8.42	< .001
Function	-1.44	0.43	-3.33	< .001
EF	0.06	0.12	0.49	.62
ToM	-0.28	0.27	-1.01	.31
Form x Function	-1.82	0.58	-3.17	< .01
Function x ToM	0.73	0.32	2.28	< .05
Task Order x EF	-0.37	0.17	-2.14	< .05
Task Order x Age	0.28	0.12	2.38	< .05
Age x EF	-0.05	0.03	-1.90	.06

Note. Final beta coefficients are reported. The intercept represents participants at the mean age of the sample who completed the pretend task first, on trials using dissimilar form/unknown function objects, who were at the mean of the sample for the ToM scale and the EF composite variable. All VIF values were less than 4.

Form and function. There were significant main effects of both form and function, as

well as a significant interaction between them (Figure 2). As predicted, performance was better

for objects that were more similar to their referent. Overall, children were more likely to be

accurate for similar form ($M = 3.39$ out of 6, $SD = 1.23$) than dissimilar form objects ($M = 1.11$,

SD = 1.33; odds ratio = 27.66). They were also more likely to be accurate for unknown function

(*M* = 3.36, *SD* = 1.16) than dissimilar function objects (*M* = 1.14, *SD* = 1.21; odds ratio = 4.22).
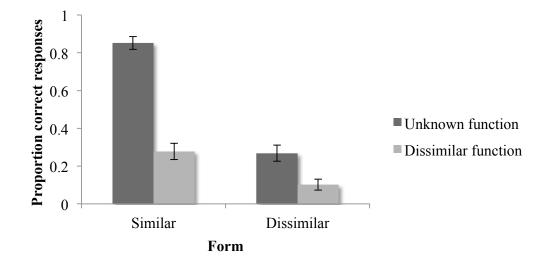

Figure 2. Form x Function interaction in Study 2. Error bars represent ±1 standard error.

There was a significant interaction between form and function. When function was

unknown (and thus provided neither facilitation nor interference), there was a large positive

effect for similar form vs. dissimilar form objects (odds ratio = 27.66). However, when function

was known and dissimilar, the effect of form was much smaller (odds ratio = 4.48). This is

consistent with the prediction that function is more influential than form: The interference from

dissimilar function seems to outweigh the positive influence of similar form when they are pitted

against each other. Also consistent with this prediction, a paired *t*-test showed no significant

difference in the number of correct trials for similar form/dissimilar function (*M* = 0.83 out of 3,

SD = 0.88) and dissimilar form/unknown function objects (*M* = 0.81, *SD* = 0.92), *t*(35) = 0.18, *p*

= .86, and the effect size of this difference was small (*d* = 0.06). The former object type would be

easier than the latter if form and function were equally important; the fact that no difference was

observed here supports the theory that function is more influential.

As in Study 1, the majority of children's errors about what the experimenter was pretending were categorized as functional (56.7%). This further supports the argument that function is highly influential by suggesting that the substitutes' functions were salient and difficult for children to ignore.

Function x ToM. Theory of mind predicted better comprehension of pretense for dissimilar function substitute objects. The effect of ToM was greater for dissimilar function objects (odds ratio for a 1 point increase in ToM = 1.56) than for unknown function objects (odds ratio = 0.76). For dissimilar function objects, children who scored at or above the mean on ToM were correct 24.2% of the time compared to 10.7% for children who scored below the mean on ToM. For unknown function objects, accuracy was 54.5% and 58.3% for children above and below the mean on ToM, respectively.

Task order, age, and EF. The final model also included the following interactions: Age x EF, Task Order x EF, and Task Order x Age. The Age x EF interaction replicated the findings of Study 1: Even within the smaller age range used in Study 2, there was a positive effect of age for children with lower EF scores, but not for children with higher EF scores. To further understand the task order interactions, separate regressions were conducted for children who completed the pretense task first or second. When the pretense task was completed second, the same Age x EF interaction seen in the whole sample was significant: $\beta = -0.16$, $SE = 0.05$, $p < .01$. However, when the pretense task was completed first, there was no significant Age x EF interaction: $\beta = -0.03$, $SE = 0.03$, $p = .22$. This indicates that the Age x EF interaction seen in the overall sample was driven primarily by children who completed the pretense task second.

