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Going beyond information theory to explain early word choice: a reply to Roy Pea*

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Pea's (1979) article has served as a stimulus for the further development of my ideas and I should like to present this development here.

Situational determinism vs. communicative intention

Pea views our rules for predicting word choice as the resurfacing of behaviourism in the garb of cognitively based approaches. Our predictions based on situational structure have been generally successful in predicting WHAT would be verbalized. However, we were very unsuccessful in predicting WHEN children would speak (Greenfield & Zukow 1978). This finding represents a limit to situational determination, which I would now like to formulate: the role of situational structure is relative to the child's communicative intention. It is the child's communicative intention within which uncertainty or alternatives are perceived. Here is an example which makes the structuring role of the child's intention particularly clear. One of the regularities we have found occurs in utterances expressing positive volition, i.e. where the child wants something: in such a situation the child verbalizes the volitional object rather than volition itself (Greenfield & Smith 1976). For example, the one-word child who wants a cookie, will say *cookie* rather than *want*. Clearly, the operation of the rule expressing this regularity is dependent upon the child's intention: in this example, it is the intention to secure the cookie. Thus, I am not proclaiming a manifesto of situational determinism, but rather elucidating the role of situational structure, given a particular communicative intention on the part of the child.

Construction of the situation by the child

Indeed, Pea's comments concerning determinism have made me realize that we can speak of the construction of alternatives in the child's own behaviour, not merely alternatives in the external situation. Here is an example (Greenfield 1979):

An Italian boy has been throwing a ball to various people. He gets ready to

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throw once more, saying *mami* ('mommy'. Then he throws the ball to his mother.

In terms of this behavioural sequence, the child, through his activity, has CREATED a set of possible recipients of action, or datives. They have not been determined by the situation, although the situation made them possible. Our claim is that this linguistic realization of *mami* indicates a sensitivity to alternative recipients or datives that COULD HAVE happened in this situation.

Salience and attention

At this point, I should like to discuss the terms SALIENT and ATTENTION ATTRACTING as alternatives to the use of UNCERTAIN. Salience, as the term has been used, implies an absolute scale of dimensions or values (e.g. colour is more/less salient than shape; red is more salient than blue). But information varies according to context. Colour is more informative than shape in an array where shape is constant and colour varies; the reverse is true in an array where colour is constant and shape varies. One might say that I am using the concept of information to help account for shifts in relative salience as a function of context.

I agree with Pea that attention attraction is the bottom line in all of this, and that our research is now ripe for an independent measure of attention. But one must still account for what makes something attract attention. The phenomena of habituation and dishabituation imply novelty and change as factors. On the other hand, sometimes the factor is variation over space, the simultaneous presence of alternatives, as in the example of *mami* above. The concepts of uncertainty and information allow us to make a generalizing statement about the determinants of salience or attention for both these cases.

It is, however, necessary to specify focal vs. background attention in relating attention to information. My view is that relative certainty, insofar as it involves taking something for granted, also involves something in background attention (e.g. self as agent). As such, it will tend to go unsaid. If, for some reason, that thing can no longer be taken for granted (e.g. mother tries to take agency from the child), the thing (here, agent) moves to focal attention, becomes uncertain, and is often linguistically expressed (Greenfield & Smith 1976, Greenfield 1978). Indeed, entities that are most important to the child – e.g. self and mother – may be just those that, under normal circumstances, recede to background awareness precisely because of their stable presence. That is, they come to be taken for granted and therefore go unstated. In the language of pragmatics, they are presupposed. Braine (1974) posited salience as the determinant of early word choice. But his notion rested on an absolute concept of salience, defined in terms of importance to the child. Because UNCERTAINTY and IMPORTANCE are distinct variables and because word choice is a function of the former rather than the latter, Braine's notion is not a workable one.

Bloom, Miller & Hood (1975) have observed datives to be rare in the speech of young children. They use this fact to argue against Braine's idea that pragmatic salience determines word choice (Pea 1979). Indeed, the concept of uncertainty puts us in a position to understand why datives would rarely be observed by researchers. Unlike the situation in which *mami* was verbalized, described above, most research on child language is done in dyadic situations involving interaction between child and mother. This dyadic structure means that there is only one possible animate recipient of the child's action and only one possible animate recipient of the mother's action. This absence of alternatives would, according to our analysis, result in a scarcity of linguistically realized datives. Thus the relative infrequency of datives, while constituting counter-evidence to Braine's concept of salience, flows naturally from the notion of uncertainty.

