ELSEVIER

Cognition 76 (2000) 91–103

COGNITION

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Young children are sensitive to how an object was created when deciding what to name it

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Received 16 October 1999; received in revised form 15 January 2000; accepted 26 February 2000

Abstract

How do young children extend names for human-made artifacts, such as *knife*, *toy*, and *painting*? We addressed this issue by showing 3-year-olds, 5-year-olds, and adults a series of simple objects and asking them for each, 'What is this?' In one condition, the objects were described as purposefully created; in another, the objects were described as being created by accident. This manipulation had a significant effect on the participants' responses: even 3-year-olds were more likely to provide artifact names (e.g. 'a knife') when they believed the objects were intentionally created and material-based descriptions (e.g. 'plastic') when they believed the objects were accidentally created. This result supports a theory of artifact naming in which intuitions about intention play an important role. © 2000 Elsevier Science B.V. All rights reserved.

Keywords: Young children; Semantics; Intentionality

1. Introduction

How do people extend names for human-made artifacts, such as *knife*, *toy*, and *painting*? There are many studies that assess the relative importance of appearance and intended function in artifact naming, but the results are messy. The original study to pit appearance and function against one another found an unexplained developmental trend – young children tend to rely on appearance, older children

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PII: S0010-0277(00)00071-8

rely on function, and adults go back to relying on appearance (Gentner, 1978). While some studies support the view that the naming of artifacts for adults is essentially appearance-based (e.g. Malt & Johnson, 1992), others find that intended function is criterial (e.g. Keil, 1989). Similarly, while some studies find that 3- and 4-year-olds will extend novel artifact names to other entities of the same shape, ignoring function (e.g. Landau, Smith & Jones, 1988, 1998), others find that children will extend new artifact names to other entities of the same function, ignoring shape (e.g. Diesendruck & Markson, 1999; Kemler-Nelson, 2000; Kemler-Nelson et al., 1995).

One explanation for these conflicting findings is that appearance (and in particular, shape) and function are usually highly correlated for basic-level categories (e.g. Rosch, 1978). For example, a knife typically has a certain shape (long, thin) *and* function (to cut). Hence it can be difficult to disentangle the two factors completely and measure which feature people judge as more central. Furthermore, even for stimuli in which this correlation does not exist, judgments that seem shape-based may reflect an attempt to discern function. Thus, from a conceptual standpoint the factors are not wholly independent (see Waxman & Braig, 1996).

A different concern is that a mature understanding of artifacts might involve intuitions about creator's intent that do not entirely reduce to either shape *or* intended function (e.g. Bloom, 1996, 2000; Dennett, 1990). For instance, chairs come in a range of shapes: there are beanbag chairs, basket chairs, deck chairs, chairs for dolls, chairs shaped like hands, and chairs suspended from ceilings on chains. And although it is true that chairs are usually designed for people to sit upon, benches, stools, and sofas are also designed for this purpose; there doesn't seem to be a unique function that distinguishes chairs from these other categories (Malt & Johnson, 1992). Furthermore, there is nothing incoherent about someone creating a chair without any desire that people sit on it. For instance, it is conceivable (at least to us) that someone could build a chair solely as an exercise in carpentry. (In fact, after the chair is built, its creator might plan to destroy it promptly.) Arguably, we judge something to be a chair if we believe that it was constructed with the intent to *be* a chair, to fall into the same class as existing chairs (for discussion see Bloom, 2000).

This analysis can be extended to the naming of representational artifacts such as drawings. For instance, a simple geometrical form such as a rectangle can be taken as a picture of a dog – and be called 'a dog' – though the representation doesn't resemble a dog and cannot be said to have a 'function' in any non-trivial sense of the term. Still, we will call it 'a dog' if we believe it was created with the intent to represent a dog.

Three- and 4-year-olds seem to share such intuitions. In one study, children were first asked to draw a balloon and a lollipop, and several minutes later were asked to describe each picture. Although the resulting drawings were indistinguishable by shape, children consistently labeled them in accord with their original intentions, as 'balloon' and 'lollipop', respectively (Bloom & Markson, 1998). Similarly, Gelman and Ebeling (1998) explored the naming of representational artwork, using a design in which subjects were asked to name a series of simple depictions, some which were described as purposefully created, others as created by accident. Even 2-year-

olds were sensitive to this manipulation; for instance, they were more likely to call a bear-shaped blob of paint 'a bear' if they believed that it was purposefully created than if they thought it was the result of an accident. Such findings suggest that children are sensitive to creator's intent when naming visual representations.

