Short report

The role of representational status and item complexity in parent–child conversations about pictures and objects

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Abstract

Mother–child conversations about pictures systematically differ from mother–child conversations about objects: Pictures are more likely than objects to elicit talk about kinds, whereas objects are more likely than pictures to elicit talk about individuals. The purpose of the current study is to examine whether this difference between pictures and objects is explained by differences in item complexity. Mothers and their 4-year-old children were randomly assigned to one of two conditions: simple or complex. In each condition, participants viewed 12 toy objects and 12 pictures, matched for content. The items were either highly detailed (complex condition) or very plain (simple condition). Replicating previous research, mothers and children provided relatively more focus on kinds when talking about pictures, and relatively more focus on individuals when talking about objects. The current results go further, however, to demonstrate that this effect is independent of the items' complexity. We therefore propose that the picture–object difference is not due to low-level differences in amount of perceptual detail provided, but rather is due to the greater ease with which pictures serve as representations [DeLoache, J. S. (1991). Symbolic functioning in very young children: Understanding of pictures and models. *Child Development*, *62*, 736–752]. These data indicate the ways in which a fundamental conceptual distinction between kinds and individuals arises in different linguistic expressions and in different contexts.
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1. The role of item complexity in parent–child conversations about pictures and objects

One of the major conceptual distinctions children must learn is that between individuals (e.g., Felix) and kinds (e.g., cats in general). Although the world presents itself as a series of individuals, we also have the capacity to consider abstract concepts that take individuals as members. Furthermore, language is an important indication of whether a speaker has in mind either an individual or a larger category. For example, proper nouns (e.g., "Felix") and direct address (e.g., "Hi, cat") indicate that construal is of an individual, whereas ostensive labeling (e.g., "This is a cat") and generic noun phrases (e.g., "Cats have four legs") indicate that construal is of a kind.

Past research has found that parents and children focus relatively more on kinds when talking about pictures than objects, and focus relatively more on individuals when talking about objects than pictures (Gelman, Chesnick, & Waxman, 2005). This result was interpreted as showing that with a picture, the child (or adult) is relatively more disposed to abstract away from the individual item before them, and to think of it as standing in for the larger category of which it is a member. In contrast, with an object, the child (or adult) is relatively more likely to think about the present individual. This greater tendency to take pictures as representing kinds is consistent with evidence that pictures serve more readily as representations than do objects (DeLoache, 1991). For example, children more readily understand *a picture* of a room as a representation of an actual room than they understand *a model object* of the room as a representation of an actual room.

1.1. Representational status or object complexity?

However, it is also possible that the object–picture difference reported in Gelman et al. was due not to representational status per se, but rather to the amount of detail provided by objects vs. pictures. In the original work, Gelman et al. made every effort to equate the complexity of objects and pictures. In fact, the pictures were drawn by an artist, using the actual objects as models. Nonetheless, because objects by their very nature include properties that cannot be fully portrayed in drawings, it is plausible that the objects were more complex than were the pictures.

In other words, the broader issue at hand is that pictures may elicit relatively greater focus on kinds *not* because they are better representations of kinds, but rather because there is less to say about a picture than about the object it depicts. For example, even a toy cat may be more detailed than a line-drawing of a cat, and correspondingly can be described with respect to many more features (size, texture, color, position, behavior, and personality). The simple line-drawing has little detail, so that if one wished to talk about it, one would have relatively little to say in the way of individuation. If this alternative hypothesis is correct, then one should find differential focus on individuals vs. kinds with items that present more vs. less detail.

There is considerable evidence that item complexity affects young children's performance on a range of tasks, including perception, memory, attention, word learning, and spatial processing (e.g., Sandhofer & Smith, 2004; Stiles & Stern, 2001). In addition, work on infant cognition indicates that babies are most drawn to items of moderate complexity (Cohen & Cashon, 2003; Fantz, 1963). It is therefore important to ask whether the difference between objects and pictures reported by Gelman et al. (2005) may in fact be a consequence of item complexity rather than representational status.

