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The Medium is the Message: Pictures and Objects Evoke Distinct Conceptual Relations in Parent-Child Conversations

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Abstract

An important developmental task is learning to organize experience by forming conceptual relations among entities (e.g., a *lion* and a *snake* can be linked because both are animals; a *lion* and a *cage* can be linked because the lion lives in the cage). We propose that representational medium (i.e., pictures vs. objects) plays an important role in influencing which relations children consider. Prior work has demonstrated that pictures more readily evoke broader categories, whereas objects more readily call attention to specific individuals. We therefore predicted that pictures would encourage taxonomic and shared-property relations, whereas objects would encourage thematic and slot-filler relations. We observed 32 mother-child dyads (*M* child ages = 2.9 and 4.3) playing with pictures and objects, and identified utterances in which they made taxonomic, thematic, shared-property, or slot-filler links between items. The results confirmed our predictions and thus support representational medium as an important factor that influences the conceptual relations expressed during dyadic conversations.

The Medium is the Message: Pictures and Objects Evoke Distinct Conceptual Relations in Parent-Child Conversations

A key developmental task is learning to organize experience and relate different kinds of entities to one another. There are different ways that entities interrelate, including taxonomically (belonging to the same kind; Gelman & Markman, 1986), thematically (interacting in the real world causally, functionally, spatially, or temporally; Smiley & Brown, 1979), shared properties (having common features, such as shape or color; Smith, Jones, & Landau, 1996), or slot-filler (filling the same role in a familiar script or schema; Lucariello & Nelson, 1985). Each is uniquely important to a fully functional understanding of the world. For example, taxonomic relations are particularly useful for forming categories and making inductive inferences; thematic relations reveal how items function and interact; shared properties reflect dimensions along which items can be compared; slot-fillers reflect scripts and schemas.

Children's capacity to use different conceptual relations to interrelate entities is often tested in free-sorting or match-to-sample tasks. For example, children are given a set of items and are asked to either put together things that are "alike" or choose an item that "goes with" a

target item. Different relations exist among the items, such as taxonomic-matches (e.g., linking a dog and a lion) or thematic-matches (e.g., linking a dog and a bone). Early research using these methods suggested that there might be developmental shifts in the significance of different kinds of relations. For example, some studies demonstrated a shift between preschool and early elementary school from organizing entities thematically to organizing them taxonomically (Blanchet, Dunham, & Dunham, 2001; Smiley & Brown, 1979), whereas other research demonstrated a developmental shift in the reverse direction—from organizing entities taxonomically to organizing them thematically (see Gelman, Coley, Rosengren, Hartman, & Pappas, 1998 for a review). However, the developmental shift view has been challenged by findings showing that no single type of relation dominates at any age (Horst et al., 2009; Lin & Murphy, 2001; Waxman & Namy, 1997). Instead, young children access multiple types of relations and exhibit substantial conceptual flexibility in their use of different relations (Blaye & Jacques, 2009; Kalish & Gelman, 1992; Nguyen & Murphy, 2003).

Given this conceptual flexibility, an important question is what factors encourage children to focus on one versus another type of conceptual relation. Prior research has identified several factors that play a role, including the procedure (e.g., sorting into bags vs. visible piles; Markman, Cox, & Machida, 1981), verbal instructions (Deák & Bauer, 1996; Markman & Hutchinson, 1984; Tare & Gelman, 2010), stimulus type (e.g., complex vs. simple items; Cimpian & Markman, 2005; Golinkoff, Shuff-Bailey, Olguin, & Ruan, 1995), stimulus domain (Blanchet et al., 2001), and strength of the relations between items (Sheuner, Bonthoux, Cannard, & Blaye, 2004).

The goal of the present study was to examine another factor that we hypothesized might evoke distinct types of relational thinking: stimulus medium (pictures vs. objects). Much of children's experience with the world is through symbolic representations of entities, such as pictures or toy objects (DeLoache, 2004), yet relatively little is known regarding if/how different symbolic media differentially guide children's attention. If pictures and objects do influence the kinds of relations to which children attend, this could have important implications for understanding the role of symbolic representations on thought, as well as optimal modes of presenting information in educational contexts. Prior work suggests two competing possibilities regarding the influence of medium on relational thinking: (1) conceptual relations are blind to medium vs. (2) pictures and objects highlight different kinds of conceptual relations. We discuss each position below.

Hypothesis 1: Conceptual Relations are Blind to Medium

Although prior studies have examined children's conceptual relations using various stimulus media—including words, three-dimensional objects (usually toy replicas of larger objects), and two-dimensional line drawings or photographs—this research has generally focused on the kinds of conceptual relations that children develop without regard to the form of the items being considered. The assumption has been that, although different media might differ in overall salience or level of detail, they should otherwise not lead to qualitative differences in the developmental patterns because they are all equivalent ways of accessing the concept. Children's conceptual linking should therefore be stable across different media.

Most studies have therefore not varied stimulus medium directly. In the few studies that have done so, the findings are inconclusive. For example, Waxman and Namy (1997) found no differences between 4-year-olds' use of taxonomic versus thematic strategies for pictures versus objects. In contrast, Deák and Bauer (1996) found that 4-year-olds were more likely to relate items taxonomically rather than on the basis of perceptual similarity when presented with objects as compared to line drawings. A direct comparison of these two studies is not permissible due to task and item differences. Moreover, to date, the effect of

stimulus medium has not been directly tested using a procedure specifically designed to assess this issue.

Hypothesis 2: Pictures and Objects Highlight Different Conceptual Relations

In contrast to the view that stimulus medium is irrelevant, other work suggests that different formats—particularly pictures vs. objects—evoke conceptually distinct modes of thinking. Specifically, prior research has shown that the different representational formats of pictures and objects influence how they are treated. Both objects and pictures can serve as representations; for example, a dog can be represented by a 3-dimensional object (e.g., a toy dog) or by some sort of picture (e.g., sketch, drawing, or photograph of a dog). However, whereas pictures are almost purely symbolic, objects pose a “dual representation” problem (DeLoache, 2000). Objects have highly salient physical properties and affordances. Construing them as representations thus requires thinking about them in two distinct ways: as objects in their own right (e.g., a plastic form, 3 inches in length) and as representations of something else (e.g., a replica of a dog). Dual representation is not as great a problem for pictures. Because pictures are relatively insubstantial, we are less inclined to think about them as physical objects per se, and can instead focus more on the depicted entities.

