Two-channel visual memory*

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Ss attempted immediate recall of word and color attributes of series of three "Stroop" words (Experiments 1 and 2) or three colored number words (Experiments 3 and 4), presented either at 2 words/sec or 1 word/2 sec. They were instructed to give either channel-by-channel recall, grouping words and colors together, or temporal recall, in which the two attributes of each item were to be reported together. In Experiments 1 and 3, in which words were to be reported before colors, channel-by-channel recall was rather better than temporal recall, especially at the fast rate. In Experiments 2 and 4, the colors were to be reported before the words, and channel-by-channel recall tended to be worse than temporal recall. In all four experiments serial position data suggested that the channel-by-channel strategy was to attend to one attribute (either words or colors) during presentation and hold the other in preattentive storage. By contrast, when instructed to give temporal report, Ss apparently alternated attention between attributes during presentation.

If Ss are presented with two short serial lists of items in synchrony, such that each member of one list is presented simultaneously with a member of the other, and are then tested for immediate recall, they sometimes try to report all of the items in one list before those in the other. We shall call this "channel-by-channel" report, where each list defines a separate "channel." It may be contrasted with "temporal" report, in which the S tries to recall each simultaneously presented pair of items in turn. For example, with dichotic presentation, a S may hear the digits 3-7-1 spoken in one ear while 4-9-6 are being spoken simultaneously in the other. If the rate of presentation for each ear is faster than about one digit every 1.5 sec, recall is usually channel-by-channel, i.e., 3-7-1-4-9-6. But, if presentation is slower, recall is more likely to be temporal, i.e., 3-4-7-9-1-6 (Broadbent, 1958).

Channel-by-channel report has been most often observed with dichotic presentation. It also occurs when one list is presented visually and the other auditorily (Madsen, Rollins, & Senf, 1970), but not when two lists are presented dichoptically (i.e., simultaneously to each eye) in a visual analogue of the dichotic procedure (Sampson & Spong, 1961). However, there is some evidence that channel-by-channel report can be an efficient strategy with purely visual input when the two channels represent different attributes of the *same* visual stimuli rather than different stimuli to each eye. Rabbitt (1962) showed series of letters in red or black, and had Ss give channel-by-channel report by recalling the

sequence of letters followed by the sequence of colors, or vice versa. Recall was reasonably accurate, but there was no direct comparison with temporal report. Corballis and Philipp (1966) showed series of "Stroop" items, each consisting of a color word presented in a color different from the word it named (Stroop, 1935)—an example would be the word RED printed in green. Recall was more accurate when the Ss were told to report all the words followed by all the colors than when they were told to report each word and its color in turn. In other words, channel-by-channel report was superior to temporal report.

According to one possible interpretation, whether report is channel-by-channel or temporal depends on the order in which the S attends to the items (Broadbent, 1958). Attending is conceived to be a serial process, so that a S can attend to only one channel at a time. If two-channel presentation is slow enough, he has time to attend to both items of each simultaneous pair before the next pair arrives. He can therefore give temporal report, recalling the items in the order he attended to them. But if presentation is too fast for him to attend to each pair in turn, he may attend to only one member of each pair and retain the other in preattentive storage. In recall, he may report the items he attended to first, and then "read out" the other items from preattentive storage. Alternatively, he may report the items in preattentive storage first, although this appears to be less efficient (Bryden, 1969). In either case, the result is channel-by-channel report.

This interpretation clearly explains why recall strategy depends on presentation rate. It also conforms reasonably well to what is known about preattentive storage. Preattentive auditory storage, or "echoic"

storage, as Neisser (1967) calls it, seems to be capable of sustaining auditory information for several seconds, long enough in most experiments to allow information in the nonattended channel to be held with reasonable accuracy while items in the other channel are attended to and perhaps reported. On the other hand, "iconic" storage, Neisser's term for the visual counterpart of echoic storage, is much more fleeting and susceptible to backward masking (e.g., Averbach & Sperling, 1961; Sperling, 1960), which could explain why channel-by-channel report does not occur with dichoptic presentation. Recent evidence suggests, however, that storage of visual *attributes* may last longer than pure iconic storage (Clark, 1969; Cohen, 1970; Dick, 1970), which is perhaps why Rabbitt (1962) and Corballis and Philipp (1966) were able to obtain efficient channel-by-channel report when the channels were attributes of visual stimuli.