Nonetheless, the concept of complexity also raises problematic issues of its own. First, complexity is a relative, rather than absolute, concept. An entity (be it an object, a picture, an event, or an idea) is not, in and of itself, simple or complex. Instead, its complexity derives from its relation to other entities of the same kind. Moreover, in developmental research what *counts* as

"complex" varies with an infant's age and familiarity with the particular stimulus under investigation (Hunter & Ames, 1988). It is therefore unclear how complexity could itself account for qualitative differences in parent–child conversations. Second, complexity is a difficult concept to operationalize. As is the case with similarity, judgments of complexity depend upon theory-based assumptions regarding what counts as a feature, and how features are weighted (Murphy, 2002; Murphy & Medin, 1985). In principle, without such assumptions in place, one entity may be considered as complex as any other. Thus, judgments of item complexity depend upon an interpretive (theory-based) lens.

Although issues of representational status (objects vs. pictures) and complexity (simple vs. complex) are each challenging on their own, our goal in the current experiments was to examine the contribution of each to the difference between objects and pictures in parent–child conversations (Gelman et al., 2005).

1.2. The present study

Therefore, in the present study, we took a different approach: For each kind under investigation (e.g., lion, airplane), we developed two object representations (one simple and one complex) and two picture representations (one simple and one complex). For example, in the simple object condition, the airplane was molded plastic, primarily uni-color, with a basic airplane shape (including wings) but no additional parts; in the complex object condition, the airplane had windows, landing gear, stripes, emblem, and greater color variation. To derive the analogous picture conditions, an artist rendered realistic colored drawings of both the simple and complex objects.

Parent–child dyads were randomly assigned to either the simple or complex condition. In each condition, half the items were pictures and half objects. Thus, the study design entails varying modality (picture vs. object) as a within-subjects factor and varying complexity (simple vs. complex) as a between-subjects factor. Although ideally one would examine both as within-subjects factor, we were concerned that doing so might lead to order effects and less sensitivity, particularly for the children. Given that we were especially interested in complexity effects, we opted to keep this factor constant for each subject, to reduce potential order effects.

If representational status is instrumental to individual vs. kind construals, then pictures should be relatively more likely than objects to focus attention on kinds. Alternatively, if item complexity is instrumental, then simple items should be relatively more likely than complex items to focus attention on kinds. Finally, because we were interested in examining a more robust sampling of children's speech about these entities, we decided to include 4-year olds, rather than 2-year olds (as in the original experiment), as conversational partners with their mothers.

2. Methods

2.1. Participants

Forty-eight mother–child pairs participated, with children (50% female) ranging in age from 3.5 to 5.0 (mean age 4.3). Participants were recruited from a midwestern university town, and were primarily White. Six additional dyads were tested but not included in the final sample: 3 spoke a language other than English for much of the session, 2 did not follow instructions, and 1 child had a speech delay. An additional 15 children (6 girls and 9 boys; mean age 4.4) and 16 undergraduates participated in pretesting of the materials.

Fig. 1. Sample item set: (a) complex piano (object), (b) complex piano (picture), (c) simple piano (object), and (d) simple piano (picture).

2.2. Items

We compiled 24 sets of items: 12 animal sets and 12 artifact sets. All items were selected to be familiar to preschool children. Each set had 4 instantiations: simple object, simple picture, complex object, and complex picture. For example, as depicted in Fig. 1, the piano set had a complex piano (in both picture and object format) and a simple piano (in both picture and object format). Because the pictures were drawn using the objects as models, the pictures and objects in each set (simple and complex) were perfectly matched in parts, color, and detail. However, the simple and complex items varied within a set (e.g., they could differ in color, pattern, posture, and/or parts).