This distinction between pictures and objects is evident in the development of children’s understanding of these two representational media. Because of the dual representation problem, young children have especial difficulty appreciating the representational nature of objects. In contrast, they readily construe pictures as representations. For example, when 2.5-year-olds are shown that a small scale model has the same layout and properties as a larger room, they fail to appreciate that the model room represents the larger room (DeLoache, 2000). When an experimenter hides a small toy in the model room to indicate where a larger toy is hidden in the large room, 2.5-year-olds fail to correctly locate the toy in the large room. In contrast, in a similar task with pictorial representations, children more readily appreciate the relation between the picture and its referent (DeLoache, 1991). When the experimenter points to a location on a photograph of the larger room to indicate where the toy is hidden, 2.5-year-olds successfully retrieve the toy. Thus, they appreciate the picture as symbolic, but not the object model.

Pictures are more easily construed as representations not only of individuals, but also of kinds. For both preschoolers and adults, pictures prompt talk about basic-level categories, whereas objects prompt talk about individuals (Gelman, Chesnick, & Waxman, 2005; Gelman, Waxman, & Kleinberg, 2008). For example, Gelman et al. (2005) examined mother-child dyads engaging in free conversations about either pictures or toy replica objects (items were viewed individually, not simultaneously). The dyads used more generic category references (e.g., “What do *froggies* say?”) when talking about pictures, whereas they were more likely to use individuating phrases, such as giving the item a proper name or treating it as a conversational partner (e.g., “Bye, Mr. Frog!”), when talking about objects. Gelman et al. suggest that, by the time children reach preschool age, the symbolic nature of pictures leads them to focus more on kinds because kinds are also symbolic—they stand for an entire group of entities that share certain properties—and pictures (as symbols) thus link more directly to kinds. In contrast, objects are less readily regarded as symbols and therefore more likely to be construed as individuals.

The Present Study

The present study tests another implication of this theoretical position, namely, that there are qualitative differences in the kinds of *inter-item relationships* that people notice for pictures vs. objects. To test this possibility, we examined whether, during parent-child conversations, pictures and objects elicit different kinds of conceptual links. This is a new research

question, as prior work examining pictures vs. objects has not examined conceptual links but has instead considered the information for items presented individually (e.g., Gelman et al., 2005). We investigated how children (ages 2 and 4 years) and their mothers interrelated items when playing with three-dimensional toy replica objects vs. two-dimensional drawings of objects. Each dyad played with a set of toy objects and a set of pictures, with the order of sets counterbalanced. The items in each modality were presented simultaneously, in unordered piles, and we observed how participants spontaneously related the items.

We predicted two primary ways that item medium might influence what inter-item conceptual links are made. First, because pictures are more readily construed as representing a larger category, we predicted that they would encourage people to focus on taxonomic relations (e.g., noting that two or more items belong to a higher-order category, such as “animal” or “food”). Second (and conversely), because objects have highly salient physical properties and affordances, this might impede them from being construed as standing in for the larger category they represent. Instead, objects might promote a greater focus on interactional and functional features and relations (e.g., seeing a toy hammer might encourage using it to pound another item). Therefore, we predicted that objects would encourage people to focus more on thematic relations.

We also made an additional prediction about the effects of item medium on thematic linking, specifically regarding the conventionality of the links. We speculated that, because the concreteness of the objects should encourage thematic linking, participants might also be prompted to consider a wider range of combinations in which the objects could interact, including links that would not plausibly occur in real-world contexts (e.g., using a hammer to ‘fix’ an animal). In other words, objects might foster a thematic outlook that would be manifest not only in a higher frequency of thematic links, but also in a broader range of thematic links. In contrast, we expected that the more abstract nature of the pictures would constrain thematic linking to more conventional relations that are consistent with category-based characteristics (e.g., pointing out that a hammer can fix an artifact). This predicted distinction would be interesting, given the importance or desirability of conventional responses in certain contexts (e.g., traditional classroom settings) versus unconventional responses in other contexts (e.g., brainstorming or creative settings). Importantly, prior work has not yet examined how stimulus medium might influence the conventionality of thematic linking (nor how this effect might differ with development, as category knowledge increases).

Because the current procedure differs from prior approaches by using an open-ended task in which participants were free to actively manipulate, discuss, and interrelate items in any way that they chose, we were interested in seeing whether participants would also relate the items in other ways besides taxonomically and thematically. In particular, two other fundamental kinds of relations that we expected would be expressed in parent-child conversations were slot-filler (e.g., placing items into the same role) and shared-property relations (e.g., finding all of the items that are the same color). Like taxonomic relations, shared-property relations were predicted to occur more often with pictures than objects. Taxonomic and shared-property relations both involve linking entities based on properties that are inherent to the entity (e.g., identity, color, shape). Hence, if pictures evoke a greater focus on categories and common features (conceptual and/or perceptual), then they should promote both more taxonomic and more shared-property relations. In contrast, we predicted that, like thematic relations, slot-filler relations would occur more with objects. Both thematic and slot-filler relations involve linking entities based on possible affordances, interactions, or common roles in certain contexts, events, or scripts. Hence, if objects evoke a heightened focus on interactional and functional features, then they should promote both more thematic and more

slot-filler relations. These findings would reveal patterns of co-occurrence amongst various conceptual relations which, to our knowledge, have not been examined in prior research.

We also investigated whether there are developmental differences in the effects of stimulus medium. We tested 2- and 4-year-olds (and adults) because prior research has demonstrated that there are developmental changes between ages 2 and 4 in the effectiveness of contextual factors in eliciting different strategies (e.g., Blanchet et al., 2001; Waxman & Namy, 1997). In addition, the prior work on symbolic understanding demonstrates different developmental progressions for pictures and objects between 2 and 4, which might differentially influence children's conceptual linking among items in each medium. With pictures, children's understanding develops gradually during the first few years of life, but they have already begun to demonstrate an appreciation of their symbolic nature by at least 2 years of age (DeLoache, Pierroutsakos, & Uttal, 2003; Ganea, Allen, Butler, Carey, & DeLoache, 2009; Preissler & Bloom, 2007; Preissler & Carey, 2004). For example, 9-month-old infants manually explore pictures, but this tendency diminishes by 18 months, when they instead appropriately point to or name depicted objects (DeLoache, Pierroutsakos, Uttal, Rosengren, & Gottlieb, 1998). Also by 18 months, when a novel word is used to refer to a picture, children understand that the label refers to the depicted object and not the picture itself (Preissler & Carey, 2004).