But is this effect limited to artwork? To explore this, the present study explores the extent to which creator's intent underlies how children and adults name familiar artifacts, both representational artifacts such as paintings and statues, and more mundane artifacts such as tools and clothing. We predicted that, for both types of artifacts, children and adults would be more likely to provide artifact names (e.g. 'it's a knife') for objects they believe to be intentionally created, and more likely to produce other types of descriptions (e.g. 'it's plastic') for objects they believe were created by accident.

2. Method

2.1. Participants

Sixty-six subjects participated in the main study. There were 30 children in the younger child group (aged 2;9–3;11 (years;months), mean age 3;6, referred to as '3-year-olds'), 19 children in the older child group (aged 4;2–6;0, mean age 5;3, referred to as '5-year-olds'), and 17 undergraduates recruited from an introductory psychology class. Roughly equal numbers of participants were randomly assigned to each of the two conditions (Intentional condition: 15 3-year-olds, ten 5-year-olds, and nine adults; Accidental condition: 15 3-year-olds, nine 5-year-olds, and eight adults). In addition, 16 undergraduates participated in pretesting of the materials.

2.2. Materials

Materials included eight control objects and nine experimental objects (real objects, not depictions of them). Four of the experimental items (referred to as 'artifacts') were designed to be potential non-representational artifacts; five of the

Table 1
Descriptions of objects used in the study

Artifact items
Newspaper folded into the shape of a hat
Long strip of suede with holes at one end, shaped like a belt
Sharp piece of Plexiglas, shaped like a knife
Stick with frayed end, shaped like a paintbrush
Art items
Crayon scribbled on paper
Rock carved into tall shape
Block of wood with triangular pieces sawed off
Piece of sticky foam with sunflower seeds arranged in a pattern
Paint splattered on cardboard

experimental items (referred to as 'art items') were designed to be potential works of art (see Table 1 for descriptions).[1]

Two stories were written to accompany each experimental object, one describing the target object as intentionally created, the other describing it as accidentally created. For example, for one object, the Intentional story was as follows: 'Jane went and got a newspaper. Then she carefully bent it and folded it till it was just right. Then she was done. This is what it looked like.' For the same object, the Accidental story was as follows: 'Jane was holding a newspaper. Then she dropped it by accident, and it fell under a car. She ran to get it and picked it up. This is what it looked like.' (see Appendix A for a complete listing of the stories.)

2.3. Pretesting

The artifact items were selected from a larger set of 40 items that were pretested on 16 adults. The goal of the pretesting was that the test items should look like the intended object (e.g. the newspaper/hat should look like a hat), and that they could plausibly be either intentionally or accidentally created (e.g. the newspaper/hat should plausibly either be the result of a purposeful attempt to make a hat, or the result of an accident).[2]

To this end, subjects were given two tasks, in counterbalanced order. The similarity task asked participants to rate the degree to which each object looked like the target category (e.g. 'Does this look like a hat?'), answering on a scale of 1 ('not at all') to 7 ('definitely'). The origins task asked participants to rate the degree to which each object was accidentally or intentionally created (i.e. 'How do you think this object got its shape?'), answering on a scale of 1 ('definitely made by accident') to 7 ('definitely made on purpose'). For the origins task, subjects were reminded to consider how the shape of an object was made, and not the material that the object is made of (e.g. the shape of a wooden paddle was made on purpose, although the wood from which it came was not made on purpose but rather grew on a tree).

We selected items that scored above 3.5 on the similarity task, and within intermediate range (3.1–4.6) on the origins task.

2.4. Procedure

Children were tested individually in a private room at their preschool. Adults were tested individually in a quiet room at the university. Participants were randomly assigned to either the Intentional or Accidental condition.

