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ABSTRACT

Studies have investigated and proposed different potential influences on children's initial mappings of object words to referents. Each proposal is a variant on the idea that children use one source of evidence about the structure of word meanings or of grammar to discover other forms of structure, and in doing so they "bootstrap" their way into language competence. Research suggests that young infants are coming to the task of language learning attending to labeled events in ways that may assist language learning. Infants as young as 9 months appear to be focusing more selectively on objects, as long as the object is consistent, when an event is labeled. Studies also suggest that infants are becoming sensitive to structure in the input from an early age. By the age of 13 months, certain linguistic frames seem to be more effective than others in directing infants' attention toward objects. Thus, both prelinguistic attentional biases and sensitivity to linguistic structure may be interacting early in the language learning process to facilitate the acquisition of word meaning. (MM)

ATTENTIONAL PREDISPOSITIONS AND LINGUISTIC SENSITIVITY IN THE ACQUISITION OF OBJECT WORDS

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The goal of this paper is to describe a series of studies investigating several different potential influences on children's initial mappings of object words to referents. This research may have implications for the idea that children "bootstrap" their way into language. Although several different versions of the bootstrapping perspective have been proposed, each of these proposals is a variant on the idea that children use one source of evidence about the structure of word meanings or of grammar to discover other forms of structure and, in doing so, "pull themselves up" into competence with their language (e.g., Gleitman, 1990; Pinker, 1984). Where the views differ is with respect to whether the initial wedge is provided by structure in the language or in the child's head, and whether it is conceptual or linguistic. For the most part, however, it is a difference in emphasis: Most views permit some role for each of these components. In this paper, I will focus on the issue of whether the structure is in the child's head or in the input (or, more accurately, I will focus on interactions between the two) and I will avoid the issue of whether it is conceptual or linguistic in nature.

Structure in the child's head, in the form of particular predispositions or biases, could assist early word learning by restricting the number of elements of an event that a child will consider as possible referents for a word. One proposed bias is an expectation that words should be associated with whole objects and not with parts or properties of objects (e.g., Markman, 1990; Mervis, 1987). In a series of studies, I investigated the possibility that this *whole object assumption* may derive from a tendency to attend more selectively to objects in the presence of labeling. More specifically, the reasoning was as follows: If something like a whole object assumption is to assist with early word learning, then it needs to be present before children begin to talk. But where might a whole object assumption come from? One possibility is that it derives from perceptual or attention predispositions and, in particular, from a tendency to become more selectively focused on objects in the presence of labeling. The rationale is as follows: In order to understand their world, infants will need to attend to various aspects of events. However, when learning language, they will need to direct their attention to one aspect of an event. It may be that there is something about labeling (perhaps initially simply the intonation) which directs infants' attention to objects. Indeed, there is work which suggests that labeling increases 10-14 month old infants' interest in objects (Baldwin & Markman, 1989). Initially, the attention-directing tendency may be very general. However, it could assist word-learning by insuring that the child's attention would be directed toward an object just when the label for that object was given. With time then, the child could learn specific associations between words and referents.

Because the same general design is used for all of the studies that I will discuss, I will describe it now. An habituation procedure is used in which infants are familiarized to one of two types of sequences. Infants are seated on a parents' lap facing a puppet stage in which they see events involving moving objects (see Figure 1). Infants in a *consistent object condition* see a single object undergoing three different motions. Infants in a *consistent motion condition* see three different objects, all undergoing the same motion. All infants see two types of test trials: (a) a *novel object* paired with a previously seen motion and (b) a *novel motion* paired with a previously seen object. (The design is presented schematically in Figure 2). In addition, for half of the infants in each condition, a nonsense word label embedded in a real speech frame accompanies the familiarization trials; the remaining half hear no labeling. The dependent measure is the length of time that infants look during each of the test trials.

If labeling results in a general increase in attention to objects, then infants in either the consistent object or the consistent motion condition should be more selectively focused on the objects (and less attentive to the motions) in the presence of labeling than in the absence of labeling. As a result, infants who hear labeling during familiarization trials should be more likely to notice the change in object than infants who hear no labeling; no such increase in attention to the change in motion during the test trials would be predicted. A second possibility is that instead of directing infants' attention to objects, labeling may direct infants' attention to an element that is consistent across labeled events. In such a case, infants should attend during familiarization to whatever element is consistent across familiarization trials. In the consistent object condition, this would still be the object; however, in the consistent motion condition, the motion would be the consistent element. Thus, in this view, infants in the consistent motion condition should, if they heard labeling, be more attentive to the motion during familiarization and, as a result, more attentive to the change in motion during the test trials than infants who heard no labeling.