To obtain an independent rating of stimulus complexity, 16 undergraduates were asked to rate each item on a scale from 1 ("very simple") to 7 ("very complex"). All items retained for the experiment revealed a clear differentiation between simple (M score of 2.25; scores ranging from

1.13 to 3.25) and complex (*M* score of 5.92; scores ranging from 4.13 to 6.75). Within each simple–complex pair, the difference between simple and complex was always at least 2 scale points (3.51 for pictures and 3.83 for objects). Importantly, participants rated the pictures as being just as complex as the objects. Overall, the objects received average complexity ratings of 5.81 (complex) and 1.98 (simple), whereas the pictures received average complexity ratings of 6.03 (complex) and 2.52 (simple).

Additionally, 15 preschool children were asked to judge which was the simpler vs. more complex of two items presented in pairs (e.g., a simple and a complex piano). Children in the pretest were first trained to make choices based on the simple/complex distinction. They saw a pair of items differing in complexity (either 2 picture frames (for the block of object trials) or 2 geometric shapes (for the block of picture trials)), and heard, "One of these is plain and simple; the other one has all kinds of extra stuff. Which of these has more stuff?" Then the experimenter presented items in pairs (simple and complex version of each item), blocked by representational status and counterbalanced. Each participant saw each item type as either pictures or objects, but not both. For both pictures and objects, children readily distinguished the simple from the complex, doing so on 84% of trials overall (84% for pictures and 84% for objects). For 47 of the 48 pairs (24 picture pairs and 24 object pairs), children more often selected the complex item as having "more stuff" (ranging from 57% to 100%). On the remaining pair, children selected the complex item 50% of the time as having "more stuff".

2.3. Procedure

Mother–child dyads were tested in our on-campus lab. Mothers were informed ahead of time that they would be videotaped and that we were interested in mother–child interactions; however, they were not specifically told that we were interested in language or differences between objects and pictures. At the beginning of the testing session, mother and child were invited to sit on a couch or at a table (whichever they found more comfortable), and mothers were encouraged to look at and talk about the pictures and objects, as they would normally do at home. Each dyad saw 24 items, 12 presented as objects and 12 as pictures, presented in counterbalanced blocks. The amount of time spent with each item was self-paced. Sessions were videotaped. At the end of the session, the child received a small gift.

Because there was one picture on each page of a book, pictures were seen sequentially. We therefore sought to impose the same sequential attention to the objects. To this end, we stored the objects in a chest of drawers, with each object covered with a cloth that had on it a number (from 1 to 12). Mothers were instructed to take out each object one at a time in numerical order, and to return it before taking out the next. The cloths ensured that children could not see more than one object at a time. Occasionally (on fewer than 4% of all utterances) more than one object was taken out of a drawer at once; such sequences were noted.

2.4. Transcribing and coding

Transcribing and coding followed the procedures described in Gelman et al. (2005), to enable maximal comparison with that earlier work. Each videotaped session was transcribed verbatim by one coder and then checked by two additional coders. Transcriptions were then coded to identify all utterances. Utterances were identified on the basis of intonational contour and timing; any continuous unit of conversation that was free of full stops was identified as an utterance. As such, utterances could consist of sentences, phrases, or even single words if they were pronounced with

final pitch (rising or falling intonation). Once the utterances were identified, a two-phase coding system was implemented.

The first phase of coding involved selecting all utterances that included a noun or pronoun referring to: the item, a part of the item, or other item(s) or parts of the same type. These utterances, hereafter referred to as "on-task" utterances, were further classified into one or more of the following types: generic phrases, ostensive labeling phrases, individuating phrases, or other. *Generic phrases* were utterances in which the noun phrase or pronoun referred to a category rather than an individual or set of individuals (e.g., "Usually boats are gray"). *Ostensive labeling phrases* were those in which a speaker provided or requested a label but offered no further information (e.g., "What is that?"). This coding category was *not* used if the utterance included some other proposition (e.g., "Couch that's yellow" would not be considered ostensive labeling). *Individuating phrases* were those in which a speaker singled out the individual item and did not invoke its membership in a kind. Examples included providing a proper name for the item, asking what proper name to give the item, or pretending that the item was itself a conversational partner (that is, talking directly to the item, or pretending to talk as that item; e.g., "Haaa Frogalina", "Bye, table"). All other utterances were coded as *other* (e.g., "Your favorite animal").