Informativeness from whose point of view?

Pea claims that we have defined uncertainty from the listener's, rather than the speaker's point of view. He cites the following passage to this effect:

> Information, in this sense, is relative to the child. An adult present in a given situation may, however, be able to understand the child because the child usually is referring to that situation and the adult can see which alternatives are important for the child (Greenfield & Smith 1976: 84).

This passage was written not to explain how alternatives were identified but rather to explain why, even though the child basically produces messages which resolve his or her own uncertainty, they also communicate to the listener. Thus we are not talking about the value of a message for a listener. At the one-word stage, uncertainty operates, we hypothesize, from the point of view of the speaker, although the listener should become more important with development. Value is an incidental by-product of informativeness: a message which describes novelty or change or selects from current alternatives is more likely to be valuable than one which belabours the obvious.

Garner (1974) says that structure and information can be defined entirely independently of the organism under study and can exist without an organism's existence. Furthermore, STRUCTURE EXISTS IN THE STIMULUS, AND OUR EXPERIMENTAL TASK IS TO DETERMINE WHEN IT CAN BE PERCEIVED, USED, OR PROCESSED AND WHICH KINDS OF STRUCTURE ARE IN FACT USED (Garner 1974: 3). Our experiments follow this strategy, setting up situations with certain types of variability and seeing whether the child responds to this variability by linguistic realization. The results of such manipulations enable us to build up a view of what the child's perspective is. It is only through such study that we will be able to confront the problem of rich interpretation and thus minimize the risk of capturing the adult's interpretation rather than the child's intentions.

Relationship of semantic choice of information theory

I should now like to resolve Pea's point concerning our conformity with either the Shannon/Wiener or Carnap/Bar-Hillel concept of information (Cherry 1966). Pea says that the information content of a message, on both views of information, is inversely proportionate to the probability of the message's occurring. There is a sense in which this is true. If the message codes an unlikely event, both message and event are unlikely. But once the unlikely event takes place, it is likely to be put into words. It is this latter situation with which I and my colleagues have been concerned. Hence, the apparent paradox that the locus of uncertainty becomes a relative certainty for linguistic realization.

A major thrust of Pea's criticism seems to be that our concept of informativeness is not a strict application of any existing information theory. It was not meant to be. Within psychology there is ample precedent for the fruitful use of information theory concepts simply as a point of departure. Garner, one of the most distinguished experimental psychologists in America, and a leader in the use of information concepts, provides an excellent example. In his 1962 book, *Uncertainty and structure as psychological concepts*, Garner states:

> As psychologists, we are certainly free to use the concepts in any manner which helps us, and we may even develop them to suit our particular purposes better. We refuse, in other words, to be concerned about a comment Cherry (1957) once made in discussing the role of communication theory in experimental psychology. He stated that a particular use of information concepts went beyond ESTABLISHED communication theory. He was undoubtedly correct in that statement, but as psychologists, we are not particularly concerned with this. If going beyond or even distorting established usage helps solve our behavioral problems, then we should feel free to do so (Garner 1962: 15).

Of his 1974 book, *The processing of information structure and structure*, Garner says, 'This book is even less directly related to information theory and that fact represents, I think, a healthy advance' (Garner 1974: x). Garner goes on to say that he is now less concerned with the QUANTITY of information, a concept from information theory, and more concerned with specifying the NATURE of psychological information and structure. Similarly, I am less concerned with how much information there is in the referential situation than with identifying its location and dimensions.

A more general issue in the philosophy of science is whether, when one takes the germ of an idea from one scientific paradigm, one is obliged to take all the baggage that goes with it. I felt that the concept of uncertainty and information held a nucleus of truth with respect to the problem of what children select to put into words. But I believe that I have the scientific right and even responsibility to develop this idea in the most fruitful way possible, unhampered by the constraints of past theory.

I agree with Garner (1962) that the core value of the information concept for psychology is the notion that information is not a function of what does happen, but rather of what could have happened but did not. In the field of child language, this notion challenges us to discover implicit possibilities, as they exist for the child, and to distinguish these from the actualities which, under the child's current circumstances, could be no other way.

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