Symbolic understanding of objects shows a slightly later developmental progression. For example, the ability to match toy replica objects to their real-object counterparts emerges at 18 months, improves by 26 months, and improves further by 35 months (Tomasello, Striano, & Rochat, 1999; Younger & Johnson, 2004). Also, as mentioned above, prior research has shown that 2.5-year-olds have difficulty appreciating objects as both objects and symbols in DeLoache's (2000) model room task, whereas 3-year-olds are able to overcome the dual representation problem in this task.

Given these distinct developmental trends, in the present study, we suspected that we might find greater age differences in participants' conceptual linking with objects than pictures. Because both 2- and 4-year-olds appreciate the symbolic nature of pictures, any effect that their symbolic nature has on conceptual relations (e.g., prompting more taxonomic and shared-property linking among items) should be evident in all age groups tested. In contrast, because 2-year-olds still have difficulty seeing objects as representations, and we predicted that focusing solely on the concrete nature of objects would facilitate thematic and slot-filler linking, it follows that 2-year-olds might exhibit an especially robust focus on thematic and slot-filler relations among objects. Conversely, 4-year-olds and adults are better able to see objects as both objects and symbols. That is, they construe objects similarly to how they construe pictures. Therefore, relative to 2-year-olds, older participants might exhibit more taxonomic and shared-property linking with objects. (However, we still expect that objects will elicit more thematic and slot-filler linking relative to pictures in all age groups.)

Thus, in summary, we predicted that pictures would encourage participants to focus on taxonomic and shared-property relations among items, whereas objects would encourage a focus on thematic and slot-filler relations. Moreover, we expected that a broader range of thematic links would occur with objects, including unconventional links that are not limited to category-specific characteristics. Lastly, we predicted that the effects of stimulus medium on inter-item linking would be most evident in 2-year-olds because their greater difficulty in construing objects as symbols should especially promote thinking about thematic and slot-filler links between the actual objects rather than linking related to taxonomic category membership or shared properties.

Method

Participants

Thirty-two mother-child dyads participated. All were White. Sixteen children were in a younger group (2.5 to 3.1; $M = 2.9$), and sixteen children were in an older group (3.7 to 5.0; $M = 4.3$). Half of the children in each age group were male and half were female. Four additional dyads were tested but not included because the dyad spoke in a language other than English for part of the session ($n = 1$), the child's speech was unintelligible on the videotape ($n = 1$), or the dyad did not complete the procedure ($n = 2$). Participants were recruited from a Midwestern U.S. university town and nearby communities. They were recruited via direct mailings and telephone calls.

Materials

Materials included a picture and a toy object version of each of the 24 items listed in Table 1. The items included 8 animals, 8 foods, and 8 artifacts. We used toys rather than actual objects so that we could present a range of objects and domains. We selected well-known items that young children are likely to be familiar with. The pictures of the items were colorful, realistic drawings created to look as similar as possible to the toys (same shape, parts, color, and details), and then laminated. See Figure 1 for sample pairs. The items were divided into two sets, each with 4 animals, 4 foods, and 4 artifacts. For a given mother-child dyad, one set was presented as pictures and the other as objects. Across dyads, each set appeared as objects for half the dyads, and as pictures for half the dyads. Thus, each item appeared equally often as a picture or as an object. This ensured that any differences between pictures and objects across participants could not be due to any specific item and its suitability for the various relational types.

Procedure

The test sessions were conducted in our on-campus lab in a child-friendly room, with a couch and child-sized table and chairs. Participants were videotaped through a one-way window into the testing room. Mothers were told that we were studying parent-child conversations and were instructed to interact with their child as they would normally at home. The experimenter placed a set of items (either all objects or all pictures) on the table in no particular arrangement and then exited the room. Half of the dyads were given objects first, and the other half were given pictures first. Item modality order was counterbalanced with respect to set-to-item assignment (i.e., whether set 1 or set 2 was presented in picture format). No constraints were placed on the order or amount of time spent with each item, but mothers were asked to spend time with every item and to use the entire time period. After 8 minutes (younger group) or 10 minutes (older group), the experimenter re-entered the play room, collected the first item set and presented a second set, differing in modality from the first set (e.g., if the first set included objects, the second set included pictures). After another 8 or 10 minutes (dependent on age group), the session was concluded.

Transcribing and Coding

To code for conceptual linking, each videotaped session was transcribed verbatim and checked for accuracy by a second transcriber. A verbal utterance was defined as any continuous unit of conversation that was free of full stops, long pauses, or interruptions from the other speaker. Non-verbal contextual information (e.g., participants' physical interactions with the items) was also transcribed.

The first and second authors coded the link data. All disagreements were resolved through discussion. Coding proceeded in five phases, with agreement assessed at each phase. We coded and analyzed the data in two ways: we first examined the rate of all taxonomic,

thematic, slot-filler, and shared-property inter-item links made by the children and mothers (coding phases I–IV below); we then coded the links again to focus exclusively on the links that children made spontaneously, unprompted by their mother’s comments (phase V). Given that our procedure involved dyadic conversations, we expected there to be relatively strong correlations between the types of conceptual relations invoked by the children and their mothers. Hence, it is possible that any effects of stimulus medium on children’s conceptual relations and any developmental differences would stem from differences in how mothers talk about items of different media to their children, not necessarily in how children think about the items. We therefore included the coding and analysis of children’s spontaneous links to assess whether children’s conceptual linking was driven primarily in response to how their mothers linked the items, or whether children were also independently and spontaneously making links.

Phase I: Identifying links—We first identified all utterances in which a participant linked two or more items—hereafter referred to as *links*. This included any utterances in which a participant mentioned, compared, or contrasted multiple items, or implied an interaction between multiple items. (Hence, even a very non-specific link, such as “Table and fish,” was included at this phase of coding.) Links could be established either within individual utterances (e.g., “Can’t Mr. Crab have some pizza?”) or within the immediate conversational context (e.g., the utterances in the following conversation were all counted as links because they are part of a conversation in which items are being grouped together: *Mother*: “Pick out the food ones first.” *Child*: “Is this a food?” *Mother*: “It is kind of food.”). Links required a clear reference to the items, either through the use of a label (‘elephant’), or a proper name (‘Mr. Elephant’) or pronoun (‘he’) established by the participant in the conversational context as a referent to the item. Both coders coded all of the transcripts for links. They first coded nine transcripts to establish criteria for coding links. They then coded the remaining 23 (72%) transcripts, with 96% agreement (Cohen’s $K = .83$). (One dyad did not make any links and was thus not coded further.)