Participants first received four control items, designed to demonstrate that it was appropriate either to name the outcome of a transformative process (e.g. 'spoon') or

[1] Adults were also tested on a 10th experimental object that was not included when testing children, because adult responses to that item could not be coded clearly. Responses to this item were not included in the analysis.

[2] The art items were not pretested, as they were not designed to have any particular shape. However, as will be clear from the presentation of the results, participants in the main study appeared to have no difficulty accepting that the art items were either intentionally or accidentally created.

to provide a description of the materials (e.g. 'plastic'). Control items in the Intentional condition all described a material/substance that was intentionally transformed (e.g. sawed, shaped, drilled, or cut), resulting in a clearly identifiable object (e.g. a piece of metal that was transformed into a spoon). Control items in the Accidental condition all described a material/substance that was accidentally transformed (e.g. knocked over, torn by accident, scratched by a cat), resulting in a modified material/substance that is not in the shape of any object (e.g. a ripped piece of Styrofoam). Children were asked one yes/no question about each item. In each condition, two of the questions asked about the outcome (e.g. 'Is it a spoon?'), whereas two of the questions asked about the material (e.g. 'Is it metal?'). For each type of question, the correct response was 'yes' to one question and 'no' to the other. See Appendix B for the full set.

Following the control items, all participants were told, 'The rest of the stories are about a girl named Jane. One thing you should know about Jane is that she broke her arm, and her arm is in a cast.' This cover story was used to motivate why the character was so clumsy, in the Accidental condition, and so imperfect, in the Intentional condition. (See Bloom & Markson, 1998, for a similar manipulation.) A line drawing of a girl wearing an arm cast was shown and identified as Jane.

Participants received all nine experimental items in one of two randomized orders. Each order was constrained so that no more than two items in a row were of the same type (Art or Artifact). For each experimental item, the researcher first read the story (Intentional or Accidental, depending on the condition), then showed the participant the corresponding object and asked, 'What is this?' Children indicated their response verbally; adults wrote their response on a page in an answer booklet. If a child responded with 'I don't know', one more prompt was provided on that item. No feedback was provided.

3. Results

Each response was coded into one of four categories. Below are actual examples from children's responses. (a) *Naming*. Providing the name of the transformed object that was not mentioned in the original story (e.g. 'a hat' for the object made out of newspaper). Naming responses were also coded if, on the art items, the participant named what was represented (e.g. 'fireworks' for the splattered paint on cardboard). (b) *Material*. Referring to materials that had been mentioned in the original story (e.g. 'newspaper' for the object made out of newspaper). (c) *Don't know*. Shrugging or saying 'I don't know'. This code was used only in the absence of any other response on that item. For example, if a participant said 'I don't know, a boat', this would be coded as a Naming response only. (d) *Other*. Mentioning physical resemblance (e.g. 'looks like a house'; 'all mushed up'); providing an unclear response; no response. Two coders independently coded data from all participants. Agreement on coding was 96% for the adults' data, 95% for the 5-year-olds' data, and 89% for the 3-year-olds' data.

For each participant, the responses of each type were summed. When a participant

provided more than one response per item, different response types were each counted, although different responses within a given type were not counted more than once. For example, one 5-year-old said, 'a neck of a giraffe; a horse' in response to the 'drawing' item, and was scored as providing one Naming response. Altogether, multiple responses were rare.

Table 2 presents the data from all four response categories as a function of age group and condition, collapsed across item type. As can be seen, the majority of responses were coded in one of two response categories: either Naming or Material (73% at age 3; 81% at age 5; and 97% among adults). Therefore, the statistical analyses focused on just these two response categories.

The number of Naming responses and the number of Material responses were summed separately for each participant and item type (art versus artifact). Then, a difference score was computed for each item type, consisting of the number of Naming responses minus the number of Material responses. This difference score was taken as reflecting the extent to which subjects named the kinds of objects versus described the substances that the objects were composed of. For instance, an overall score of 5 on the art items would correspond to a participant who described all of the art stimuli with object names ('Naming' – e.g. 'painting', 'statue'), and a score of -5 would correspond to a participant who described all of the art stimuli in terms of what they were composed of ('Material' – e.g. 'wood', 'paper'). Finally, the difference scores for the artifacts were multiplied by 1.25, to correct for the smaller number of items of that type (four artifact items versus five art items) and thereby enable direct comparisons between the two item types.