Note that coding of kind-referring (generic and ostensive labeling) phrases and individuating phrases was quite conservative. Thus, in order to qualify as "individuating", an utterance not only had to refer to an individual, but furthermore had to highlight the status of the object as an individual (e.g., with a proper name, or talking to/for the item). Thus, an utterance such as "What color is that birdy?," though referring to an individual bird, was not coded as "individuating." Conversely, in order to qualify as "kind-referring", an utterance not only had to draw on categorical knowledge, but furthermore had to refer explicitly to the category per se, either through ostensive labeling or generic nouns. Thus, an utterance such as "Is that for me to sit on?" said about a couch indicates knowledge of couches as a category, but was not coded as kind-referring.

Cohen's kappas were calculated, yielding .94 for identification of on-task utterances (97% agreement, based on 43 dyads) and .88 for coding as generic, ostensive, individuating, and other (94% agreement, based on 43 dyads).

3. Results

The procedure successfully elicited conversation within the dyads (Ms = 99 on-task utterances per child and 177 on-task utterances per mother). As expected, the number of utterances in these 4-year olds is higher (by approximately 50%) than among 2-year olds in earlier work (Gelman et al., 2005); the relative proportion of speech that was produced by children is also higher (36% in this study vs. 25% in the earlier work). Overall, mothers produced more utterances than did their children ($F(1, 88) = 37.75$, $p < .001$, $\eta^2 = .30$), and objects elicited more utterances than did pictures (Ms = 36.42 and 32.43, respectively, $F(1, 88) = 143.26$, $p < .001$, $\eta^2 = .62$). (All eta-squared (η^2) results that we report use the partial eta-squared formula (SSeffect/(SSeffect + SSerror)). Tabachnick and Fidell (1989) suggest that partial η^2 is an appropriate alternate computation of η^2.) However, there were no differences in the mean number of on-task utterances for simple vs. complex items (Ms = 33.93 and 34.93, n.s.).

Our main questions concerned the influence of representational status (objects vs. pictures) and item complexity in the tendency of dyads to focus on individuals vs. kinds. We tabulated the number of utterances that referred to kinds (i.e., generic and ostensive labeling phrases) and those that singled out individuals (i.e., individuating phrases). We then calculated the proportion of each type of utterance. For example, the proportion of kind-referring phrases was calculated by divid-

ing the total number of kind-referring phrases by the total number of on-task utterances produced (including kind-referring, individuating, and other). As is standard for analyses of mother–child conversations (e.g., Gelman, Coley, Rosengren, Hartman, & Pappas, 1998), we chose to ana-lyze percentages rather than raw numbers, as we were interested in the relative attention paid to different kinds of concepts (individuals vs. kinds). Analyses of raw numbers would have been misleading in this respect, because sheer amount of talk would have overwhelmed any rela-tive differences. This approach also permitted a direct comparison across speakers (mothers vs. children).

The data for each type of phrase were submitted to an analysis of variance, using speaker (child, mother), block order (pictures vs. objects first), and complexity (simple, complex) as between-participants factor and representational status (picture, object) as a within-participants factor.