Discussion

Our Study 2 results replicated and extended the findings of Study 1. Consistent with previous research, children's ability to comprehend pretend actions with substitute objects was dependent on the similarity of the object to its referent. There are clear effects of both form and function, but three pieces of evidence suggest that function is more influential than form. First, children were equally able to identify the pretender's actions (e.g., sawing) with objects that were similar in form and dissimilar in function (a comb) as with objects that were dissimilar in form but had an unknown function (a circular object), even though an equal weighting of form and function would predict that the latter would be more difficult. This finding is consistent with results of previous studies on both children's production (Jackowitz & Watson, 1980) and comprehension (Bigham & Bourchier-Sutton, 2007) of substitute object pretense.

Second, the significant Form x Function interaction meant that the effect of form was stronger for unknown function objects than for dissimilar function objects. With unknown function objects providing neither facilitation nor interference from function, similarity of form had a large positive effect. However, the effect of form was significantly smaller when function was dissimilar, suggesting that interference from the dissimilar function was stronger than facilitation from the similar form. Finally, the majority of children's errors involved saying the function of the substitute object, suggesting that function was highly influential.

In real-world pretense scenarios, the relative influence of form and function is dependent upon the magnitude of the dissimilarity in either dimension for a particular object. For example, if a substitute object was very different in form and only somewhat similar in function compared to its referent, then the influence of form might predominate. However, the same basic result has now been observed across three different studies (including this one) using a total of 11 different

sets of objects (Bigham & Bourchier-Sutton, 2007; Jackowitz & Watson, 1980). Thus, although

the magnitude of influence may vary somewhat from object to object, the general finding that

function carries more weight than form holds across a variety of different objects and actions.

The difference in influence may be because form and function play different roles in

children's interpretation of substitute pretense. As Fein (1975) proposed, similarity of form may

be important in helping children to map their mental representation of the pretend identity onto

the substitute object. Therefore, form has a positive effect where similar form facilitates

comprehension and dissimilar form does not. In contrast, the effect of function may be primarily

one of interference. When a substitute object has a dissimilar function from its pretend identity,

the object's function provides an alternative explanation for the pretender's actions in a way that

dissimilar form does not. This would mean that function has a primarily negative effect where

dissimilar function interferes with comprehension and unknown or similar functions do not.

Research on categorization and social learning shows that children are highly attentive to

the functions of artifacts. Infants and toddlers use function as a basis for categorizing artifacts

(Kemler Nelson, Frankenfield, Morris, & Blair, 2000; Träuble & Pauen, 2007), and preschoolers

are more likely to ask questions about the functions of artifacts than of animals (Greif, Kemler

Nelson, Keil, & Gutierrez, 2006). Two-year-olds rapidly map functions to artifacts after

observing a single instance of the artifact in use, later resisting using the object for anything

other than the demonstrated function (Casler & Kelemen, 2005). Thus, function is salient to

children from an early age and is a key component of their understanding of the identity and use

of artifacts. It follows that children may have particular difficulty ignoring an object's true

function when it is used to represent something else during pretense.

Unlike Study 1, there was a statistically significant contribution from ToM, likely because we used a more sensitive measure. Children with higher ToM scores were more likely to identify pretense with dissimilar function substitutes than children with lower scores, perhaps because they were more likely to consider the pretender's intentions. The need to consider the pretender's intentions may be particularly important with dissimilar function objects because the function of the substitute is available as a possible interpretation of the pretender's actions. Children with more advanced ToM may be more likely to look past the literal properties of the action and recognize that the pretender intended to represent the object as something else.