These data were entered into a 3 (age: 3-year-olds, 5-year-olds, adults) $\times$ 2 condition (Intentional, Accidental) $\times$ 2 (item type: Art, Artifact) ANOVA. Age and condition were between-subjects variables, and item type was a within-subject variable. Table 3 presents the means as a function of condition, item type, and age.

Results indicate a main effect of condition ($F(1, 60) = 46.23$, $P < 0.001$). As predicted, the difference score was higher in the Intentional condition ($M = 1.07$) than in the Accidental condition ($M = -2.09$). Furthermore, there was a significant

Table 2
Mean % of responses of each of the four types, as a function of age group and condition

	Naming (%)	Material (%)	D/K (%)	Other (%)
3-year-olds				
Intentional	41	39	8	16
Accidental	16	53	8	23
5-year-olds				
Intentional	58	23	8	12
Accidental	30	54	2	15
Adults				
Intentional	72	30	0	0
Accidental	14	82	0	6

age × condition interaction ($F(2, 60) = 4.08$, $P < 0.05$), reflecting the fact that the magnitude of the effect increased with age. Nonetheless, the condition difference was significant within each age group considered separately (3-year-olds: $F(1, 28) = 12.76$, $P < 0.01$; 5-year-olds: $F(1, 17) = 8.40$, $P = 0.01$; adults: $F(1, 15) = 20.27$, $P < 0.001$).

There was also a non-significant trend for a three-way interaction involving age × condition × item type ($F(2, 60) = 3.04$, $P = 0.0552$). Although the condition effect held up for every item type at every age (see Table 3), for 5-year-olds only there was a larger condition effect for art items than for artifact items ($F(1, 17) = 5.15$, $P < 0.05$).

3.1. Controlling for performance on control items

Although the control items were designed to ensure that subjects knew that both Naming and Material responses were appropriate, some of the participants rejected either Naming or Material responses that were provided on these items. For example, some children in the Intentional condition reported that the intentionally-created cardboard box was not cardboard (Material), because 'it's a box' (Naming). Because we were predicting Naming responses in the Intentional condition, it seemed particularly important to ensure that subjects in this condition realized that Material responses were appropriate on the Intentional controls. Likewise, because we were predicting Material responses in the Accidental condition, it seemed most important to ensure that subjects in this condition realized that Naming responses were appropriate on the controls.

Therefore, we conducted a secondary analysis that included only those participants who correctly answered 'yes' on the 'cardboard' control item in the Intentional condition (thereby endorsing a Material response) and those who correctly answered 'yes' on the 'stain' item in the Accidental condition (thereby endorsing a Naming response). This analysis excluded ten 3-year-olds (seven in the Intentional condition, three in the Accidental condition), two 5-year-olds (both in the Intentional condition), and one adult (in the Accidental condition). At each age, a *t*-test was conducted, comparing participants' total difference scores (which could range from −9 to 9) across the two conditions. As found earlier, subjects scored higher

Table 3
Mean adjusted difference score (naming minus material responses) as a function of item type, condition, and age (standard deviations in parentheses)[a]

	Art items		Artifact items	
	Intentional	Accidental	Intentional	Accidental
3-year-olds	− 1.00 (1.65)	− 2.20 (2.11)*	1.10 (2.18)	− 1.75 (2.35)**
5-year-olds	2.20 (1.81)	− 1.67 (3.00)**	1.12 (1.71)	− 0.69 (2.73)*
Adults	2.00 (2.55)	− 3.87 (0.99)**	2.22 (4.23)	− 2.81 (2.81)**

[a] *Significant condition difference by *t*-test, $P < 0.05$, one-tailed; **significant condition difference by *t*-test, $P < 0.02$.

in the Intentional condition than the Accidental condition, at all ages (3-year-olds: $M = 0.25$ and -3.08, respectively, $t(18) = 3.19$, $P < 0.01$; 5-year-olds: $M = 3.5$ and -2.22, respectively, $t(15) = 2.97$, $P < 0.01$; adults: $M = 3.78$ and -6.29, respectively, $t(14) = 4.49$, $P < 0.001$).