Phase II: Link type—We next coded the structural type of each link. Thus, all and only utterances that had been established as links in Phase I were coded in Phase II. Four primary link types were coded (see Table 2 for examples). *Taxonomic* links referred to shared (superordinate) category membership amongst items, using either a category label (e.g., ‘food’) or category-defining criteria (e.g., ‘things we eat’). *Thematic* links referred to a functional relation between two items. *Shared-property* links referred to a common feature, such as color. *Slot-filler* links referred to a common role in a script or event. Any link that did not fit into one of these four categories was coded as *other*. Each utterance could receive multiple codes if the participant made multiple links (e.g., “Should the animals then eat the ice cream cone?” includes both a taxonomic link [‘the animals’] and a thematic link [between ‘the animals’ and ‘the ice cream cone’]). Both coders first coded four transcripts to establish criteria for coding link type. They then coded the remaining 27 (84%) transcripts, with 94% agreement (Cohen’s $K = .73$).

Phase III: Item domain—In Phase III we identified the domain of the item(s) involved in each link (*animal*, *food*, *artifact*, *unspecified*) so that we could then eliminate links from the analyses that did not have clearly specified referents. Domain was coded as unspecified when the speaker did not explicitly or clearly refer to a specific item (e.g., “What can drive in this truck?” would be coded as “unspecified” [‘What’] and “artifact” [‘this truck’]). Each coder individually coded domain for 12 transcripts. The remaining 7 (22%) were coded by both coders, with 96% agreement (Cohen’s $K = .92$).

Phase IV: Conventionality of thematic links—In Phase IV, we coded the conventionality of the thematic links to test for the predicted effects of stimulus medium (more unconventional thematic links with objects). In this phase, the thematic links (for pictures and objects) were coded as conventional, unconventional, or unspecified. *Conventional* links were those that could plausibly occur in a real-world context. We included a fairly broad set of links as conventional. For example, an animal ‘eating’ a food item (e.g., frog eating ice cream) was coded as conventional, since it is conceivable that such an event might occur. *Unconventional* links were those that would not likely occur in real world contexts. For example, “You’re gonna fix his [elephant] back with the hammer?” would be unconventional because it would be unusual to use a hammer to ‘fix’ an animal. In contrast, “The piano has to be fixed [referring to hammer],” would be conventional because it is normal to use a hammer to fix an artifact. Other examples of unconventional links include when participants described a smaller animal eating one of the larger animals, or when they anthropomorphized the animals, such as by attributing emotions or mental states to them. *Unspecified* links were any thematic links not falling into one of the other three categories. This usually occurred when the items involved in the link were not clearly specified (similar to the domain coding describe above).

The coders first coded 8 transcripts to establish the criteria for the conventionality coding. They then individually coded 7 transcripts. The remaining 9 (30%) were coded by both coders, with 90% agreement (Cohen’s $K = .81$).

Phase V: Spontaneity—Lastly, we coded whether children’s links were spontaneous or prompted by their mother in some way. Specifically, we coded whether the child’s utterance in which the link occurred was *spontaneous* and unprompted, a *repeat* of a prior utterance from the mother, or a *response* to a question or prompt from the mother. (See Table 3 for examples.) Both coders first coded fourteen transcripts to establish criteria for coding spontaneity. They then individually coded 5 transcripts. The remaining 7 (22%) were coded by both coders, with 91% agreement (Cohen’s $K = .77$).

Results

The procedure successfully elicited conversation within the mother-child dyads. On average, each dyad produced 545 utterances total during the session. Overall, mothers produced more utterances ($M = 347.4$, $SD = 58.5$) than children ($M = 197.7$, $SD = 46.9$), $t(30) = 16.63$, $p < .001$, and pictures elicited more utterances ($M = 143.2$, $SD = 46.8$) than objects ($M = 129.4$, $SD = 47.3$), $t(31) = 6.18$, $p < .001$. Importantly, the procedure also successfully elicited conversational links (mothers: $M = 52.91$, $SD = 33.89$; children: $M = 22.16$, $SD = 15.76$). Analyses of these links follow.

Effects of Item Medium on Link Type

Each participant received 4 raw scores for pictures and 4 raw scores for objects that corresponded to the number of each link type (taxonomic, thematic, shared-property, slot-filler) that was made with that medium. To control for variation in talkativeness, we adjusted the raw scores by dividing by the number of utterances produced for that item modality and multiplying by 100. For example, if the participant had made 4 taxonomic links and had produced 200 utterances overall when playing with the picture set, they would get a score of 2.0 ($4 \times 100 / 200$) for taxonomic links regarding pictures. Because we had no predictions regarding links that were structurally classified as “other” (7.3% of all links), nor for references to items that were coded as “unspecified” for domain (3.2% of all items invoked in links), we did not analyze such links further.

To test the effects of stimulus medium and age on the types of links elicited, we conducted a mixed ANOVA on the link data with speaker (mother, child), age group (dyads with a 2-year-old child, dyads with a 4-year-old child), set-to-item assignment (whether set 1 was presented as pictures and set 2 as objects, or set 2 was presented as pictures and set 1 as objects), and block order (pictures first, objects first) as between-subjects variables, and item type (picture, object) and link type (taxonomic, thematic, shared-property, slot-filler) as within-subject variables.

There was a main effect of item type, $F(1, 48) = 41.54, p < .001$: participants produced relatively more links when talking about objects ($M = 27.9, SD = 20$) than pictures ($M = 10.8, SD = 13.5$). There was also a significant main effect of link type, $F(3, 144) = 45.71, p < .001$. Overall, thematic links were more frequent than the three other link types, and taxonomic links were more frequent than shared-property and slot-filler (all $ps < .01$). Most importantly, there was also a significant interaction between item type and link type, $F(3, 144) = 58.88, p < .001$ (see Table 4). Consistent with our predictions, this interaction revealed striking differences in the types of links evoked across objects versus pictures. When talking about objects, participants made more thematic links than all other link types, and fewer shared-property links than all other link types (all $ps < .01$). In contrast, when talking about pictures, taxonomic links were most frequent, occurring significantly more frequently than either thematic or slot-filler links ($ps < .05$), and marginally more frequently than shared-property links ($p = .10$). Both thematic and slot-filler links occurred more often with objects than pictures ($ps < .01$), and both taxonomic and shared-property links occurred more often with pictures than objects ($ps < .05$). Hence, as predicted, the types of links evoked in conversation differed across the two item media, with taxonomic and shared-property links occurring more with pictures, and thematic and slot-filler links occurring more with objects. No other effects or interactions were significant, including any expected effects of age.