The first two studies were with infants of about 9 and of about 14 months of age. The results revealed a change in focus of attention between the two age groups: Although 14-month old infants showed the expected increase in attention to objects with labeling, 9-month olds appeared to show increased attention to an element that was consistent across labeled events (see Figures 3 and 4). These results could suggest an interesting change, between 9- and 14-months, in the way in which infants attend to labeled events. One possible interpretation of these results is that a tendency to focus on objects in the presence of labeling comes into play between 9 and 14 months, a period of transition between an essentially prelinguistic period and the beginnings of language. Indeed, it may be that a tendency to attend to objects in the presence of labeling is related to that transition. However, before that interpretation can be embraced, some alternate possibilities and issues need to be discussed.

The first question concerns what is going on with the 9-month olds. The pattern of results could suggest that 9-month olds were attending to the consistent element: In the consistent motion condition, infants who heard labeling looked significantly longer for the change in motion than did infants who heard no labeling. There is, however, another possible account for these results. It could be that the 9-month olds were actually more sophisticated than was originally expected. The original suggestion was that labeling may result in a general enhancement of attention to objects. However, the observed results could potentially be accounted for if labeling resulted not in a general facilitation of attention to objects, but in a tendency to focus on a specific object or even to associate a label with a specific element. In the consistent motion condition, infants heard a single label associated with three different objects. If they were expecting the label to be associated with a single object, they could have shown a decrease in relative looking to the novel object not because they were attending to consistency but rather because they were confused by the multiple objects. Indeed, although infants in the consistent motion condition who heard labeling showed a significant increase in attention to the novel motion, relative to infants in the unlabeled condition, the relative amount of time spent looking at the novel motion was not significantly different from chance (due to a slight object preference in the unlabeled condition; see Figure 4).

A recent study sought to distinguish the possibility that the 9-month old infants were attending to a consistent element (that is, the consistent motion) from the possibility that they were expecting a single object. The design for this study was similar to that the design described above except that only the consistent motion condition was run and, during the test trials, the object was always novel: The test trials consisted of (a) a novel object paired with a familiar motion and (b) a novel object paired with a novel motion. If labeling is directing infants' attention to the consistent element (i.e., the motion), then infants who hear labeling should attend more to the motion during familiarization and, as a result, should look relatively longer for test trials of type (b) than those of type (a). In contrast, if infants are focused on the object during familiarization, but expect the single label to correspond to a single object, then infants should fail to distinguish between the familiar motion and the entirely novel test trials. As can be seen in Figure 5, results are most consistent with this second possibility: Infants showed no preference for either of the two types of test trials regardless of whether they heard labeling.

The results of this third study are consistent with the suggestion that these young infants expect a one-to-one correspondence between labels and objects. That interpretation may, however, be extending a bit too much beyond the data. A perhaps safer interpretation is that there is an interaction between objectness and consistency such that labeling directs attention to objects but

only if they are consistent. In any event, these results do not support the suggestion that labeling directs attention to any consistent element.

What then can be said for the change, between 9 and 14 months, in infants' attention to labeled events? As was mentioned earlier, one possible interpretation is that a general tendency to focus on objects in the presence of labeling comes into play between 9 and 14 months. Such a tendency could be related (either as a result of or as a contributor to) the changes in language ability which are occurring during that period. However, if younger infants are already sophisticated enough about word-referent relations to expect a single object to be associated with a single label, or even if it is the case that labeling directs attention to objects as long as they are consistent, then it seems surprising that labeling should have a more general effect on the attention of older infants. There is, however, another possible explanation for the results observed with older infants. The nonsense word labels were always presented in frames of the form *itsa*_____, *thatsa*_____, and *theresa*_____. Perhaps these older infants were also more sophisticated than originally expected and had figured out that frames like *itsa* ____ and *thatsa* ____ tend to indicate objects.

One additional study sought to investigate this possibility. This fourth study also used a procedure similar to that described above, except that one additional labeling condition was added. Infants were assigned to one of three labeling conditions: (a) an *unlabeled condition*, (b) a *noun-labeled condition* and (c) a *verb-labeled condition*.[1] The first of these two conditions corresponded to the two labeling conditions in Studies 1, 2 and 3. The verb-labeled condition was, however, a new condition: Infants assigned to that condition heard the nonsense-word labels embedded in a verb-like frame (e.g., *it's gepping*). If the 14-month old infants were noticing the frame in which a word was presented and, in particular, were using the "noun" frame to direct their attention to objects, then the attentional patterns of infants in the noun-labeled condition should differ from those in the verb-labeled condition. In particular, labeling should be more effective in directing infants' attention to objects in the noun-labeled condition than in the verb-labeled condition. Indeed, if infants were much more sophisticated than we had expected, it might even be the case that the verb labeling would draw infants' attention to the motion. In contrast, if it is only something general about language which is directing infants' attention, then there should be no differences between the noun-labeled and verb-labeled conditions.