An alternative interpretation of channel-by-channel report stresses postattentive rather than attentional processes. Yntema & Trask (1963) found that Ss presented with dichotic word-digit pairs were better able to recall them grouped (or "channeled") into words and digits rather than according to ears, even though grouping into words and digits meant switching between ears. They argued that sorting into words and digits could not be accomplished preattentively, and proposed instead that simultaneously presented items were attended to simultaneously and "tagged" according to type, ear of arrival, and possibly other attributes as well. Semantic type, they suggested, provided a stronger tag for the search processes involved in recall than ear of arrival.

A study reported by Bryden (1969) suggests potential means of distinguishing between preattentive and postattentive processes in two-channel memory. He presented pairs of digits dichotically, and instructed his Ss to attend to just one ear during presentation. In recall, Ss were told either to report items in the attended channel followed by those in the nonattended channel, or vice versa. Recall of items in the two channels differed in two respects. First, it made little difference to recall of nonattended items whether they were reported before or after recall of attended items, whereas recall of attended items was markedly impaired if nonattended items were reported first. Secondly, and regardless of order of report, recall of items in the nonattended channel showed a marked recency effect with no primacy effect, whereas recall of items in the attended channel exhibited a much

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flatter serial position curve with a primacy, as well as a slight recency, effect. These data are consistent with the view that storage of attended items depends on an articulatory code (cf. Hintzman, 1967), but that storage of nonattended items is essentially auditory or echoic (cf. Crowder & Morton's, 1969, "precategorical acoustic storage").

Bryden's data support the attentional rather than the postattentional interpretation of channel-by-channel report, but this is perhaps not surprising since he instructed his Ss to attend to just one channel during presentation. It is entirely possible that a postattentional explanation is more appropriate when the S is not so instructed, and perhaps especially when channels are defined according to attributes, as in the experiments by Rabbitt (1962), Corballis & Philipp (1966), and Yntema and Trask (1963). Alternatively, these experiments may simply imply that preattentive analysis may proceed much further than Broadbent (1958), for example, envisaged. Thus, in Yntema and Trask's experiment, the Ss may have been able to decide *preattentively* which of two simultaneously spoken items was a word and which was a digit, and *then* attend to one and not the other.

The experiments we report were planned to investigate further the channel-by-channel and temporal report of word and color attributes of series of colored words—Stroop items in Experiments 1 and 2 and colored number words in Experiments 3 and 4. In particular, we hoped to be able to infer from serial-position curves whether channel-by-channel report was achieved by attentional or by postattentional strategies. Serial-position effects similar to those reported by Bryden (1969) for dichotic presentation would argue in favor of an attentional explanation. On the other hand, if both channels in channel-by-channel report showed similar serial-position effects, it might be concluded that channeling was achieved essentially by postattentional sorting. Although we recognize that strong inferences based on serial-position curves would be premature at this stage, there is increasing evidence that different storage mechanisms are reflected in serial-position effects (e.g., Crowder & Morton, 1969).

EXPERIMENT 1

In this experiment we compare channel-by-channel and temporal report of Stroop items presented at two different rates. The faster, two items per second, was the rate at which Corballis and Philipp (1966) found channel-by-channel report to

be superior to temporal report. The slower rate was one item every 2 sec; when pairs of dichotically presented words are heard at this rate, Ss usually adopt a temporal rather than a channel-by-channel report strategy. Consequently, we expected channel-by-channel report to be the more accurate at the faster rate, but the reverse, if anything, to be the case at the slower rate. As in Corballis and Philipp's (1966) experiment, the words were to be reported before the corresponding colors.

Subjects

The Ss were 20 undergraduate volunteers, 12 men and 8 women, all under 30 years of age.

Materials

The stimuli were color words mounted on 35-mm slides and projected against a white background. There were seven possible words: BLACK, RED, PINK, ORANGE, YELLOW, GREEN, and BLUE. These were also the seven possible colors. Each trial consisted of three word-color combinations, selected randomly, except that (1) each word was printed in a color different from the color it named, and (2) no word or color could be repeated on a given trial, but it was possible for one word and one color to be the same (e.g., the first word and second color could both be RED).