3.1. Kind-referring phrases

The mean percentage of kind-referring utterances produced (generic plus ostensive labeling) are depicted in Fig. 2. A main effect of representational status, $F(1, 88) = 96.54$, $p < .001$, $\eta^2 = .52$, revealed the predicted effect of relatively more kind-referring phrases for pictures than objects ($Ms = 0.46$ and 0.29). However, modality also interacted with each of the other factors indi-vidually and jointly: modality × condition, $F(1, 88) = 4.91$, $p < .05$, $\eta^2 = .05$, modality × speaker, $F(1, 88) = 6.31$, $p < .02$, $\eta^2 = .07$, and modality × condition × speaker, $F(1, 88) = 6.94$, $p = .01$, $\eta^2 = .07$. An inspection of the three-way interaction revealed that there was one significant effect of complexity: children provided relatively more kind-referring talk for complex than simple pictures, $p < .02$. However, most importantly, although the influence of representational status varies somewhat by speaker and condition, it is significant for both mothers and children, at both levels of complexity, all $ps \leq .001$. Finally, a main effect of speaker, $F(1, 88) = 39.07$, $p < .001$, $\eta^2 = .31$, indicated that children produced relatively more kind-referring expressions than did their mothers.
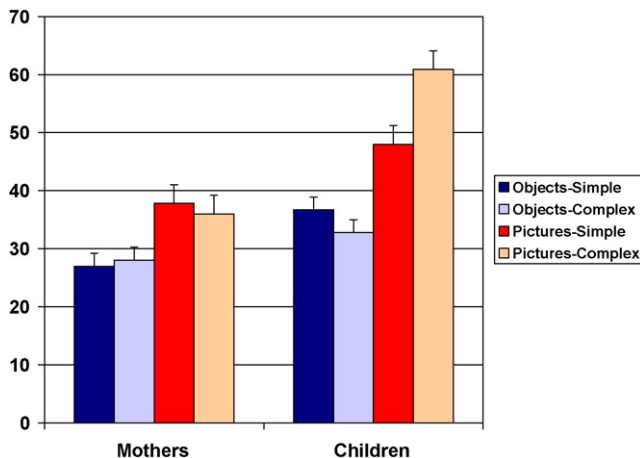

Fig. 2. Mean percentage of kind-referring (ostensive + generic) utterances, as a function of speaker, representational status, complexity, and domain.
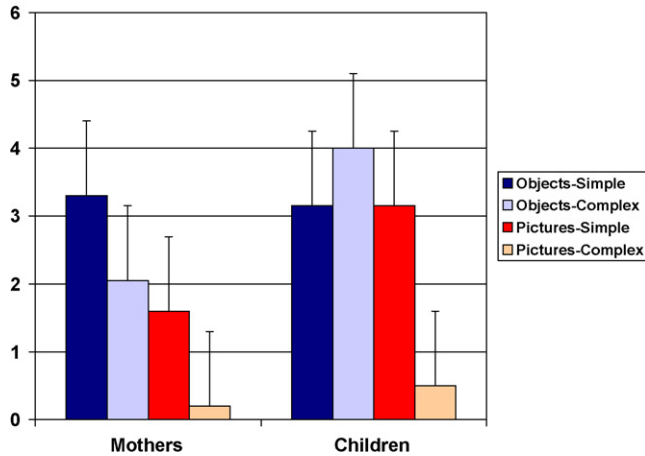
Fig. 3. Mean percentage of individuating phrases, as a function of speaker, representational status, complexity, and domain.

3.2. Individuating phrases

Fig. 3 presents the percentage of individuating phrases produced in each condition (note that the low numbers – under 5% – reflect the relatively low frequency of this type of talk). Perhaps most importantly for the hypotheses at hand, the analysis revealed a main effect for representational status, $F(1, 88) = 7.66$, $p < .01$, $\eta^2 = .08$, but no effects involving item complexity. The representational status effect was consistent with the prediction that individuating responses were relatively more common for talk about objects than talk about pictures ($Ms = 3.1\%$ vs. 1.3%). This was moderated by an interaction with order, $F(1, 88) = 8.33$, $p < .01$, $\eta^2 = .09$, which indicated that interacting with objects in the first block encouraged a higher proportion of individuating talk about pictures than did interacting with pictures first. In other words, the tendency of objects to promote thinking about items as individuals persisted beyond the first block of items, and continued into the second block.