3.2. Item analyses

We also examined results for each item separately, and found that the condition differences were representative of the set of items as a whole. For 3-year-olds, all four artifact items and three of the five art items went in the predicted direction; one art item went in the opposite direction, and one art item was equal across the two conditions. For 5-year-olds, three of the four artifact items went in the predicted direction, one artifact item went in the opposite direction, and all of the art items went in the predicted direction. For adults, all of the nine items showed a condition difference in the predicted direction.

3.3. Naming responses to art items

A final issue concerns the nature of the naming responses to the art items. As noted above, two kinds of naming responses were included: those that named the resulting object as artwork (e.g. 'painting', 'statue', 'drawing', 'decoration'), and those that named what was represented (e.g. 'fireworks', 'a fish', 'a man'). As shown in Table 4, naming the object as artwork was quite rare among the children, but increased to nearly half of the naming responses among the adults. This developmental pattern might have an uninteresting explanation (e.g. perhaps children do not know artwork names such as 'painting'), but it could conceivably reflect a more revealing conceptual difference. For example, perhaps children are seeking to name the specific entity that is represented, while adults are more interested in naming representational kinds. This issue awaits further research.

4. Discussion

The present results suggest that intuitions about intent play an important role in

Table 4
Naming responses to artwork, as the number (proportion) of all trials: Naming the object as artwork (NOA) versus Naming what is represented (NWR)

	Intentional			Accidental		
	NOA (%)	NWR (%)	No. of naming responses	NOA (%)	NWR (%)	No. of naming responses
3-year-olds	14	86	21	17	83	12
5-year-olds	10	90	30	18	82	11
Adults	47	53	32	67	33	3

how children name artifacts. Even 3-year-olds (the youngest age group tested) take intentionality into account when deciding what to name an object; they are more prone to use an object name when the object is described as purposefully created, and to describe the substance when the object is described as the result of an accident. Indeed, although the adults did show the most powerful condition effects, we did not find substantial variability in performance due to age.

These results serve to replicate recent findings that intentionality is key to children's naming of drawings (Bloom & Markson, 1998; Gelman & Ebeling, 1998). At the same time, they extend the results to the naming of other sorts of artwork and, more importantly, to non-representational artifacts such as tools and clothing. This extension is noteworthy for two reasons. First, artwork is self-consciously interpretive, it is owned, signed, and named by the artist, and the importance of creator's intent for artwork is often highlighted in this domain, as we often ask even preschoolers to explain what their artwork depicts. Because of this, representations could be considered a special case. But we find instead that intentionality is salient even when naming everyday objects, as 'a knife', 'a hat', and so on.

Second, the items we used were three-dimensional objects that were presented at close range to subjects. But despite the immediacy and richness of the perceptual information, it did not override other information when determining children's patterns of naming. For example, although the Plexiglas knife looked very knife-like in shape and substance, 3-year-olds were more likely to call it 'a knife' when it was the result of an intentional creation process, than when it was the accidental result of an unintentional process. This suggests that the child's focus on intentionality is not a 'last-resort' consideration, something that applies only when other information is absent. It suggests also that the effects we found are likely to extend outside of a laboratory setting.

None of this is to deny that children are sensitive to both shape and function, and that such cues usually suffice for the normal naming and categorization of artifacts. But our results are consistent with the theory that shape and function are important only because they are such reliable cues to creator's intention. As Dennett (1990) puts it, "There can be little doubt what an axe is, or what a telephone is for; we hardly need to consult Alexander Graham Bell's biography for clues about what he had in mind." From this perspective, the relative importance of shape and function in a given context might reflect the extent to which these factors are taken as reflections of creator's intent. For instance, certain simple functions (such as being able to soak up water) can occur by accident and hence are relatively irrelevant for artifact naming, while more complex functions (such as serving as a musical instrument) are typically the result of purposeful intent and hence are seen as more relevant for naming. In Bloom (2000), it is argued that this analysis can help make sense of the apparently conflicting developmental findings, such as Landau et al. (1998), who found a shape bias, and Kemler-Nelson et al. (1995), who found a function bias.