Study 2 also partially replicated the Age x IC interaction found in the open-ended comprehension condition of Study 1 using a broader composite of EF tasks. In both studies, the effect of age was strongest for children with lower scores on the IC (Study 1) and EF (Study 2) measures. In Study 2, this interaction was driven primarily by the children who completed the pretense task after the individual difference tasks. The fact that we replicated the age by IC interaction found in Study 1 strengthens the possibility that EF is related to substitute pretense comprehension. However, as in Study 1, the interaction is difficult to interpret: Older children with lower EF scores outperformed children with higher EF scores on the pretense task.

Study 3

The first aim of Study 3 was to investigate whether the results of Study 2 would replicate in a sample of children drawn from a different community. A second aim was to assess whether language might account for the relation between pretense and EF observed in Studies 1 and 2. Language has been shown to be related to both pretense (e.g., Elias & Berk, 2002; McCune, 1995; Orr & Geva, 2015; Taylor & Carlson, 1997) and EF (Albertson & Shore, 2008; Carlson et al., 2014), and therefore could at least partially account for the observed relation between them.

Method

Participants. The sample consisted of 36 children (17 boys and 19 girls) between 47 and 61 months of age (M = 53.90 months, SD = 3.84 months). Three additional children were tested but not included in the final sample because they were unwilling to complete the study. Participants were recruited from schools in an urban area. The racial composition of the sample was 61% Caucasian, 36% African-American, and 3% Asian.

Procedure. All participants were tested in a quiet area of their school or daycare. The procedure for the pretense task and individual difference battery was identical to that of Study 2. The 4th edition of the Peabody Picture Vocabulary Test (PPVT4; Dunn & Dunn, 2007) was administered at the end of the session.

Coding. Participants were video or audio recorded whenever parents consented. The individual difference tasks were coded live by the experimenter and a second observer. Cohen's kappa was .99 for the ToM scale, 1 for digit span, .91 for HTKS, and .99 for day/night. A second person coded the pretense task for 20% of participants, and Cohen's kappa was .95.

Results

After partialling out age, scores on HTKS were significantly correlated with both digit span (r = .52, p < .001) and day/night (r = .39, p < .05), but digit span and day/night were not significantly correlated with each other (r = .25, p = .14). Because alpha for the three measures was still high (.68), they were converted to z-scores and summed to create an EF composite as in Study 2. The ToM scale (M = 3.14, SD = 0.98) was centered on the mean prior to analyses. PPVT scores (M = 113.42, SD = 17.34) were converted to age-normed scores according to the published manual and centered on the sample mean. Consistent with previous research, PPVT scores were significantly correlated with EF after partialling out age (r = .56, p < .001).

As in Study 2, similar function objects were left out of the analyses due to a ceiling effect

for those with similar form (97.2% correct) and the ambiguity of those with dissimilar form.

Data were analyzed using mixed effects logistic regression including random intercepts for

participants.[3] The regression predicted a binary variable representing whether the response on a

given trial of the pretense task was correct. The best fitting model can be seen in Table 3.

Table 3

Study 3: Final Results of Mixed Effects Logistic Regression Model

Predictor	β	SE	z	p
Intercept	-2.09	0.47	-4.42	< .001
Age (centered)	-0.27	0.28	-0.97	.33
Gender	1.21	0.56	2.15	< .05
Form	3.67	0.47	7.87	< .001
Function	-1.66	0.48	-3.48	< .001
ToM	0.02	0.30	0.06	.95
Form x Function	-1.98	0.63	-3.14	< .01
Function x ToM	0.52	0.32	1.65	.09

Note. Final beta coefficients are reported. The intercept represents male participants at the mean
age of the sample on trials using dissimilar form/unknown function objects, who were at the
mean of the sample for the ToM scale. All VIF values were less than 4.