The words were projected from a Kodak rotary slide projector onto a white screen about 9 ft from S. Each word was projected onto the same area of the screen, for a duration of 0.25 sec. A small white dot was projected for 0.25 sec, beginning 0.75 sec after presentation of the last word in a series, as a signal for S to begin recall.

Procedure

The Ss were divided into two equal groups. One group was instructed to give channel-by-channel report, the other temporal report. The channel-by-channel group were told to report all the words first, and then all the colors, in the order of presentation. The temporal group were told to report each word and then its color, in turn. In both cases, Ss were asked to fill in items they could not remember with the word "blank"; thus an S in the temporal group who forgot all the colors might say, for example, "blue, blank, red, blank, yellow, blank." Ss were generally able to do this without difficulty, so that, except in rare cases, there was no ambiguity as to whether individual responses referred to words or colors.

Prior to the experimental trials, each S was shown patches of each of the colors and asked to name them. This was done to ensure there was no ambiguity as to how

each color was to be named. He was then given three practice trials, followed by 20 experimental trials. Presentation was either *fast* (two stimuli per second) or *slow* (one stimulus every 2 sec). Half of the Ss (FS group) received 10 fast trials followed by 10 slow, while the rest (SF group) received the slow followed by the fast. Slow presentation was achieved by using a single Kodak projector, but for fast presentation it was necessary to alternate two projectors. Ss' spoken responses were recorded on tape.

Results and Discussion

We scored the results in two ways: (1) *Total correct* responses, obtained by summing over the 10 trials at each rate the number of times S reported each word or color in each serial position. The words or colors were considered correctly reported if they appeared anywhere in the output sequence, regardless of order of report. Thus each S had a total of 12 scores, classified by serial position, attribute, and rate, each out of 10. (2) *Correctly placed responses*, obtained as for (1) except that a response was counted as correct only if it was placed correctly in sequence, according to instructions. These responses were also classified according to position, attribute and rate, and each score was out of 10.

The scores on each measure were then subjected to five-way analysis of variance. The independent variables were instructions (temporal vs channel-by-channel), order (FS vs SF), rate of presentation, channels (words vs colors), and serial positions (first, second, or third within each channel). The last three variables involved within-S comparisons, and for all tests of significance involving serial positions degrees of freedom were chosen conservatively to avoid the assumptions of homogeneity of covariance (see, e.g., Winer, 1962, p. 123). Thus, in fact, all F-ratios were evaluated with 1 and 16 degrees of freedom.

In this and the following experiments, which were analyzed in identical fashion, the two scoring measures gave essentially parallel results. For convenience, therefore, statements about the results, including statements of significance, apply to both measures unless there is cause to differentiate them. When p values differ but are significant in both cases, the larger is given.

There were significant differences due to presentation rates ($p < .001$), channels ($p < .001$), and positions ($p < .05$), indicating, respectively, that recall was better overall at the slower than at the faster rate, better for words than for colors, and better for the first item than for the other two. Channel-by-channel

Table 1
Mean Correct, Out of Six, for Each Condition in Each Experiment. Unbracketed Figures are for Total Correct; Bracketed Figures are for Correctly Placed Responses.

	Temporal		Channel By Channel	
	Fast	Slow	Fast	Slow
Experiment 1	3.72 (2.96)	5.00 (4.49)	4.93 (4.53)	4.86 (4.32)
Experiment 2	3.50 (2.52)	4.67 (4.24)	3.64 (2.58)	4.01 (3.27)
Experiment 3	4.35 (3.30)	4.97 (4.70)	4.83 (4.38)	4.79 (4.55)
Experiment 4	4.16 (3.41)	4.92 (4.53)	3.96 (3.12)	4.49 (3.95)

report was also more accurate than temporal report, but the difference was significant ($p < .05$) only for correctly placed responses.

More important for our purposes than the main effects were the interactions. First, there was a significant ($p < .001$) interaction between instructions and rates. Tests of simple effects showed channel-by-channel report to be significantly ($p < .001$) better than temporal report at the fast rate. Although temporal report was the more accurate at the slow rate, the difference was not significant. These results, summarized in Table 1, are in line with the results of dichotic listening experiments (Broadbent, 1958). They tend to support the view that different orders of report are achieved by different attentional strategies rather than by postattentive sorting (see introduction), since if the latter were responsible there is no very clear reason why rate of presentation should be so critical.