Next, to further examine the patterns of co-occurrence among the four link types, we examined correlations in the frequency of link types within each item type. There were significant correlations between the number of thematic and slot-filler links that participants made. For both objects ($r = .43, p < .001$) and pictures ($r = .54, p < .001$), participants who made relatively more thematic links also made relatively more slot-filler links. There were no significant correlations within item type for taxonomic or shared-property links. Thus, thematic and slot-filler links showed similar patterns of stimulus medium effects within participants, whereas these consistencies were not evident between taxonomic and shared-property linking.

Conventionality of Thematic Links

We next examined our prediction that pictures would constrain thematic linking to conventional relations, whereas objects would promote more unconventional thematic linking. In our analysis of conventionality, we focused only on participants who made at least one thematic link with objects *and* one thematic link with pictures, as a comparative analysis of content required data in both cells of the design (4-year-olds: $n = 3$, Mothers: $n = 7$; 2-year-olds: $n = 5$, Mothers: $n = 10$). We also excluded thematic links coded as “unspecified” because we had no clear predictions for these. To examine the effect of item medium on conventionality, we conducted two separate ANOVAs on the proportion of thematic links in each of the two conventionality categories (conventional, unconventional), with item type as a within-subject factor, and age and speaker as between-subject factors.

The ANOVA on the conventionality data revealed a main effect of age, with participants in older dyads making more conventional thematic links than those in younger dyads, $F(1, 21) = 15.81, p < .05$. There was a marginally significant effect between item type and speaker,

$F(1, 21) = 3.28, p = .08$. Mothers made significantly more conventional links with pictures ($M = .70$) than objects ($M = .44; p < .01$), whereas children did not show this difference (pictures: $M = .60$; objects: $M = .62$). However, there was also a significant interaction between item type and age, $F(1, 21) = 13.86, p < .001$. Mothers and children in 4-year-old dyads made more conventional links with pictures (mean proportion of thematic links that were conventional = .99) than objects ($M = .58$), $p < .05$, whereas participants in the 2-year-old dyads showed no effect of item type (pictures, $M = .32$; objects, $M = .48$). No other effects or interactions were significant.

The ANOVA on the unconventional data revealed a main effect of age, with participants in younger dyads making more unconventional thematic links than those in older dyads, $F(1, 21) = 12.93, p < .05$. There was also a marginally significant effect between item type and speaker, $F(1, 21) = 3.9, p = .06$. Mothers made significantly more unconventional links with objects ($M = .50$) than pictures ($M = .22; p < .01$), whereas children did not show this difference (objects: $M = .35$; pictures: $M = .38$). However, there was also a significant interaction between item type and age, $F(1, 21) = 11.18, p < .05$. Participants in older dyads made more unconventional links with objects ($M = .38$) than pictures ($M = .00$), $p < .05$, whereas participants in 2-year-old dyads showed no effect of item type (pictures, $M = .60$; objects, $M = .47$). No other effects or interactions were significant.

Thus, overall, the conventionality data are consistent with our prediction that stimulus medium would influence thematic link conventionality; however, this effect interacted with age and marginally interacted with speaker. Mothers and children in older dyads, especially, showed differences in conventionality based on stimulus medium—they made more unconventional links with objects than pictures, and more conventional links with pictures than objects. We also found that, overall, older dyads were more conventional in their thematic linking and younger dyads were more unconventional.

Children's Spontaneous Links

Lastly, we tested whether the effects of stimulus medium on children's conceptual linking were also evident in their spontaneous links—that is, links that were unprompted by mothers' comments. Before conducting the analyses that focused exclusively on children's spontaneous links, we first examined the correlations between children's and mothers' conceptual linking as a whole. Our expectations were correct—there were strong associations between the types of links made by mothers and the types of links made by their children. There was a significant positive correlation for all four link types, both across item type and within pictures and objects separately. That is, the number of taxonomic links made by mothers was positively correlated to the number of taxonomic links made by their children ($r = .63, p < .001$), and likewise for the other three types (thematic: $r = .57, p < .001$; shared-property: $r = .80, p < .001$; slot-filler: $r = .59, p < .001$).

However, a substantial number of children's links (77% for objects; 43% for pictures) occurred in spontaneous utterances, without any prompting from their mothers. To examine children's spontaneous links, we conducted a mixed ANOVA with age group (2-year-olds, 4-year-olds) as a between-subject variable, and item type (picture, object) and link type (taxonomic, thematic, shared-property, slot-filler) as within-subject variables. This analysis revealed significant main effects of item type, $F(1, 30) = 37.07, p < .001$, and link type, $F(3, 90) = 31.93, p < .001$, both in the same directions as in the omnibus ANOVA on all links above. There was also a significant interaction between item and link type, $F(3, 90) = 36.18, p < .001$. Consistent with our predictions, both thematic ($p < .001$) and slot-filler ($p < .01$) links occurred more frequently with objects than pictures. However, there were no significant effects of item type on taxonomic or shared-property links. Finally, there was a significant three-way item type x link type x age interaction, $F(3, 90) = 3.09, p < .05$.

Planned pairwise comparisons revealed that, although both age groups made more thematic links with objects versus pictures, only 2-year-olds made more slot-filler links with objects than pictures. In addition, the 4-year-olds made more taxonomic links with objects than did 2-year-olds (all $ps < .05$). Thus, younger children were more likely to focus on slot-filler relations when spontaneously linking objects, whereas older children were more readily able to focus on taxonomic relations. These results are consistent with our prediction that younger children's linking would be especially influenced by the concreteness of the objects, focusing on thematic and slot-filler links, whereas 4-year-olds might be more able to appreciate the symbolic nature of objects.

Discussion

The current findings demonstrate that pictures and objects prompted distinct kinds of conceptual linking in mother-child conversations and play. As predicted, pictures encouraged mothers and their young children to focus more on taxonomic relations and shared properties, and objects encouraged a greater focus on functional and interactional relations and common roles in scripts or events (i.e., thematic and slot-filler relations). These findings have important implications for understanding the content and organization of children's and adults' concepts and the influence of item medium on concepts.