Results did reveal an effect of frame type on the 13-month old subjects' attention to labeled events. (See Figure 6). Considering first the comparison between the noun-labeled and unlabeled conditions (which essentially replicates Study 2), it can be seen that the results are more consistent with results obtained with 9-month olds than with 14-month olds: Infants in the consistent object condition showed an increase in looking to the novel object with labeling, but only if the object had been consistent. This difference may be due to differences in the age or subject pool, or to other slight differences in methodology. Turning to the differences between the noun-labeled and verb-labeled conditions, we do find evidence of an effect of frame: Infants in the noun-labeled condition showed a greater increase in attention to the novel object than did infants in the verb-labeled condition. However, infants in the verb-labeled condition also showed some increase in attention to the novel object. Thus, these results suggest that 13-month old infants may be sensitive to the distinction between a noun- and a verb-frame and that the noun-frame may be more successful in directing attention to objects, but they also suggest that there may be a general effect of labeling on infants' attention to objects; these results provide no evidence that a verb-frame may direct attention to motion.

Again, however, there are alternate interpretations for these results. In particular, it is not clear that this study provided a fair test of sensitivity to a verb-frame. Recall that the verb-frame was of the form *that's* _____*ing*, with an example being *that's geping*. It could be that infants perceived this frame as a proper noun frame with, for example, *geping* being a name. If some subset of the infants had that interpretation of the frame and others had either a verb interpretation or no interpretation, then the slight facilitation of attention to the novel object in the verb-labeled condition could result not from a generalized effect of labeling on attention to objects but, rather, differences in interpretation of the frame. Regardless of the explanation, infants did respond

[1] The use of the terms *noun-label* and *verb-label* is not intended to imply that infants are treating the words appearing in these frames as nouns or verbs; it is simply a convenient description.

differently in the verb-labeled than in the noun-labeled condition, indicating that 13-month old infants are showing some sensitivity to the frame in which a novel word is presented.

What interpretations can be drawn concerning infants' attention to labeled events and, more generally, concerning how infants may bootstrap their way into an understanding of word meaning? Given the nature of the results, it is clear that suggestions must be made with caution. However, it does seem that young infants are coming to the task of language learning attending to labeled events in ways that may assist language learning: Infants as young as 9 months appear to be focusing more selectively on objects, as long as the object is consistent, when an event is labeled. These studies also suggest that infants are becoming sensitive to structure in the input from an early age: By the age of 13 months, certain linguistic frames seem to be more effective than others in directing infants' attention toward objects. Thus, both prelinguistic attentional biases and sensitivity to linguistic structure may be interacting from early in language learning to facilitate the acquisition of word meaning. Additional work clearly is needed to provide additional support for these suggestions, to determine the relative contributions of each, and to fill out the picture. The research described here represents an initial contribution toward understanding how children initiate word-referent mappings.