There were also significant interactions between: instructions and channels ($p < .01$); instructions and positions ($p < .001$); channels and positions ($p < .01$); instructions, rates, and positions ($p < .01$); and rates, channels, and positions ($p < .05$). The nature of each can be discerned in the data summarized in Fig. 1. Note also that Ss in the channel-by-channel group recalled the words perfectly at the fast rate, and nearly perfectly at the slow rate, so that all of the above interactions are to some extent contaminated by a ceiling effect. The main differences between the channel-by-channel and temporal groups are nonetheless clear enough.

First, consider the channel-by-channel group. Ss in this group almost certainly attended to the words during presentation, since recall of the words was nearly perfect. At the fast rate, recall of the colors showed a recency effect but no primacy effect, a result similar to that reported by Bryden (1969) for the "unattended" channel in dichotic listening. This suggests that Ss generally did not attend to the colors during presentation, but held them in preattentive storage. However, the small primacy effect in recall of colors at the

slow rate suggests that some Ss may have sometimes attended to the colors as well as the words under this condition. To the extent that they did so, channel-by-channel report may have depended partly on a postattentive sorting of word and color labels. But even so, the marked difference in recall of words and colors, compared with that of the temporal group, for example, suggests that Ss in the channel-by-channel group paid attention primarily to the words rather than the colors during presentation.

By contrast, the data suggest that Ss in the temporal group probably attempted to attend to both words and colors during presentation. This was evidently particularly difficult at the fast rate; the rapidly declining serial-position curves

suggest that Ss were hard-pressed to switch attention fast enough to "keep up." They fared better at the slow rate, but even here recall of the words was poorer than for channel-by-channel report, although recall of the colors was better.

In sum, this experiment suggested that temporal and channel-by-channel recall were achieved by different *attentional* strategies, rather than by different *postattentive* strategies.

EXPERIMENT 2

Our analysis of the results of Experiment 1 suggested that for channel-by-channel report, at least at the fast rate, Ss generally held the colors in preattentive storage while attending to the words. If this is correct, color information must have been retained in preattentive storage with at least 50% accuracy for at least 2-3 sec, allowing time for recall as well as presentation. Our concern now was to discover if Ss would make use of preattentive storage for *word* information, if instructed to report the colors rather than the words first. In Experiment 2, therefore, we repeated the essential features of Experiment 1, except that Ss were to report each color before the

Fig. 1. Serial-position curves for each set of instructions and each presentation rate in Experiment 1. On the abscissae, C = color, W = word, and digit following each refers to position in presented series; points are ordered according to recall instructions.

Fig. 2. Serial-position curves for each set of instructions and each presentation rate in Experiment 2. Description of abscissae as for Fig. 1.

corresponding word. We hoped thus to redirect their strategies so that the colors would be given attentional priority over the words.

Subjects

The Ss were 10 male and 10 female undergraduate volunteers, all under 30 years of age.

Materials and Procedure

As in Experiment 1, except that Ss in the channel-by-channel group were instructed to report all the colors and *then* all the words, and Ss in the temporal group were instructed to report, in turn, each color followed by the corresponding word.

Results and Discussion

Results were analyzed as in Experiment 1 and are summarized in Table 1. Except where specified, the description of results refers to both scoring measures. As in Experiment 1, analysis of variance showed recall to be significantly ($p < .001$) better when presentation was slow than when fast. In contrast with Experiment 1, though, temporal report was on the whole more accurate than channel-by-channel report, but the difference was not significant. The

interaction between rates and instructions was again significant ($p < .05$), however. Tests of simple effects showed that temporal report was significantly ($p < .05$) better than channel-by-channel report at the slow rate. At the fast rate, channel-by-channel report was marginally better than temporal report, but the difference was not significant.

There were also significant interactions between: instructions and channels ($p < .01$); channels and positions ($p < .01$); and instructions, channels, and positions ($p < .001$)—see Fig. 2. For channel-by-channel report, but not for temporal report, the words showed much more marked recency effects and less marked primacy effects than the colors. This suggests that the principal strategy in channel-by-channel recall was to attend to the colors and hold the *words* in preattentive storage, as we anticipated. However, this strategy seems to have been more marked when presentation was slow than when it was fast, since there was a slight primacy effect in the latter case but none at all in the former. This is perhaps surprising, since one might expect fast presentation to encourage attention to just one channel at a time. The explanation may lie in a property of the Stroop test,

namely, that it is much more difficult to name the colors without interference from the words than vice versa (Stroop, 1935). This interference seems to be based on an attentional dominance of words over colors rather than on response competition (Hock & Egeth, 1970). Hence, it may have been moderately difficult in our experiment to *attend* to the colors without the words intruding, and perhaps especially so when presentation was fast. This may also explain why channel-by-channel report was poorer at the fast rate than at the slow rate (see Table 1), the opposite of the usual result.

