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When is it best to hear a verb? The effects of the timing and focus of verb models on children's learning of verbs*

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ABSTRACT

This paper explores the effects of certain aspects of verb input on verb acquisition. It has been observed that the timing of a verb model affects children's learning of the verb (Tomasello & Kruger, 1992). It has also been observed that the focus of the event to which the verb refers affects the argument structure children assign to the verb (Pinker, 1989). This experiment investigated the interaction between the timing of verb models and the focus of the events to which they refer. Thirty children aged from 2;3 to 3;6 heard two novel verbs, one movement focused and the other result focused. Half heard the verbs before the event (impending condition) and half after it (completed condition). An interaction of verb timing and verb focus was found. The movement verb was learned better in the impending condition and the result verb in the completed condition. The contribution of this finding to our understanding of the processes involved in verb acquisition is considered.

INTRODUCTION

Understanding how children discover the properties of verbs is a major challenge for child language research. From their exposure to events and the utterances that refer to them, children must deduce a relationship between the event and the verb-argument structures which describe it. This relationship is by no means transparent. As Tomasello & Kruger (1992) point out, concrete nouns have permanent referents which are often present when the child hears the word. Verbs, however, often refer to transient events or to

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events which are anticipated or completed when an utterance occurs, which may make it difficult for children to work out what they refer to.

Timing of the verb in relation to the event is only a part of the problem, however. Events are ambiguous in their interpretation in a way that the referents of nouns are not. Fisher, Hall, Rakowitz & Gleitman (1994) and Gleitman & Gillette (1995) report an experiment showing that even simple scenes may be viewed from different points of view which, in turn, may be expressed by different verbs. Adult subjects watched a silent video of mothers playing with their children and were required to guess the noun or verb used by the mother at a particular point. Subjects were near to ceiling with nouns, guessing correctly about 80% of the time even on first exposure, but they correctly identified verbs less than 15% of the time. Evidently, the relationship between verbs and the scenes they depict is not predictable.

To illustrate the difficulties a child faces, imagine viewing a simple scene such as a baby dropping a rattle. The event is transient and reference to it is likely to follow its completion. The speaker may take the perspective of the baby, the rattle, or both and this choice determines the choice of verb and the arguments used with it. Thus 'The baby let go', 'The rattle dropped', or 'The baby dropped the rattle' are all appropriate. The speaker also selects those features of the event on which to focus. Thus direction or manner of the movement of the rattle may be selected resulting in 'The baby dropped the rattle' or 'The baby threw the rattle'. Worse still, the speaker may comment on related but unobservable aspects of the event such as its cause or effect resulting in utterances such as 'She doesn't want her rattle' or 'She's lost her rattle'. The problem for a child witnessing this scene is to identify the verb and to decide which of the many aspects of the observed event it encodes.

It must be assumed that children detect subtle cues which enable them to work this out. The challenge for child language research is to discover the nature of these cues. If it can be shown that some feature of verbs or of their contexts facilitates their acquisition, it may be inferred that the child is sensitive to and cued by that feature. Experimentally this may be achieved by manipulating the features of verbs, previously unknown to the child, and showing that these affect comprehension and/or production of those verbs. Current research has used this approach to explore hypotheses about the variables which facilitate verb acquisition.

Tomasello & Kruger (1992) have considered how the timing of verb models might affect acquisition. They predicted that children will understand and learn verbs more readily in non-ostensive contexts (where the verb refers to an 'impending' or 'completed' action) than in ostensive contexts (where it refers to 'ongoing' action). In an observational study they found that mothers' verb models referred more frequently to impending actions than ongoing or completed actions. Impending models also received the highest

proportion of responses from children and the extent of their use by the mother was positively correlated with their children's verb vocabulary. In an experiment children were exposed to novel events and verbs presented in three timing conditions: impending, ongoing and completed. Children's production was best in the impending condition and comprehension better in both the impending and completed conditions than in the ongoing condition. These studies confirm that non-ostensive models favour verb learning, impending models being the most consistently favourable.

Tomasello & Kruger infer that children hearing a verb anticipating an action have sufficient information about the adult's intended referent to learn the verb. Indeed, it is easier for them to learn the verb in this situation, than if they witness the verb and action simultaneously. This reflects more general evidence that children do not rely on temporal contiguity between a word and its referent, and can use a variety of cues in the action and discourse context to determine adult referential intentions (Tomasello, Strosberg & Akhtar, 1997). However, as Tomasello & Kruger (1992) point out, we do not know just what cues children use to identify the impending actions which are the adult's focus of attention. Whatever the effects of the timing of the verb, they cannot explain how the child works out which aspects of the event are encoded by the verb.