Form and function. Replicating the effects of Study 2, there were significant main

effects of form and function as well as a significant interaction between them (Figure 3). Overall,

children were more likely to be accurate for similar form ($M = 3.22$ out of 6, $SD = 1.55$) than

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[3] We initially included random intercepts for objects as in Studies 1 and 2. However, the variance attributable to this
random effect was near zero, so it was removed from the model. Its removal did not have any effect on the rest of
the model.

dissimilar form objects (*M* = 1.03 out of 6, *SD* = 1.34; odds ratio = 39.42), and they were more

likely to be accurate for unknown (*M* = 3.19 out of 6, *SD* = 1.47) than dissimilar function objects

(*M* = 1.06 out of 6, *SD* = 1.45; odds ratio = 5.25).
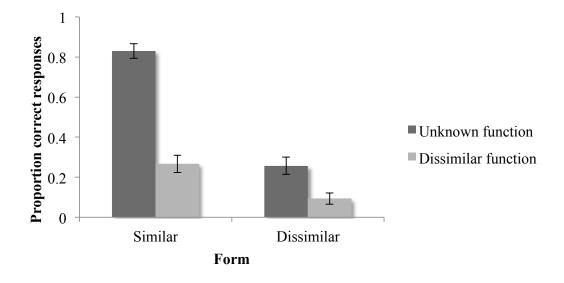

Figure 3. Form x Function interaction in Study 3. Error bars represent ±1 standard error.

The interaction between form and function was also replicated. When function was

unknown, there was a large positive effect for similar form vs. dissimilar form objects (odds ratio

= 39.42). However, when function was dissimilar, the effect of form was smaller (odds ratio =

5.42). As in Study 2, a paired *t*-test showed no significant difference in the number of correct

trials for similar form/dissimilar function (*M* = 0.78 out of 3, *SD* = 1.02) and dissimilar

form/unknown function objects (*M* = 0.75, *SD* = 0.94), *t*(35) = 0.15, *p* = .88, *d* = 0.05. The

majority of children's errors (55.8%) were categorized as functional.

Function x ToM. The Function x ToM interaction found in Study 2 was marginally

significant here. The effect of ToM was greater for dissimilar function objects (odds ratio for a 1

point increase in ToM = 1.72) than for unknown function objects (odds ratio = 1.02). For

dissimilar function objects, children who scored at or above the mean on ToM were correct

21.7% of the time compared to 15.5% for children below the mean. For unknown function

objects, accuracy was 54.8% and 54.3% for children above and below the mean, respectively.

Other variables of interest. The interactions involving EF, age, and task order found in

Study 2 were not replicated; there were no significant effects involving any of these variables.

There was also no significant effect of language. There was a significant main effect of gender,

with girls outperforming boys (odds ratio = 3.34). There no interactions involving gender.

Combined Analyses

The failure to replicate the findings regarding EF could be due to differences in the

samples between Studies 2 and 3. Children in Study 3 scored significantly lower than children in

Study 2 on digit span, $t(70) = 2.38$, $p < .05$, and HTSK, $t(70) = 2.66$, $p < .01$. Because the

interactions observed in Studies 1 and 2 revealed different effects for children at the lower and

upper end of the EF distribution, the interaction may not be observable within a sample that

scored lower overall. To test this, the data from Studies 2 and 3 were combined ($N = 72$). In the

full sample, all three EF measures were significantly correlated with each other; alpha for the

three measures was .72. To put all participants on the same scale, new z-scores were computed

for digit span, HTSK, and day/night using the means and standard deviations of the full sample,

and the three were summed to create an EF composite.

The model that best fit the data for this combined sample mirrored the individual findings

of Studies 2 and 3. There were significant main effects of form ($\beta = 3.49$, $p < .001$), function ($\beta =$

-1.55, $p < .001$), and a significant interaction between them ($\beta = -1.91$, $p < .001$). As in the

individual studies, a paired t-test showed no significant difference in the number of correct trials

for similar form/dissimilar function ($M = 0.81$ out of 3, $SD = 0.94$) and dissimilar form/unknown

function objects ($M = 0.78$, $SD = 0.92$), $t(71) = 0.24$, $p = .81$, $d = 0.06$. The interaction between

function and ToM that was significant in Study 2 and marginally significant in Study 3 was

significant with the combined sample ($\beta = 0.59$, $p < .01$). None of the EF results found in Study 2

reached significance in the combined sample.