In sum, these results suggest that Ss did generally achieve channel-by-channel report by attending to the colors and holding the words in preattentive storage, but that this strategy was hampered at the fast presentation rate by an attentional dominance of words over colors. If this interpretation is correct, it implies that semantic information can be extracted and stored preattentively. Note, however, that in the channel-by-channel condition recall of the words, especially the first in each series, was poor.

EXPERIMENTS 3 AND 4

Stroop items possess the property that the same set of labels applies to both attributes, the word itself and its color. There is thus a conflict of labeling. This may make it especially difficult to switch attention between attributes, to the advantage of channel-by-channel report over temporal report. It was precisely for this reason, in fact, that Stroop items were chosen, since our initial aim in this research (cf. Corballis & Philipp, 1966) was to demonstrate efficient channel-by-channel report with visual input. Having done so, however, the next step was to determine what role the labeling conflict actually plays. Therefore, in Experiments 3 and 4 we repeated Experiments 1 and 2, respectively, except that number words were used in place of color words.

Materials and Procedure

The stimuli were number words, ranging from ONE to TEN and mounted on 35-mm slides. Each word could be printed in any of the seven colors used in Experiments 1 and 2. Method of presentation was the same as in the first two experiments.

Experiment 3 resembled Experiment 1 in that Ss were instructed either to report all the words followed by all the colors (channel-by-channel report) or to report each word and its color in turn (temporal report). Experiment 4 differed only in that Ss were instructed to report colors before words, as in Experiment 2. Other details of design and procedure were exactly as in the first two experiments.

Fig. 3. Serial-position curves for each set of instructions and each presentation rate in Experiment 3. Description of abscissae as for Fig. 1.

Results and Discussion

Analyses of results were exactly as in Experiments 1 and 2. Again, the following description of results applies both to total correct and to correctly placed responses, except where the distinction is made explicit.

Experiment 3. There were significant main effects due to rates ($p < .05$), channels ($p < .001$), and positions ($p < .05$). These effects were very similar to those in Experiment 1. And, as in Experiment 1, there was a significant ($p < .05$) interaction between instructions and rates (see Table 1). Temporal report was significantly ($p < .05$) poorer when presentation was fast than when it was slow, whereas channel-by-channel report was slightly (but not significantly) better when presentation was fast. This interaction had the same sense as that in Experiment 1 and again supports the view that report order was a function of attentional strategies rather than postattentive ones.

The following interactions were also significant: Instructions by Channels ($p < .05$), Rates by Channels ($p < .05$), Instructions by Positions ($p < .001$), and Instructions by Rates by Positions ($p < .05$). Figure 3 indicates the nature of these interactions. As in Experiment 1, the

serial position effects for the channel-by-channel groups again suggested that Ss attended mainly to the words and stored the colors preattentively, especially at the fast rate when there was no primacy effect in recall of the colors. The temporal group again showed steeply declining serial-position curves at the fast rate, but relatively flat curves at the slow rate, suggesting that the strategy in temporal report was to switch attention between channels during presentation. There was a more marked difference between recall of words and colors than in Experiment 1, giving the serial-position curves for the temporal group a scalloped appearance.

In sum, then, the use of number words in place of color words did not seem to alter the general features of recall which were observed in Experiment 1, although the results of Experiment 1 were generally sharper. In both experiments, Ss seem to have achieved different recall orders by different attentional strategies rather than by postattentive processes.

Experiment 4. There were two significant main effects: Recall was better at the slow rate than the fast rate ($p < .01$) and better for words than colors ($p < .05$). In contrast with Experiment 2, there was no significant interaction between instructions and rates.

Fig. 4. Serial-position curves for each set of instructions and each presentation rate in Experiment 4. Description of abscissae as for Fig. 1.