The proposal that children are trying to make sense of creator's intent when naming artifacts raises the question of where this understanding comes from. It might be in part due to the child's experience with language – adults use artifact names such as 'chair', 'clock', and 'toy' to describe diverse sets of items, and this

might motivate children to seek cues to category membership that go beyond shape and function. A different possibility (but consistent with the above) is that children's intention-based understanding of artifact names is a by-product of two more general aspects of their mental life. Firstly, they are 'naive essentialists', in that they seek to understand the superficial properties of objects in terms of deeper, more essential aspects of their nature (see Gelman & Hirschfeld, 1999). Secondly, they are highly interested in the goals and desires of other people (e.g. Meltzoff, 1995). Together these two aspects of children's thought might explain why they see the intent of an artifact's creator as an important consideration when deciding how an object should be named.

Acknowledgements

This research was supported by NICHD grant HD36043 to the first author and a grant from the Spencer Foundation to the second author. We are grateful to the children who participated in the research, and to the children, parents, staff, and teachers at the University of Michigan Children's Center and the University of Michigan Center for Working Families for their support. We thank Jonathan Flukes, Cristina Bares, and Carol Amin for their able research assistance, and three anonymous reviewers for helpful suggestions and comments.

Appendix A. Experimental stories (I, Intentional; A, Accidental)

The names in parentheses preceding the stories describe what the objects resembled, but they were never mentioned to the participants.

Artifact items

(Hat):	(I) Jane went and got a newspaper. Then she carefully bent it and folded it until it was just right. Then she was done. This is what it looked like. (A) Jane was holding a newspaper. Then she dropped it by accident, and it fell under a car. She ran to get it and picked it up. This is what it looked like.
(Belt):	(I) Jane chose a piece of cloth. She got her scissors and carefully cut out a long piece. Then she used her hole-punch and punched five holes in it. This is what it looked like. (A) Jane was holding a piece of cloth. By mistake, it got caught in a very sharp machine, and one piece ripped off. Then the sharp machine punched some holes in it. This is what it looked like.
(Knife):	(I) Jane bought a piece of plastic. She got out her saw and carefully sawed the plastic. Then she made it all smooth with sandpaper. Then she was done. This is what it looked like.

(*continued*)

	(A) Jane had a piece of plastic. She dropped it and it broke into lots of different pieces. She said, 'Oh, no!' Then she picked up one of the pieces off the floor. This is what it looked like.
(Paintbrush):	(I) Jane found a piece of wood. One day she took out a small saw and carefully cut the wood on one end. She spread it out with the saw. This is what it looked like. (A) Jane found a piece of wood. One day she wasn't paying attention and her dog came over and chewed on one end of it. This is what it looked like.

Art items

(Drawing):	(I) Jane took a crayon and a piece of paper. She sat down at her desk and she carefully made a couple of lines on the paper. Then she was done. This is what it looked like. (A) Jane's dog took a crayon in its mouth and ran up and down on top of Jane's desk. There was a paper on the desk and the crayon rubbed against it a couple of times. This is what it looked like.
(Statue 1):	(I) Jane walked around in her back yard and found the nicest rock she could see. She carefully chipped off pieces of the rock by hitting it with a hammer, and made it all smooth with a piece of sandpaper. This is what it looked like. (A) Jane picked up a rock in her backyard. She was feeling very angry, so she threw the rock against the wall over and over again, and little pieces of it broke off. This is what it looked like.
(Statue 2):	(I) Jane bought a big piece of wood. One day she used a knife and carefully cut off little pieces of it. Then she rubbed the wood with oil so that it would be all shiny. Then she was done. This is what it looked like. (A) Jane bought a big piece of wood. She used a knife to cut off little pieces of it so that she could use the little pieces to build a dollhouse. After she cut off all of the pieces, she threw the rest of the wood in the garbage.
(Collage):	(I) Jane had a piece of sticky foam in her classroom. She picked up a bag of seeds and carefully put the seeds on it, slowly putting them in all different places. This is what it looked like. (A) Jane picked up a bag of seeds and was walking over to put them in her garden. But she tripped over her shoelaces, and all of the seeds spilled out and they landed on a piece of sticky foam. This is what it looked like.