Discussion

Study 3 sought to replicate the results of Study 2 and to investigate the contribution of

language to pretense comprehension. The effects of form and function as well as the interaction

between function and theory of mind were replicated in this new sample. Language was

significantly related to EF as predicted, but there was no relation between language ability and

pretense comprehension. However, the EF results found in Studies 1 and 2 did not replicate here.

Overall, the studies presented here give an inconsistent picture of the role of EF in the

comprehension of substitute object pretense. Previous research has shown a relation between EF

and pretense (Albertson & Shore, 2008; Carlson et al., 2014; Kelly, Dissanayake, Ihsen, &

Hammond, 2011), but these studies did not involve substitute pretense comprehension. Kelly et

al. (2011) only assessed production of pretense. Albertson and Shore (2008) and Carlson et al.

(2014) both showed children actions with a substitute object, but unlike in the current study,

children were explicitly told both the real and pretend identity. EF was related to recall of the

two identities. In that case, EF may be required to keep both identities in mind and to respond

with the correct one based on the question asked.

Past studies may have found an effect of EF on the production of substitute object

pretense because production requires inhibiting the impulse to act on the substitute object's true

function (Carlson et al., 2014; Kelly et al., 2011); as discussed above, the lack of a relation

between IC and pretense production in Study 1 here was likely due to ceiling effects. However,

the weak and inconsistent findings here suggest that EF may play less of a role when it comes to

identifying a pretender's actions. It is possible that the impulse to respond based on the true function of a substitute object is stronger when acting directly on an object than when observing someone else; previous work has found that objects that are strongly associated with particular manual actions are more difficult for children to use in pretense (Pederson et al., 1981). However the relative importance of EF to production vs. comprehension remains an open question, and thus the differing roles of EF in various types of pretense deserve future study.

General Discussion

The work presented here had three primary aims. First, these studies show the importance of similarity between a substitute object and its pretend referent, particularly with regards to function. Actions with substitutes that are dissimilar in form or function are more difficult to comprehend because there is a greater difference between the substitute and the object it is meant to represent, but function is a more important feature. When function is dissimilar, the substitute's true function provides an easily available interpretation of the pretender's actions, making pretense comprehension more difficult.

Second, we demonstrated within a single study with a closely matched procedure that the production of substitute object pretense develops prior to the ability to comprehend the same actions. This may be because the two require different sets of cognitive skills. Thus, the final aim of this work was to explore reasons for this developmental difference by investigating the contribution of theory of mind and executive function to pretense comprehension. Although the findings for EF were inconclusive, the results suggest that theory of mind facilitates comprehension, particularly when dissimilar substitutes are used.

These studies, coupled with past research, permit us to propose a precise developmental timeline for the production and comprehension of substitute object pretense. During the second

year of life, children learn to imitate adults' substitute pretense. They gradually lose their dependence on similarity between substitute and referent; by the age of 2, children can imitate actions with objects that are dissimilar in either form or function (Jackowitz & Watson, 1980). Between 2 and 3, children begin to produce these actions on their own without modeling; again, they gradually move from similar to dissimilar substitutes, mastering the most dissimilar objects by 3½ (Elder & Pederson, 1978). They also begin to comprehend these actions in others, at first only with similar substitutes (Harris & Kavanaugh, 1993; Tomasello et al., 1999).

As shown in the current studies, 4- and 5-year-olds show improved understanding of pretense with substitutes that are not similar to their referents. Yet even 5-year-olds still have difficulty with comprehending pretense with objects that are dissimilar in both form and function. The findings of Bigham and Bourchier-Sutton (2007) suggest that it may take some time for children to become fully competent with these most difficult objects: Their 5- to 8-year-old group was only correct on these objects about 66% of the time.