These findings add to the literature regarding the flexibility of children's conceptual relations (e.g., Blaye & Jacques, 2009; Kalish & Gelman, 1992; Nguyen & Murphy, 2003) by demonstrating that item medium is an important factor that influences children's and adults' conceptual linking during parent-child play and conversations. Pictures and objects highlight different kinds of inter-item relations—to both parents and children. This is contrary to what has been assumed in many prior studies on early concepts. Future research on conceptual relations should thus be mindful of how stimulus medium may influence which relations are most readily brought to mind.

The current work also contributes to a portrait of children's understanding of representational media (e.g., DeLoache, 2000). In particular, we suggest that the difference in representational status between pictures and objects is a key factor in our finding that pictures and objects yield different foci of attention in conceptual linking. Because objects have salient physical properties and affordances that draw attention to their functional, interactional, and individuating features, this presumably encourages consideration of thematic and slot-filler links among objects. In contrast, pictures more readily serve as representations of broader categories than objects. This likely encourages consideration of abstract taxonomic links among pictures, as well as how items relate on properties inherent to the represented items (e.g., their color). Prior work has demonstrated that children's symbolic understanding undergoes a complex developmental process involving several emerging competencies (Callaghan, 2008; Troseth, Pierroutsakos, & DeLoache, 2004). For instance, with pictures, children go from having difficulty understanding that pictures are depictions and not real objects, to understanding the connections between pictures and their references (e.g., that a label given to an object depicted in a picture refers to the object itself and extends to real-world instances of the object; Ganea et al., 2009; Preissler & Carey, 2004). The current work expands on prior work by showing that the relative difficulty in considering objects as representations has implications for the ways in which children relate items to one another in forming larger conceptual structures.

It will be important for future research to assess whether mechanisms in addition to representational status are also involved in the effects shown here. In particular, two other key differences between objects and pictures are (1) their degree of manipulability and (2) the functions or activities for which they are commonly used in adult-child contexts. In

terms of manipulability, objects are directly manipulable and afford actions, whereas items depicted in pictures are not. Recent research suggests that the degree of manipulability of items influences the accessibility and salience of various conceptual relations. In particular, Kalénine and Bonthoux (2008) showed children (5- and 7-year-olds) and adults triads of pictures consisting of a target item, a related item that was either taxonomically or thematically related to the target, and an unrelated item. The depicted items varied in their degree of manipulability, and participants were asked to choose which item “goes with” the target picture. Both children and adults were faster at identifying thematic relations for manipulable objects (e.g., clothing) and taxonomic relations for non-manipulable objects (e.g., vehicles). These results are particularly compelling given that participants were responding to images on a computer screen and were not actually able to physically interact with the manipulable items. In the current study, the even greater manipulability of the toy objects may have contributed to increased salience and accessibility of interactional and functional features (i.e., thematic and slot-filler relations). For example, grasping and moving a toy lion may encourage consideration of how it might interact with other objects in the context. It may even prompt consideration of a new, unconventional thematic relation that might not be considered otherwise (e.g., pretending that the lion wants to sit on the couch). Conversely, the non-manipulability of the items in the pictures may have reduced the salience and accessibility of thematic and slot-filler relations, instead promoting a greater focus on taxonomic and shared-property relations.

A second mechanism that may contribute to the observed picture-object differences is item function. Casual observation suggests that objects and pictures are associated with distinct functions in parent-child contexts, which may contribute to the different types of talk and play seen with these media in the current study. Pictures are more often used as educational tools (e.g., in informational books), whereas toy replica objects are more often used for play. Consequently, pictures may encourage more pedagogical talk and activities (e.g., pointing out different properties of or information about the depicted items, sorting items into categories, and so on). In contrast, objects may promote more talk and play involving pretense, as well as inter-item interactions and repeating actions with different objects in the case of slot-filler linking (e.g., acting out one animal “eating” a food item, then repeating the same act with another animal). The extent to which these functional differences contribute to differences in conceptual linking with pictures and objects has important implications for understanding what contexts encourage natural pedagogy (e.g., Csibra & Gergely, 2009). In particular, it would suggest that pictures promote more instructive communication and play in parent-child contexts than do objects. Such findings would also raise the question of whether these distinct functions are simply conventional in our culture, or instead whether there is something fundamental about pictures that promotes pedagogical instruction, and/or something fundamental about toy objects that promotes imaginative play (i.e., that pictures actually *afford* pedagogy whereas objects do not).

Further research is needed to test more directly whether item manipulability and/or function are characteristics contributing to the distinct effects of pictures and objects on conceptual relations. Note that item manipulability and function do not necessarily compete with representational status, as explanatory factors. All three factors are likely to co-occur in typical parent-child interactions (objects are typically manipulated, involved in imaginative play, and pose dual-representation difficulties; pictures are more static, involved in pedagogical instruction, and pose much less of a dual-representation problem). Moreover, the effects of these factors might interact and compete with each other. This possibility is consistent with prior work showing interactions between dual representation and experience manipulating and playing with items. In particular, DeLoache (2000) demonstrated that 2.5-year-olds—who typically have difficulty appreciating a scale model as representational—were better able to succeed in the model room task when the scale model was placed behind

a window, preventing them from actively manipulating it. Moreover, 3-year-olds—who typically perform well in this task—had difficulty when they were first given the opportunity to play with model room before completing the test task. Thus, manipulability and prior play experience influence children's ability to appreciate the representational status of objects. It would be valuable in future research to examine the relations among these interrelated factors in children's conceptual linking.

The current findings also demonstrate interesting developmental differences. Notably, there were no differences between mothers and children in the primary analyses of the effects of item medium. Nevertheless, when only children's spontaneous links were considered (and not those prompted by their mothers), there was a facilitative effect of objects on thematic and slot-filler relations, but no effect of pictures on taxonomic and shared-property linking. On the one hand, the results with objects indicate that the effects of item medium on children's linking behaviors were not solely a product of children repeating or responding to their mothers' linking. That is, children were independently sensitive to this factor. On the other hand, the facilitative effect of pictures on children's taxonomic and shared-property linking was stronger when their non-spontaneous links were also considered and, therefore, seems to have stemmed partly from the mothers' prompting and guidance. This is an interesting finding given that children begin to appreciate pictures as symbols by two years of age (DeLoache et al., 2003; Preissler & Bloom, 2007; Preissler & Carey, 2004). Our results suggest that the effect of pictures on eliciting taxonomic and shared-property relations may emerge somewhat later than does an understanding of the symbolic nature of pictures. It is possible that an appreciation of the symbolic nature of pictures is a necessary precursor to more readily focusing on shared category membership and common features among items depicted pictorially. However, future research would be needed to directly test this possibility.