Fisher *et al.* (1994) and Gleitman & Gillette (1995) propose that children use the verb's structural environment to work out its meaning, following a procedure they call SYNTACTIC BOOTSTRAPPING. In an experiment reported by Fisher *et al.*, children saw an event described by a novel verb in one of two syntactic structures. For example, a picture was described as 'The elephant is moking the ball to the bunny' in one condition and as 'The bunny is moking the ball from the elephant' in the other. They were then asked what 'moking' meant. The prediction that they use the presence and position of the arguments to predict the focus of the verb was borne out. Children were more likely to define the novel verb using an English verb which matched the given syntactic structure than one appropriate to the scene but with a different syntactic structure. These findings suggest that children can use the presence and position of arguments to predict the focus of the verb. However, as Pinker (1994) points out, the syntactic frame of a verb essentially provides information about the perspective a speaker takes on an event; it provides no information about other aspects of the event encoded by the verb, such as manner or direction of movement or properties of arguments involved in the event.

Pinker proposes that children work out the semantic structure of a verb from the situations in which it occurs. They can then use the semantic structure to predict the argument structure in which it will occur (a procedure he terms SEMANTIC BOOTSTRAPPING). This is illustrated in a series of experiments reported by Gropen, Pinker, Hollander & Goldberg (1991)

where children saw novel events labelled by novel verbs. All the events involved the transfer of one object to the surface of another. In some the most salient aspect of the event was the manner of the movement (e.g. one object moved to the surface of the other in zigzagging manner), in others it was a change of state of the surface (e.g. one object was moved directly to the surface of the other causing it to change colour). The prediction that the child will note the salient feature of the event (the manner of movement or the change of state) and focus on the object affected by it (that moving or that undergoing a change of state) was borne out. Subjects were more likely to express the affected object as the direct object of the novel verb.

We have, then, a variety of claims and evidence regarding the cues which direct children to the semantic and syntactic properties of the verb. In each case, children were presented with controlled information limiting the cues available to see what use they made of them. In each, one type of cue was counterposed against another. It may be that children's understanding of verbs depends on particular combinations of different cues, rather than on a single type of cue. This possibility is followed up in the present study, by investigating the interaction between certain of the cues considered above. In particular, we observe that the salient aspects of different events are distributed over time in different ways. We therefore predict that the timing of a verb relative to its referent event will have different effects depending on the aspect of the event which is salient and the time at which it is salient.

Tomasello & Kruger hint at this possibility when they point out that different verbs require different types of information to be inferred from the pragmatic context. As these types of information may be available at different points in the event, the timing of the verb may have different effects according to the timing of the information it encodes. For example, verbs encoding a distinctive action may be more easily learned from an ongoing model (heard while the action is occurring), while verbs encoding a change of state may be more easily learned from a completed model (heard when the end-state is observable).

This possibility was investigated in an experiment similar to that reported by Tomasello & Kruger. Subjects were exposed to two novel verbs in two timing conditions, either before the event (impending condition) or after it (completed condition). Both events involved contact between two objects, but they differed in the effects of the contact and the time at which those effects were observable. The 'movement focus' event involved movement of the objects which extended over time and then ceased, leaving no effect on either object. The 'result focus' event involved a brief contact between the objects which left a lasting effect on one of them. We predicted that the different timing conditions would have different effects on the learning of the two verbs. In the impending condition there would be no observable referent at the time of hearing either verb so the child would be alerted to look for a

referent subsequently. Both events would satisfy the child's expectation. However, the movement focus event might be picked out more easily than the result focus event because its salient feature is immediately observable and is constant over time. In the completed condition, there would be no observable referent at the time of hearing the movement focus verb or subsequently, so the child could only pick out the relevant event retrospectively; at the time of hearing the result focus verb, on the other hand, the result would still be observable and so might be picked out more easily. We therefore predicted that it would be more helpful for the child to hear the verb before the movement focus event (impending condition), but after the result focus event (completed condition). Effects of the ongoing condition were not considered.

METHOD

Design

The study was similar in many respects to that by Tomasello & Kruger (1992). Children were exposed to novel verbs (nonsense words) and their learning of them assessed. Whereas Tomasello & Kruger examined learning of a single verb under different timing conditions – impending, ongoing and completed – this study examined both timing of verb presentation and the focus of the event to which the verb referred. The utterance containing the verb occurred either prior to the event (impending condition) or after it was finished (completed condition). There were two verbs, presented with two different events. In one a movement continued over time then stopped (movement focus), in the other a brief movement had a lasting result (result focus).

