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SAM AND THE EFFECTS OF PRECUING IN PROBED RECALL

A comment on 'The time course of precueing effects in probed immediate recall', by A.J.P. Hendrikx

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Hendrikx (1987) observed that precuing in the positional probe paradigm leads to faster responses but not to a higher probability of correct recall. He claimed that the SAM theory proposed by Raaijmakers and Shiffrin (1980, 1981) predicts an advantage for both latency and accuracy. Hence, these results were believed to be incompatible with the SAM theory. It is shown that this claim is false and is based on an incorrect analysis of the experimental paradigm. The SAM theory is shown to be able to give a simple explanation for these data.

In a recent article in this journal, Hendrikx (1987) described some experimental results that he interpreted as being inconsistent with the predictions of the SAM theory proposed by Raaijmakers and Shiffrin (1980, 1981). In this note I will show that this conclusion is not justified and that the SAM theory is in fact able to give a quite simple explanation for the observed pattern of results.

In order to demonstrate this assertion, it is necessary to briefly describe the experimental paradigm used by Hendrikx (1987). In this paradigm, a series of six consonants is presented on a CRT, one at a time, at a rate of two items/second. After a variable interval following the presentation of the last letter, a probe signal is given as a cue for recall. The probe signal consists of a light indicating the serial position of the to-be-recalled item. The dependent variables are the latency of the correct responses and the accuracy of recall.

Hendrikx (1987) considered the effects of a precue signal, i.e. a signal indicating a subset of the serial positions and given in the

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interval between presentation of the last letter and the probe signal. Thus, a precue signal tells the subject that the to-be-recalled item will be one of the items that were presented in the cued serial positions. In his experiment, Hendrikx always cued two serial positions, either 1–2, 3–4, or 5–6. The interval between the precue signal and the probe cue was varied between 300 and 900 msec.

The results of this experiment indicated that precuing leads to a decrease in the latency of correct responses, but has no effect on the probability of correct recall. Hendrikx assumed that the 'SAM theory predicts that precuing improves both recall *latency and accuracy* of all prerecent items. As these items are retrieved from the long-term store by means of a probabilistic search, the precue signal will enable the subject to sample the desired item with more specific retrieval cues concerning its positional attributes' (1987: 128–129). Following this reasoning, it was concluded that the observed results were not in accordance with the predictions of the SAM theory.

A reanalysis of the precuing procedure

I will make three straightforward assumptions concerning the effects of precuing. The first assumption is that the subject starts a directed search process as soon as the precue signal is presented. That is, the subject tries to recall the two cued items. Second, if an item can be recalled using the precue signal, it will also be recalled using the probe signal, which is, after all, a more specific version of the precue signal. In order to understand this assumption it is necessary to note that the probe information is a *subset* of the precuing information and hence *not an independent cue*. This means that the combined 'precue + probe' cue gives the *same* retrieval information as the probe alone. E.g., the set of cues 'position 3 or 4' plus 'position 3' is just as effective as the cue 'position 3'. Finally, it is assumed that for all practical purposes the 2.5 second recall interval that is allotted to both the experimental and the control condition is sufficient to retrieve the item if it can be retrieved at all. That is, the probability of retrieving the item after 3.5 seconds does not differ much from the probability of retrieving that item after 2.5 seconds. This assumption makes perfect sense since the mean latencies for correct responses varied between approximately 700 and 1400 msec. In any case, this assumption could be tested.

Now consider the consequences of these assumptions. Let T_1 be the moment in time when the precue signal is presented and T_2 the moment in time when the probe signal is given. As mentioned above, it is assumed that search starts on T_1. According to SAM, this search process involves a series of elementary retrieval attempts. Now let us consider what happens at T_2. There are two possibilities: either the search in the T_1–T_2 interval has led to retrieval of the to-be-recalled item (i.e., this item is maintained in an active, highly accessible state in short-term store) or this item has not yet been retrieved.

In the first case, the subject is able to give a fast response. This leads to a decrease in the latency compared to the control condition. However, all these responses will also be recalled by the control group in the 2.5 second response interval, since the retrieval cue used by the control group (the probe signal) is at least as effective as the cue used in the T_1–T_2 interval by the experimental group (the precuing signal). In the second case, the search process continues using the probe signal as a cue. Hence, in this case, accuracy and latency will be equal in the two conditions. (This conclusion is based on the Markov or no-memory property of exponential waiting time distributions: the retrieval cycles are independent events.)

From this it follows that precuing leads to a decrease in latency of correct responses but has no effect on accuracy. Any item that can be recalled in the precuing condition will also be recalled in the control condition. Basically, our reanalysis shows that Hendrikx' assumption that precuing gives the subject 'more specific retrieval cues' is incorrect. Hendrikx failed to take into account that the two cues, precue signal and probe signal, were not independent.

Conclusions

Our analysis shows that the SAM theory, although not specifically developed to account for the results of the positional probe paradigm, does predict the basic finding of the precuing experiments, i.e. that precuing leads to a decrease in latency but has no effect on accuracy. In fact, a natural conclusion of our reanalysis of this paradigm is that this result will be predicted by almost any reasonable model of human memory.

In his article, Hendrikx (1987) mentioned one other result that he

believed to be incompatible with the SAM theory. It was observed (in a different experiment) that 'the precuing advantage vanished or even turned into a detrimental effect when two locations at either side of the list were precued, or when the list was subjectively grouped into two sublists and the cued locations were at either side of the boundary between the sublists' (Hendrikx 1987: 125). Hendrikx assumed that the 'SAM theory would rather expect that when an additional retrieval cue is inadequate, it would simply have no effect at all' (p. 126).

This latter conclusion is obviously incorrect since inadequate cues will, in the SAM theory, frustrate the search process, i.e. lead the search in incorrect directions. More technically, it would decrease the probability of sampling the relevant image. However, it does not seem to be correct to say that such a cue is inadequate. The problem seems to be that the precue may lead to retrieval of subsets of items that do not include the target item. Switching to a different subset of items may be time-consuming and have a negative effect on the latency of correct responses. In either case, it should be evident that the SAM theory is well equipped to handle such results. In fact, a large part of our research has been devoted to explaining the negative effects of certain cuing manipulations (see Raaijmakers and Shiffrin 1981).

Given these results, it may be concluded that the SAM theory has no problem in accounting for the data of the positional probe paradigm and that the results of Hendrikx (1987) are not incompatible with this theory.

References

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