Although there were no significant effects involving speaker, we also analyzed the data for children and mothers separately, to determine if the effect of representational status held up for both speaker tiers. For mothers, once again individuating responses were relatively more frequent for talk about objects than talk about pictures, $F(1, 44) = 6.78$, $p < .02$, $\eta^2 = .13$. For children, there was a significant representational status × order interaction, $F(1, 44) = 5.44$, $p < .05$, $\eta^2 = .11$. This indicated that when pictures were first, there was a clear representational status effect ($Ms = 4.5\%$ and 0.10% for objects and pictures, respectively, $p < .01$), but no significant difference when objects were presented first.

4. Discussion

The results of the present experiment provide support for the view that pictures and objects generate different kinds of talk and, by implication, focus attention on different kinds of concepts. Mother–child dyads produced relatively more kind-referring talk (ostensive labeling and/or generics) when faced with pictures than with objects, and mothers produced relatively more individuating language for objects than for pictures. This finding replicates prior work (Gelman et al., 2005), and is consistent with the hypothesis that representational status is key in the tendency

to construe items as individuals vs. kinds. Objects foster a greater focus on individuals; pictures foster a greater focus on categories.

In contrast, complexity appears to play a minor role in mothers' and children's individual vs. kind construals. In fact, there was only one significant effect of object complexity, and it was the opposite of what one would predict if complexity were responsible for the object/picture differences (i.e., for children, relatively more kind-referring utterances for complex than simple pictures). The present findings thus provide important new evidence on why parent–child conversations differ in the context of pictures vs. objects. Although representational status (picture vs. object) was fully crossed with item complexity (simple vs. complex), and although 4-year-old children were sensitive to the simple/complex distinction in the items we presented (note their excellent performance in the pretesting task, as well as the interaction involving complexity mentioned above), representational status was much more powerful than item complexity, in influencing the nature of parent–child talk. Thus, although distinctions in item complexity were apparent to both mothers and their children, this dimension was largely irrelevant to the degree of kind- vs. individuating talk.

It is nonetheless possible that the picture/object contrast may be confounded with complexity in ways that were not captured in the child ratings. Specifically, objects may have been viewed as more complex than pictures overall, a difference that would not have shown up in the child ratings, which only examined complexity *within* objects and *within* pictures. If this were the case, and if picture–object differences in complexity were substantially greater than within-picture and within-object differences in complexity, then complexity could be driving the results. However, we feel that this interpretation is unlikely to be the case, given the adult complexity ratings. Recall that adults rated complexity for each item (picture or object) considered individually. They were not limited to within-picture pairs and within-object pairs. If there were object/picture differences, they would presumably have emerged in the adult ratings. Instead, the objects and pictures overall received identical complexity ratings.

Overall, the present results diminish considerably the possibility that differences in representational status can be attributed to differences in item complexity. Instead, they provide additional support for the view that pictures of objects and toy replicas of objects differ in their representational status. As argued by DeLoache's dual-representation theory (2004), children's tendency to think about representations as objects in their own right derives from their dual status as both objects and representations:

> "A unique aspect of symbolic objects is their inherently dual nature. A symbolic artifact such as a picture or a model is both a concrete object and a representation of something other than itself. To use such objects effectively, one must achieve dual representation, that is, one must mentally represent the concrete object itself and its abstract relation to what it stands for. One has to perceive the symbol and interpret its relation to its referent. The need for dual representation constitutes a challenge for young children, who have difficulty considering both the symbolic object itself and its referent." (DeLoache, 2004, p. 69)

Although DeLoache's theory was proposed to account for objects that are specifically designed to call to mind another specific object (e.g., a toy room that represents an actual room), the same logic can be extended to objects that call to mind generic kinds of things (e.g., a toy hippo can represent hippos more generally; Gelman et al., 2005). Objects are viewed as individual entities unto themselves and therefore engender a relatively higher tendency to produce individuating phrases. In contrast, except within the realm of art, pictures of objects are not typically construed as objects in their own right (DeLoache, 1991), and instead are closer to "pure" representations.