Thirty children were assigned randomly to two groups. Each saw the two events and heard the corresponding verbs. One group were trained in the impending condition, hearing both verbs prior to the events. The second were trained in the completed condition, hearing both verbs after the event. The hypothesis predicted that the impending condition would favour learning of the movement verb and the completed condition would favour learning of the result verb.

Children were trained on one verb on each of two successive days. In each group, seven children were trained on the result verb on day one and the movement verb on day two. The other eight children were trained on the verbs in the reverse order. Acquisition of the verb by the children was tested in three ways. These were spontaneous production during play and, afterwards, comprehension of it in testing and elicited production.

Subjects

Thirty children (13 girls, 17 boys) drawn from four nursery schools in North London took part in the experiment. Their ages were in the range 2;3 to 3;6. As the nursery schools were private, most children came from middle class families. All spoke English as their first language. Discussions with teachers in the schools and observation of the children were used as an informal means of checking that their language was developing normally. Children were invited to take part in the study and only those who wished to were used.

Procedure

The experiment was conducted and the data collected by the first author. Prior to the experiment letters of explanation were sent to each nursery school which undertook to inform parents. Immediately before the experiment two days were spent in each nursery so that the children became familiar with the experimenter. The experiment was carried out sitting on the floor which was consistent with many of the play activities previously observed in the nurseries. Children were tested individually in a quiet room which was familiar to them.

The movement verb was *pog* and the result verb *bock*. Both were unfamiliar meaningless words for the children (a children's game called *pog* is now for sale but was not available at the time of the experiment). They were selected to be clearly distinct from each other but had similar phonological structures (differing only in the voicing of the stops) so as to avoid the possible effects of phonology on learning. Both were treated as transitive and were presented in the same structures so that in each condition the verbs had equal syntactic support.

Two play situations were created in which to enact the two verbs. In the first a spinning wheel was made from a small dish and different objects were placed on it and spun around. In the second an office printing stamp was used to print on various types of paper. Before the training session the child was shown the target action and asked 'What am I doing?' by the experimenter. This was to check that the child did not already have a verb that would adequately describe the action. Training involved 10 exposures to the action and appropriate utterance.

The four conditions were as follows:

1. Movement verb in the impending condition: The experimenter modelled the verb before carrying it out. For example, the experimenter might say 'Look I am going to *pog* the ring.'
2. Movement verb in the completed condition: Here the experimenter commented after she had spun the wheel. For example the experimenter would say 'Look, I *pogged* the flower.'

3. Result verb in the impending condition: The experimenter modelled the verb before she carried it out. For example the experimenter might say 'Look I am going to *bock* the card.'
4. Result verb in the completed condition: Here the experimenter commented after stamping the paper. For example the experimenter would say 'Look, I *bocked* the paper.'

As the testing procedure (see below) involved a test of comprehension, three other actions were modelled five times each with the objects and with their appropriate (real) verbs. These acted as distractors so that it was possible to demonstrate that the child could perform both other and the target actions on request. For the movement verb they were *throw*, *drop* and *slide*. For the result verb they were *draw*, *scrunch* and *tear*.

Each session lasted approximately 15 minutes.

The child's score for each verb was made up of their ability to use it spontaneously, whether it could be elicited from them and whether they could comprehend it. They received one mark if they used the target verb during the training sessions. After training the experimenter would repeat the target action up to three times asking the child 'What am I doing?' Production of the appropriate response gained a further mark. Comprehension was assessed by asking the child to perform the target action and the distracter actions. To obtain a further mark they had to perform the target action and at least one other correctly. Thus the maximum score for each child in each condition was three.

RESULTS

The mean scores for each condition are shown in Table 1. The total data were analysed using a two factor analysis of variance in which the timing condition (impending/completed) was a between subject factor and the verb focus (result/movement) was a within subject factor. The main effects were not significant, however, there was a highly significant interaction between them ($F(1, 28) = 33{\cdot}64$, $p < 0{\cdot}0001$). This is apparent in Table 1 and simple main effects tests carried out on the interaction showed that the movement verb

TABLE 1. *Mean scores of subjects in each condition (max. score = 3)*

	Result verb	Movement verb
Group 1: Impending condition		
Mean	0·67	1·40
S.D.	0·444	0·470
Group 2: Completed condition		
Mean	1·46	0·27
S.D.	0·483	0·044

was significantly better learned ($F(1, 56) = 17{\cdot}07$, $p < 0{\cdot}001$) in the impending condition and the result verb significantly better learned ($F(1, 56) = 8{\cdot}50$, $p < 0{\cdot}01$) in the completed condition.