Comprehension of substitute pretense may develop later than production because of greater reliance on developing ToM and other abilities. Correctly interpreting another's substitute pretense requires integrating action properties with knowledge of the pretender's mental state. The observer must understand that the actor has an intention to behave in a non-literal way; a pretender banging a shoe on a table intends for that action to be interpreted as something other than banging a shoe on a table. Even for adults, the interpretation of pretend actions involves consideration of the pretender's mental state; studies using fMRI have shown that areas of the brain thought to be involved in theory of mind are activated when observing pretend actions with substitute objects (German, Niehaus, Roarty, Giesbrecht, & Miller, 2004; Smith, Englander, Lillard, & Morris, 2013; Whitehead, Marchant, Craik, & Frith, 2009).

If children do not recognize that an actor is intending to pretend and therefore is projecting a mental representation of another object onto the substitute, then they would interpret the action literally. If, however, they do recognize that the actor intends the object to represent something else, then they can use the properties of the action to guess what that something else might be. Children with better ToM may be better at considering a pretender's mental states, or simply more likely to do so spontaneously, leading to better pretense comprehension.

Several decades of research have attempted to show that engaging in pretend play helps children to develop better social and cognitive skills, including ToM and EF (see Lillard et al., 2013 for a review). However, the research presented here suggests a reverse relationship: ToM might be a prerequisite for children to engage in some types of object-based pretend play with others. Rather than a unidirectional causal link, there may be a mutual feedback loop between pretend play and other cognitive abilities. For example, early substitute object play may help strengthen ToM, allowing for more complex play, which, in turn, could continue to improve ToM and other abilities. If pretend play and cognitive abilities influence each other in this way, then it is important to understand the typical time course of the development of substitute object pretense so as to identify key transitional points. Providing children with substitute objects that fall within their zone of proximal development would elicit the most benefit.

Future research should investigate substitute object use in more naturalistic situations. Considering that many commercially available children's toys are replica objects, it remains an open question how often children use dissimilar substitutes themselves or observe dissimilar substitutes used in their everyday play. The studies reviewed here have shown that children as young as 3½ can use dissimilar substitutes when asked, but we still do not know whether they are apt to use them in real-life situations. If given the choice, would children *always* prefer a

more similar substitute? Do they assume the same is true of others? Providing children with

opportunities to use more dissimilar substitutes when scaffolded by more experienced play

partners might help them develop the ability to use them on their own earlier, which could

trigger subsequent improvements in other domains.

Furthermore, the pretend actions used in the current studies were very sparse; natural

pretense includes other cues that could help children interpret pretend actions, such as speech,

sound effects, and the context of the action within the pretend scenario. Lillard and Witherington

(2004) found that explicit, verbal references to pretend actions or imagined substances were

infrequent when mothers pretended in front of their toddlers, but other behaviors that signal

pretending could help cue children to consider the pretender's intentions. The richer context

provided by more complex pretend play may help children comprehend actions with dissimilar

objects; because the complexity of pretense tends to increase with age, more experience with

such supportive contexts could at least partly explain children's decreasing reliance on similarity

as they get older. The role that verbalization and other cues play in the comprehension of

substitute pretense by older children is worth investigating.

In sum, the ability to understand the use of substitute objects by others during pretend

play shows considerable development throughout the preschool and early school years.

Children's reliance on similarity between the substitute and its pretend identity gradually

decreases. The same general pattern is seen in the production of substitute object pretense, but

production develops slightly earlier than comprehension. For pretense comprehension, similarity

of function is more influential than similarity of form. ToM is one ability that appears to

contribute to this development. These findings suggest a possible reciprocal relationship between

pretend play and other skills, and thus have implications for attempts to improve the latter

through pretend play interventions.

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