This age difference in the effect of pictures was unexpected in light of the prior work on the development of symbolic understanding; however, we found two additional developmental differences that were consistent with our predictions. First, when examining children's spontaneous links, we found that younger children were more likely to focus on slot-filler relations when linking objects, whereas older children were more readily able to focus on taxonomic relations. Thus, as expected, dual representation with objects was less of an obstacle for 4-year-olds. Their performance suggests that they more readily appreciate the symbolic nature of the toy replica objects and consider properties inherent to the categories the objects represented. Two-year-olds, in contrast, were more focused on functional and interactional properties of the objects, presumably because the concrete nature of objects makes it difficult for younger children to appreciate their representational status (DeLoache, 2000). These results suggest that older children can focus on taxonomic links more readily, even when confronted with items of a modality that fosters taxonomic linking to a lesser degree—namely, objects.

Second, there were developmental differences in the conventionality of participants' thematic links. Overall, participants in younger dyads made fewer conventional thematic links and more unconventional thematic links than did participants in older dyads. In addition, the predicted effect of item medium on conventionality was evident only in mothers and in older children—their thematic links were more conventional with pictures and more unconventional with objects. Thus, especially in older dyads' conversation and play, thematic links with pictures are more restricted to conventional, category-based relations, whereas thematic links with objects are less constrained. This is consistent with our prediction that the different representational status of pictures and objects would influence the conventionality of thematic linking. We suggest that the highly concrete nature of objects promoted thematic linking to such an extent that new, unconventional and

idiosyncratic interactions among entities were generated. In contrast, the abstract nature of pictures seemingly constrained linking to more conventional relations. Moreover, it is likely that younger dyads' thematic links were more unconventional and affected less by item medium because younger children have less knowledge of conventions and categories. Thus, in parent-child conversations with younger children, both the parent and the young child may be more likely to consider unconventional relations.

The developmental effects aside, our results demonstrate that even children as young as two years of age are remarkably flexible in the conceptual relations they discuss, depending on item medium. This flexibility is notable given that 2-year-olds are generally poor at shifting their thinking so readily. For example, on dimensional card sort tasks, children younger than 5 have difficulty switching between two rules for sorting a set of cards, even though they might know both rules (Carlson, 2005). In addition, the effect of item medium on 2-year-olds' conceptual relations in the current study is remarkable given that children at this age are only just beginning to understand the dual representational nature of objects.

Lastly, an important feature of this study is the use of an open-ended task. This allowed us to examine children's *own* attention and interests in various conceptual relations. Prior work has often used explicit sorting procedures and/or forced-choice categorization tasks in which items are presented one at a time. The explicit sorting procedure is useful for exploring whether young children can relate items in one way or another (e.g., taxonomically *or* thematically; taxonomically *or* slot-filler), and such studies have revealed important findings regarding conceptual development. However, the use of forced-choice procedures also limits participants to relating items in only one or two ways. In contrast, the open-ended procedure in the current study allowed participants to view multiple items simultaneously. This allowed us to explore whether young children (and adults) have access to and interest in a wider range of relational types. The results confirmed this possibility: participants (both children and adults) made numerous spontaneous links of several different types. Prior work has suggested that children's interests guide their cognitive development (e.g., Hidi & Renninger, 2006). Thus, children's attention to various conceptual relations likely facilitates further learning about novel entities and the various ways in which items interrelate.

The breadth of conceptual links participants made and the systematic effects of item medium on their linking have implications for understanding the nature of conceptual relations and conceptual organization more broadly. In particular, the finding that certain types of links co-occur across contexts provides indirect evidence for similarities and differences among conceptual relations. Taxonomic and shared-property relations are prompted by the same item media (e.g., pictures, but not objects), suggesting that they may be conceptually similar—that is, they may be related in the minds of both young children and adults. Both involve linking entities based on properties that are inherent to the entity. Likewise, thematic and slot-filler relations are prompted by the same media (e.g., objects, but not pictures), suggesting that they may be conceptually similar to each other. Both involve linking entities based on possible affordances, interactions, or common roles in certain contexts, events, or scripts. The current study was exploratory regarding the conceptual similarity among different relations, but provides a provocative set of initial findings. This will be important for future research to assess more directly. For example, it remains possible that, rather than conceptually-based clusters, certain link types co-occurred because they are evoked by the same kind of play (e.g., making objects interact elicits talk about thematic and slot-filler relations). On the other hand, if these clusters are confirmed in future research, it would have broader implications for children's reasoning and learning. For example, drawing children's attention to shared perceptual properties may serve as a cue to shared taxonomic relatedness, perhaps with objects as well as pictures (Bloom, 2000).

Conclusions and Future Research

In sum, the current study, in conjunction with prior work on conceptual relations, demonstrates that, throughout development, human concepts permit a variety of strategies for interrelating entities. The extent to which a given strategy is readily accessed depends on task and item characteristics—in this case, due to the modality of the items as pictures versus objects. The current data, in conjunction with prior work on symbolic understanding, suggest that this effect stems from the distinct representational natures of pictures and objects.

This study raises several important questions for future study. Most importantly, it would be interesting to conduct further tests to determine more precisely the mechanisms underlying the effects of item medium on conceptual relations. To test the possibility we have proposed—that the distinct representational statuses of pictures and objects underlie these effects—one could manipulate the representational status of pictures and objects directly. For example, one could study objects that are more abstract and less realistic depictions, and thus more likely to be construed as representations (e.g., a wooden replica animal lacking details and coloring); or, in the other direction, one could study actual functional objects rather than toy replicas. It would also be interesting to vary the representational status of the pictures, for example, using photographs of items, which are less abstract representations compared to the drawings used in the present study.

Other tests could also assess the possibility that differences in the manipulability or the functions of pictures and objects contribute to the effects reported here. For example, the manipulability of the items could be varied by placing the objects at a distance or behind a window, thus preventing participants from actively manipulating them (for similar procedures, see DeLoache, 2000; Gelman et al., 2005). This might reduce thematic and slot-filler linking and encourage talk about abstract thematic links and shared properties among items. Similarly, increasing the manipulability of pictures might reduce taxonomic and shared-property linking and promote thematic and slot-filler linking. This possibility is supported by prior work demonstrating that the presences of manipulative features in picture books (e.g., “pop ups”) hinders 2- to 3-year-olds’ learning of facts provided in the book (Tare, Chiong, Ganea, & DeLoache, 2010).