DISCUSSION

The findings of this investigation into children's learning of two novel verbs concurred with our prediction that the timing of the verb model would have different effects according to the focus of the event to which it referred. The interaction between timing condition and verb focus indicated that the impending condition was more effective for learning the movement focus verb, while the completed condition was more effective for learning the result focus verb. The effect was particularly striking in the case of the movement focus verb, where children in the completed condition showed virtually no knowledge of the verb despite having 10 exposures to it. This suggests that when the verb was uttered after the completion of the movement event it was ignored by the children. The same verb uttered before the same event was noticed and served to focus them on the following event.

These findings are consistent with the results of the Tomasello & Kruger study (1992) in showing verb timing effects on verb learning, but go further in exploring the direction of those effects. Although the data are limited, being confined to one example of each event type, the fact that children's responses to the verbs were affected by the timing of their presentation in the direction predicted is consistent with the claim that the effects of verb timing are not independent of the verb. We cannot, then, assume that there is an ideal timing for modelling verbs in general. It is interesting that the event modelled by Tomasello & Kruger involved pressing a button which caused a doll to roll down a ramp and either through a hole or into a helicopter. This is a complex event which includes an action causing movement which results in a final resting place. Interestingly, the impending condition was found to be most consistently helpful, but the completed condition was also facilitatory. Since the event compounded movement and result, these mixed effects are consistent with our findings for events which place a greater focus on one or the other. We might predict that the ongoing condition, which was least favourable in Tomasello & Kruger's study, might nevertheless be helpful for events of a different focus, perhaps those which focus ongoing activities such as actions of the body. It may be that the ongoing condition, which we did not investigate, would have favoured one of our events, most plausibly the movement focus event.

Our findings are also consistent with Pinker's claim that children are able to identify the focus of events and use this to work out verb properties. The finding that verb timing had different effects on the learning of the two verbs suggests that the children were tuning into the events at different points in time. This can be explained in terms of the events differing in their focus,

that is, in the aspect of the event which is most salient and the point in time at which it is most salient.

The significance of our results, though, lies in the interaction between timing of the verb model and focus of the verb. Our findings suggest that children picked up different cues simultaneously in determining verb reference. The timing of the verb form appeared to act as a cue to the likely focus of the event to which it referred. When they heard the verb form at a point when nothing significant was happening, children were more alert to the movement focus event whose salient feature occurred immediately and consistently. When they heard the verb after the event, they were more alert to the result focus event whose salient effect was still observable. This preliminary finding of an interaction between different aspects of verb input in verb learning might provide further leads in cracking the apparently intractable problem of verb acquisition. Sensitivity to features of the pragmatic interaction (such as Tomasello *et al*. (1997) investigate and discuss) at the same time as features of the scene might enable children to delimit the properties of a verb in a way that isolated cues will not.

For researchers, this moves enquiry beyond the question of whether children are sensitive to one or another cue, towards exploring the range and relative weighting of cues used in verb acquisition. Timing effects invite further investigation. We have considered them in relation to just one contrast in verb semantics, and one pair of events exemplifying that contrast. Given the complexity of verb semantics (see, for example, Pinker, 1989), we might look at the effects of verb timing on acquisition of different components of verbs. What, for example, is the optimum timing of verbs focusing manner of movement, or properties of that which moves? What is the optimum timing for verbs focusing sources or goals of movement? What is the optimum timing for verbs focusing mental states, or transfer of information? Our investigation was also limited in exposing children to the verbs in an artificially controlled context. This permits the investigator to control critical features of the input and track their effects, but the findings cannot be generalized to verb learning in natural interactions. It is important to find ways of tapping the effects of the same factors in a natural setting.

Extending the notion of investigating the simultaneous effects of different cues might yield further insights. For example, rather than investigating event focus and argument structure separately, we might explore their interaction. This would mean presenting different types of event focus and different types of argument structure simultaneously, in order to determine which combinations are most effective for verb learning. An accumulation of detailed information about how one aspect of input interacts with another will gradually fill in the picture of how children work out not just the focus of the adult's attention, but the very specific aspects to which the adult's words refer.

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