(*continued*)

(Painting):	(I) When Jane was in school, she used some paint to make something for her teacher. This is what it looked like. (A) When Jane was in the basement, she accidentally spilled some paint on a piece of paper. This is what it looked like.

Appendix B. Control stories

The names in parentheses preceding the stories describe what the objects resembled, but they were not presented to the participants (apart from what was stated in the stories).

Intentional condition

(Spoon):	George had a piece of metal. He carefully sawed out a piece and shaped it with special tools. When he was done, this is what it looked like. Is it a spoon?
(Shoelace):	Janet had a piece of cloth. She carefully measured it and put little pieces of plastic on the ends. When she was done, this is what it looked like. Is it a chair?
(Button):	Robert had some plastic. He carefully sawed a little piece and drilled four holes in it. When he was done this is what it looked like. Is it metal?
(Box):	Elizabeth had a piece of cardboard. She carefully cut it out with scissors. Then she folded it and glued it together. This is what it looked like. Is it cardboard?

Accidental condition

(Stain):	George had some soup. His cat came by and knocked it over onto the rug by mistake. When he looked down, this is what it looked like. Is it a stain?
(Styrofoam):	Janet had a piece of Styrofoam. By mistake she dropped it into a blender, and it got all torn up by accident. When she took it out, this is what it looked like. Is it a chair?
(Tape):	Robert had some tape. He was trying to unroll a long piece, but by accident it all got stuck together. When he finally got his fingers unstuck, this is what it looked like. Is it metal?
(Cardboard):	Elizabeth had a piece of cardboard. She accidentally left it on the floor. When she came back to get it, her cat had been scratching on it. This is what it looked like. Is it cardboard?

References

Bloom, P. (1996). Intention, history, and artifact concepts. *Cognition*, *60*, 1–29.

Bloom, P. (2000). *How children learn the meanings of words*. Cambridge, MA: MIT Press.

Bloom, P., & Markson, L. (1998). Intention and analogy in children's naming of pictorial representations. *Psychological Science*, *9*, 200–204.

Dennett, D. C. (1990). The interpretation of texts, people, and other artifacts. *Philosophy and Phenomenological Research*, *50*, 177–194.

Diesendruck, G., & Markson, L. (1999). *Function as a criterion in children's object naming*. Poster presented at the Biennial Meeting of the Society for Research in Child Development, Albuquerque, NM.

Gelman, S. A., & Ebeling, K. S. (1998). Shape and representational status in children's early naming. *Cognition*, *66*, 35–47.

Gelman, S. A., & Hirschfeld, L. A. (1999). How biological is essentialism? In S. Atran, & D. Medin (Eds.), *Folkbiology*. Cambridge, MA: MIT Press.

Gentner, D. (1978). What looks like a jiggy but acts like a zimbo? A study of early word meaning using artificial objects. *Papers and Reports on Child Language Development*, *15*, 1–6.

Kemler-Nelson, D. G. (in press). Attention to functional properties in toddlers' naming and problem-solving. *Cognitive Development*.

Kemler-Nelson, D. G.11 Swarthmore College Students (1995). Principle-based inferences in young children's categorization: revisiting the impact of function on the naming of artifacts. *Cognitive Development*, *10*, 347–380.

Landau, B., Smith, L. B., & Jones, S. S. (1988). The importance of shape in early lexical learning. *Cognitive Development*, *3*, 299–321.

Landau, B., Smith, L. B., & Jones, S. S. (1998). Object shape, object function, and object name. *Journal of Memory and Language*, *38*, 1–27.

Malt, B. C., & Johnson, E. C. (1992). Do artifact concepts have cores? *Journal of Memory and Language*, *31*, 195–217.

Meltzoff, A. N. (1995). Understanding the intentions of others: re-enactment of intended acts by 18-month-old children. *Developmental Psychology*, *31*, 838–850.

Rosch, E. (1978). Principles of categorization. In E. Rosch, & B. B. Lloyd (Eds.), *Cognition and categorization* (pp. 27–48). Hillsdale, NJ: Erlbaum.

Waxman, S., & Braig, B. (1996, April). *Stars and starfish: how far can shape take us?* Paper presented at the 10th Biennial International Conference on Infant Studies, Providence, RI.