Once again extending from concrete representation to generic representation, we suggest that pictures more readily than objects call up representations of the kinds to which they belong (Gelman et al., 2005). (Note, however, that the present study does not concern speakers' *ability* to conceptualize objects as representative of a category, as presumably all participants have the capacity to construe objects in this way. Instead, we have studied speakers' *disposition* to conceptualize objects as representative of a category. In this sense, our study should be contrasted with studies by DeLoache (1991) and by Preissler and Bloom (2007), which focus directly on children's capacity to comprehend and use the object/representation distinction.)

More generally, although complexity is an important predictor of infants' and children's performance on a range of tasks (e.g., Cohen & Cashon, 2003; Fantz, 1963; Sandhofer & Smith, 2004; Stiles & Stern, 2001), the distinct representational roles of objects and pictures does not reduce to a complexity effect. Instead, these results provide evidence for a powerful, if subtle, link between linguistic expression and the fundamental conceptual distinction between kinds and individuals.

Although the present data establish that representational status has effects that do not reduce to complexity per se, this does not imply that complexity is irrelevant to children's kind concepts. The current study manipulated complexity within fairly narrow constraints, in order to maintain tight experimental control over the distinction between pictures and objects. Therefore, all the pictures and objects in the present study were toys (or drawings of toys), were colorful, were three-dimensional (in actuality or implied), and possessed identifiable parts. None were actual, non-toy objects (given the obvious difficulties of keeping live animals in the lab and the impossibility of controlling for the behaviors of live animals vs. toys). None were simple black-and-white line drawings.

We suspect that both children and adults may display sensitivity to complexity if we permitted the factor to range fully, and to be confounded with other factors. For example, a real (live) bull is more complex than a toy bull, and we suspect that a real (live) bull would pose more insistent dual-representation difficulties than a toy bull. Accordingly, we would predict that the live bull would yield a higher proportion of individuating talk than a toy bull. Similarly, a simple black-and-white line-drawing of a bull would seem not only simple in its depiction, but also more abstract than a realistic painting, less likely to pose dual-processing problems, and therefore relatively more likely to elicit kind-referring talk. In short, if complexity varies dramatically enough, then simpler drawings and objects can be more abstract (e.g., Picasso's famous series of depictions of a bull) and thus decrease dual-representation obstacles. Thus, we would expect a simple line-drawing to elicit relatively more kind references, and a detailed portrait to elicit relatively more individuating talk.

The present hypothesis regarding the role of representational status on language and concepts is only one possible interpretation of the present results, and in future research it will be important to consider alternative possibilities. For example, objects afford more interaction and pretend play than do pictures, because they are three-dimensional and manipulable, and perhaps this factor contributed to the picture/object differences. We suspect that this cannot be the whole story, because in prior work, picture/object differences were maintained even when objects were placed in transparent plexiglas boxes, rending the objects untouchable (Gelman et al., 2005, Study 2). Nonetheless, the representational hypothesis must be considered just one of several possibilities.

These results have intriguing implications for language acquisition. It would be interesting to know whether the picture/object distinction affects learning words for novel kinds. For example, children may learn new words more accurately, and extend them taxonomically, more often when provided with pictures than with three-dimensional objects. The results also have implications for the role of picture-book reading in children's early learning. Hearing information in books

may encourage children to think about the broader categories that are referred to, and perhaps to generalize new facts to other members of the category. Thus, picture-book reading, one of the most common types of parent–child interactions in our society, may be particularly effective in enhancing early development of knowledge and cognition.

Acknowledgments

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