To further examine the role of function, participants could be instructed to engage in activities with the items that vary in the extent to which they prompt pedagogical or interactional play and conversation. For example, they could be asked to pretend or act out stories with pictures, which may increase their focus on thematic and slot-filler links. Alternatively, they could be asked to sort the toys into bins, which may increase their talk about taxonomic or shared-property relations with objects. These sorts of tests would provide more insight into the factors leading parents and children to focus on different relations in their talk and play with pictures vs. objects.

It would also be important to further examine the extent to which these effects do or do not involve language expression. It is possible that the effects of item medium on conceptual relations are specific to tasks involving conversation. For example, speakers may choose to verbally express certain conceptual relations more than others with particular media, and this may or may not reflect which relations they emphasize or notice on a non-linguistic task. In addition, it would be interesting to know whether established social conventions play a role in guiding which relations are the focus across certain contexts. For example, people may commonly talk more about taxonomic relations with pictures and thematic relations with objects, and these conventions may then prompt such linking in parent-child conversations.

We also do not know to what extent our findings are limited to the sample tested, that is, to English-speaking parent-child dyads, and/or to children in well-educated, Western family contexts. A substantial body of prior research demonstrates the effects of language, culture, and socioeconomic factors on conceptual development (e.g., Callanan, Jipson, & Soennichsen, 2002; Lucy & Gaskins, 2001; Rogoff, 2003). Therefore, the effects of item medium on conceptual relations may differ across languages, cultures, and/or social contexts. For example, the extent to which parents talk in everyday contexts about different conceptual relations for pictures and objects may influence the extent to which children focus on them.

Despite the need for further inquiry into the scope of the current effects, the finding that children appreciate certain types of relations with certain item modalities has broader implications for the kinds of learning contexts that may be most effective for transmitting different kinds of information. The ease with which pictures promote a focus on taxonomic links suggests that pictures may have an advantage over concrete objects, if the goal is to focus children's attention on taxonomic, biological, or categorical relations (which is often the kind of information favored in school settings). Given that books are a particularly common and effective means of presenting pictures to young children, these findings suggest a mechanism whereby book-reading may confer conceptual advantages during childhood. Objects, on the other hand, may have an advantage over pictures in encouraging thinking about unconventional relations and thus may be more effective if the goal is to elicit novel and creative thinking.

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Figure 1.
Sample object and picture versions of three test items (elephant, couch, and pizza).

Table 1

Items Presented to Mother-Child Dyads During the Test Sessions

Set 1	Set 2
<i>Animals</i>	
Cow	Pig
Lion	Elephant
Eagle	Frog
Crab	Fish
<i>Food</i>	
Corn	Lemon
Pear	Watermelon
Pizza	Hotdog
French Fries	Ice Cream
<i>Artifacts</i>	
Truck	Airplane
Couch	Table
Shoe	Hammer
House	Piano

Note. For each dyad, either Set 1 was presented as pictures and Set 2 as objects or vice versa (Set 1 as objects and Set 2 as pictures).

Table 2**Sample Links as a Function of Speaker and Structural Type**

Children	
<i>Taxonomic</i>	(a) Mommy you can play with <u>the animals</u> . (b) Mother: What other categories of stuff do you have? What stuff do you have there? Child: <u>Food</u> .
<i>Thematic</i>	(a) I think <u>the elephant</u> should eat <u>the hotdog</u> . (b) See <u>these</u> [cow and lion] are friends.
<i>Shared-Property</i>	(a) And <u>this</u> [airplane] is green. <u>That</u> [fish] has green. (b) How 'bout you're gonna be, how 'bout, those, <u>the good ones</u> go with the good people?
<i>Slot-Filler</i>	(a) Mother: Do <u>cows</u> eat people? Child: <u>Lions</u> eat people too. (b) Child: Watch <u>the fish</u> is going to play the piano with his whole face, watch. Mother: How 'bout <u>the elephant</u> ? Can he play with his trunk? Child: Watch. <u>This</u> [fish] will play.
<i>Other</i>	(a) I'm gonna keep <u>the French fries</u> and <u>the pizza</u> and <u>the pear</u> . (b) The couch goes and then the couch goes on the shoe so it tips.
Mothers	
<i>Taxonomic</i>	(a) Is there another one that's <u>food</u> ? (b) <u>These</u> are <u>kind of things that you find in your house</u> , right?
<i>Thematic</i>	(a) <u>The fish</u> could play <u>the piano</u> . (b) What would happen if you <u>hammered a watermelon</u> ?
<i>Shared-Property</i>	(a) Wanna find <u>pictures</u> with brown? (b) And there's <u>two healthy things</u> here. <u>The pear</u> and <u>the corn</u> .
<i>Slot-Filler</i>	(a) Oh <u>the fish</u> is gonna eat the ice cream? Now <u>the elephant</u> is? (b) <u>Watermelons</u> don't go in there [piano]. Oh you think <u>the ice cream cone</u> needs to go in there huh.
<i>Other</i>	(a) What else do you want? <u>The cow</u> or <u>the lion</u> ? (b) Here's <u>three things</u> which one do you want to start with?

Note. Some utterances have been edited and some intervening conversation has been omitted for clarity.

Table 3

Examples of Children's Links in Utterances Coded as Repeat, Response, and Spontaneous

RepeatMother: I think that the fish could eat part of the airplane.Child: And the fish eats the airplane.

ResponseMother: What do you think this fish's favorite food is?Child: Watermelon.

Spontaneous

Mother: Okay what's this?

Child: A airplane.

Child: Look it- I'm playing- now give me all these foods.

Table 4

Mean Percent of Utterances Including Each Link Type, as a Function of Age Group and Item Type (SD in parentheses)

	Taxonomic	Shared-Property	Thematic	Slot-Filler
Dyads with 2-year-olds				
Pictures	6.0 (9.96)	1.0 (2.9)	3.6 (6.9)	0.8 (2.2)
Objects	1.9 (3.1)	0.1 (0.5)	20.7 (16.5)	4.4 (7.7)
Dyads with 4-year-olds				
Pictures	4.6 (5.9)	3.9 (8.4)	0.6 (1.23)	0.4 (1.3)
Objects	4.4 (5.6)	0.9 (2.8)	21.8 (17.5)	1.7 (2.3)
Overall				
Pictures	5.3 (8.2)	2.4 (6.4)	2.1 (5.2)	0.6 (1.8)
Objects	3.1 (4.6)	0.5 (2.0)	21.2 (16.9)	3.0 (5.8)