Serial-position curves are shown in Fig. 4 and illustrate the following interactions: Instructions by Channels ($p < .05$), Rates by Channels ($p < .05$), Instructions by Positions ($p < .01$), and Instructions by Channels by Positions ($p < .05$). The main point to be observed is that the serial-position curves for the channel-by-channel group, in particular, contrast with those of Experiment 2. At both rates, the colors, which were reported first, show strong recency but no primacy effects, while the words, reported second, show rather flat curves with both primacy and recency effects. This suggests that most Ss actually attended to the words during presentation while storing the colors preattentively, but reported the colors first. The poor recall of the words compared with that in Experiment 3 can be attributed to the fact that they were reported after the colors, since Bryden (1969) has shown that recall of the attended channel, in dichotic listening experiments at least, is markedly impaired if it follows recall of the unattended channel.

In this experiment, then, instructions to report the colors first in the channel-by-channel group apparently failed to divert the Ss' attention from the words to the colors. This is in contrast to Experiment 2, in which the same instructions seem to have induced most Ss, at least, to attend to the colors rather than the words during presentation. We are at a loss to explain this discrepancy. Indeed, one might have expected just the opposite, namely, a stronger tendency to attend to the words when Stroop items were used, since the attentional dominance of words over colors is stronger when the words are themselves color words than when they are neutral (Hock & Eggeth, 1970).

GENERAL DISCUSSION

In general, we conclude that order of recall in these experiments was achieved mainly (though not necessarily exclusively) by different attentional strategies. In temporal report, then, the Ss probably attended to each attribute of each item in turn, and then reported the information in the order in which it was attended to. In channel-by-channel report they probably attended mostly to just one attribute during presentation, holding the other in preattentive storage, and then reported either the attended channel followed by the unattended one (Experiments 1, 2, and 3) or the unattended followed by the attended (Experiment 4). Our main reason for preferring this interpretation of channel-by-channel report to an interpretation in terms of postattentional resorting or scanning (cf. Yntema & Trask,

1963) is that, in each experiment, recall of information in the two channels showed rather different serial-position curves. These curves were not simply a function of attribute, since each type of curve was exhibited by both attributes. Neither were they a function of order of report, since the curves for the temporal group nowhere resembled those for the channel-by-channel group. In Experiment 4, moreover, it was the first channel reported which exhibited the sharp recency effect, while in the other three experiments it was the second channel reported which did so. We conclude, therefore, as did Bryden (1969) for dichotically presented information, that the different serial-position curves reflect different coding and storage processes, and that these in turn depend upon whether or not the information was attended to during presentation (see introduction). We must repeat, however, that this interpretation must remain fairly tentative until more is known about the precise relation between serial-position effects and attentional processes in two-channel memory.

Our interpretation does raise questions about the nature and definition of attention. Clearly, if a person is to attend to one stimulus attribute, yet still extract and store another preattentively, these preattentive analyses must proceed at least to a level where the two attributes are separately analyzed. Selective attention must be a higher level process than Broadbent (1958) implied. This is now generally accepted (see, e.g., Norman, 1969), but it may still be questioned whether analysis can proceed as far as the extraction and storage of verbal labels and yet be "preattentive," as we claimed in Experiment 2. More generally, one might argue that there is no all-or-none distinction between attentive and preattentive processes, but rather that there are simply different levels or degrees of attention.

However, we think there is still good reason, even if largely heuristic, for maintaining an all-or-none concept of attention, while recognizing different levels of preattentive analysis. Following Neisser (1967), we can suppose attention to be an active, serial process of construction, whereas preattentive analysis, however sophisticated, is still essentially passive and parallel. According to this distinction, it does not seem too unreasonable to suppose a person could preattentively extract and store overlearned verbal labels for familiar words, but he could not construct (or understand) a novel sentence without the use of attentive processes. In two-channel verbal memory, the process of attention may essentially involve the active construction of an articulatory sequence. It

would include rehearsal, whose main role may be precisely that of serially organizing verbal responses (Corballis, 1969). By contrast, items stored preattentively may be labeled individually but not organized into a sequence. In recall they may be simply "read out" of storage in turn. This raises the question of how the S orders them in recall. One possibility is that the relative strengths of the item representatives in memory provides an order cue (cf. Fozard & Yntema, 1966); that is, the S reports the weaker traces first. In any event, Bryden (1969) has shown that unattended information is less likely to be ordered correctly than attended information.

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