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Figure 1

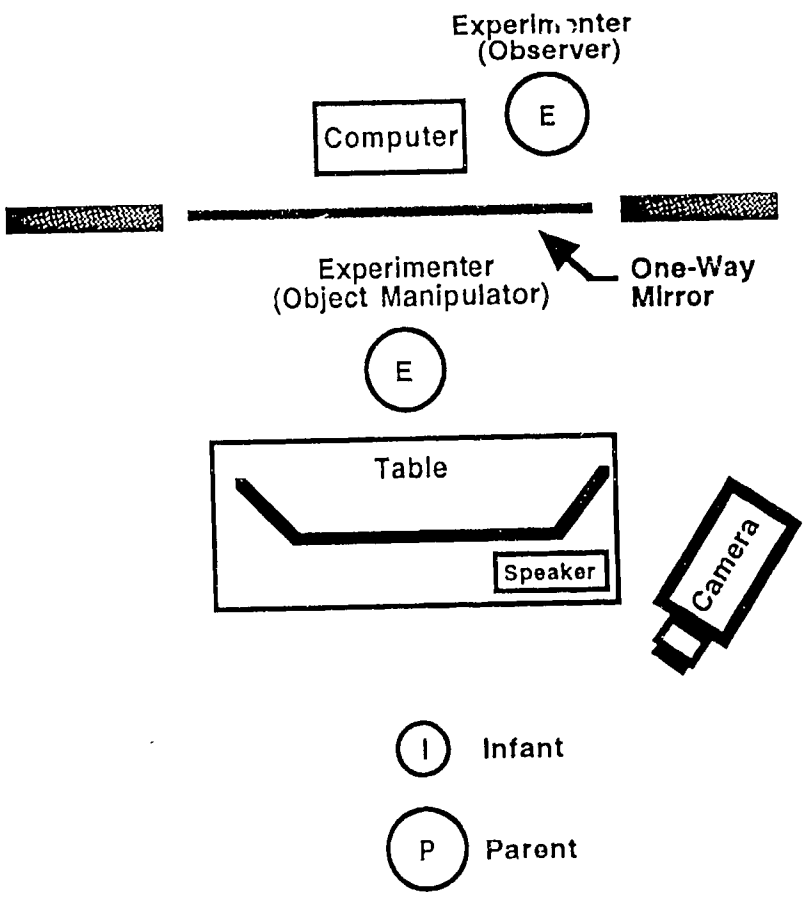

Figure 2

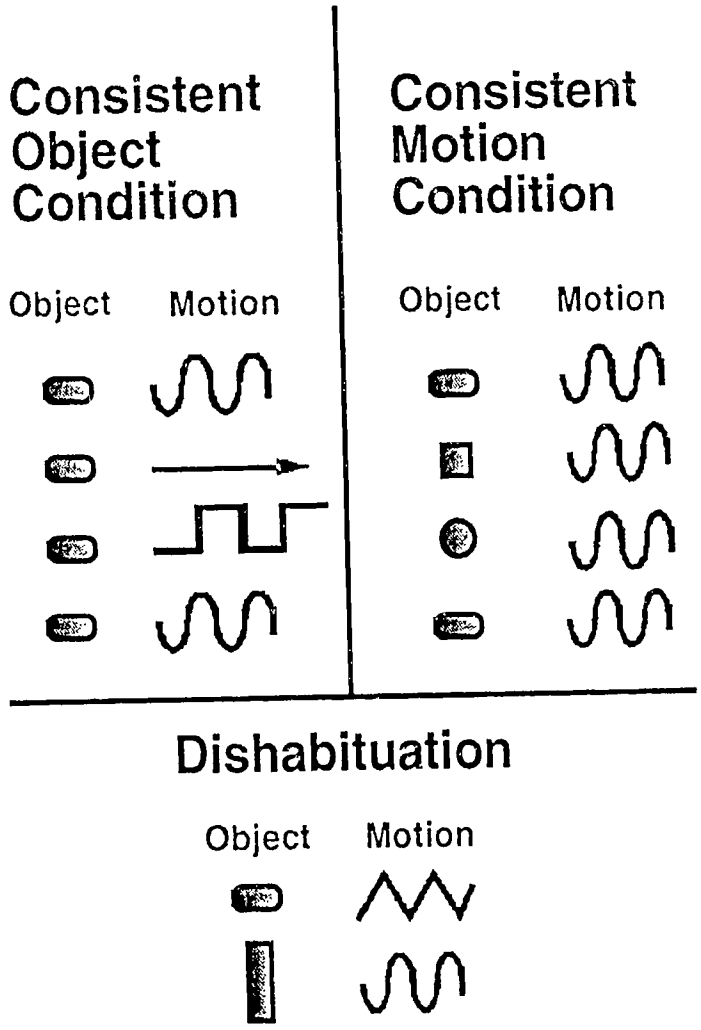

Figure 3

Proportion Looking to the Novel Object: Nine-Month Old Infants

	Consistent Motion	Consistent Object
Unlabeled	.55	.56
Labeled	.47	.59

Note: Results are presented in proportion looking to the novel object, which is the amount of time spent looking at the novel object during the test trials divided by the total amount of time spent looking at the novel object and novel motion test trials. Thus, a proportion of greater than .50 indicates a preference for the novel object, whereas one of less than .50 indicates a preference for the novel motion.

Figure 4

Proportion Looking to the Novel Object: Fourteen-Month Old Infants

	Consistent Motion	Consistent Object
Unlabeled	.50	.52
Labeled	.59	.62

Figure 5

Looking Behavior of Nine-Month Old Infants to Familiar and Novel Motions

	Unlabeled	Labeled
Familiar Motion	14.9	14.0
Novel Motion	14.2	15.3
Proportion Novel Motion	.49	.53

Note: Looking times for familiar and novel motion are raw mean scores given in seconds; proportion novel motion is calculated as described above except that time looking at the novel motion is divided by the sum of looking to both types of test trials.

Figure 6

Proportion Looking to the Novel Object: Thirteen-Month Old Infants

	Consistent Motion	Consistent Object
Unlabeled	.56	.43
Noun-Labeled	.48	.70
Verb-Labeled	.49	.57