Presentation Rate and the Representation of Briefly Glimpsed Pictures in Memory

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Four experiments on memory for briefly presented complex pictures showed the following: (a) Pictures shown in a sequence for 110 msec each with a blank 5,800-msec interstimulus interval (ISI) were later remembered almost as well as pictures shown for 6 sec each with no ISI; (b) when the ISI was deleted, recognition memory for the briefly presented pictures dropped almost to chance; (c) however, filling a 3-sec ISI with a to-be-ignored picture that was the same on all trials had little or no effect on memory for the briefly presented pictures; (d) when the time between 110-msec pictures was decreased from 4,850 to 1,300, 620, 385 or 0 msec, the ability to detect that they were mirror reversed in the recognition test decreased more rapidly than did recognition accuracy. Evidently, incidental visuospatial properties of a picture can be encoded for at least 1 sec after a brief presentation unless another to-be-remembered picture is presented during that time.

A compelling feature of recognition memory for pictures is that thousands of pictures, each viewed for only a few seconds, are retained extremely well (e.g., Standing, 1973). This excellent level of performance drops dramatically, however, when the duration of each picture in a continuous sequence is reduced from 2 sec to 125 msec (Poter & Levy, 1969). The purpose of the present research was to gain insight into pictorial encoding by examining the reasons for this decline. Three issues are addressed.

The first issue concerns the relative importance of stimulus duration and stimulus offset time (i.e., the time between stimuli) in pictorial encoding. Clearly, recognition memory suffers when the duration per picture is decreased (Lutz & Scheerer, 1974; Shaffer & Stiffin, 1972; Tversky & Sherman, 1973; Weaver, 1974; Weaver & Stanney, 1978). One suggestion regarding the effect of stimulus duration is that it places a limit on the number of eye fixations that can be made on a picture, thereby of shortening the transfer of visual detail to long-term memory (Lofthus, 1972). The effect that stimulus offset time has on...
Experiment 1

Stimulus duration and total study time (stimulus duration plus stimulus offset time) were varied independently to determine the effect that each has on retention of pictures. To determine if the appearance of a meaningful visual event interferes with processing of a briefly presented picture, pictures were presented with ISI filled by: presentation of either a homogeneous field or a complex picture that repeated throughout the sequence. If pictures are processed only until the next meaningful input, then recognition accuracy should decrease dramatically when the ISI contains a picture rather than a blank field. In principle, recognition memory for pictures in the picture-filled-ISI condition should be identical to that obtained for pictures presented for the same brief duration but with no ISI (continuous presentation).

Method

Subjects. Subjects were 80 undergraduate volunteers from Broadhead University reporting normal or normal-corrected vision.

Stimuli. One-hundred-fifty stimuli were chosen from a set of 255 color magazine photographs used by Intraub (6797). (Stimuli for Experiment 1 were selected from this set. The cutout pictures included 13 main objects and were photographed in the center of a homogeneous medium-gray background. Kodak KPA color 35-mm film and Kodakchrome II, Type A 35-mm movie film were used to minimize differences in color balance between slides and movies.

Apparatus. Stimuli were presented using a Gerbrands Model G1170 two-channel projection television driven by two Hunter Model 110 interval sweepers, except in the case of the most rapid presentation sequences for which a slide projector and standard speed (18 frames per second projector) was used. In both cases, stimuli were projected on a screen approximately 1.2 m in from the subjects; the field was approximately 14" x 14".

Design and procedure. The 120 pictures were presented in four different conditions. There were 30 subjects in each condition, run in groups of 3 or 4. In the 6-sec continuous condition, the pictures were presented at 3 sec each in a continuous sequence. In the blank-ISI condition, the pictures were presented for 110 msec each, with a 5,800-msec ISI during which a homogeneous medium-gray field was presented. The picture-filled-ISI condi-

tion was identical to the blank-ISI condition, except that a picture was projected during the ISI.
Two different ISI pictures were employed: each was presented to half of the subjects in the blank-ISI condition. In the 110-msec continuous condition, the pictures were presented for 110 msec each in a contiguous sequence.

All subjects were instructed to attend to each picture in the inspection sequence and were informed that a recognition test would follow. Subjects in the picture-filled-ISI condition were familiarized with their ISI picture at the beginning of the session. They were instructed to attend only to the briefly presented stimulus pictures during presentation. Prior to the experiment, all subjects were presented with a sample sequence containing 20 pictures to familiarize them with the viewing conditions.

There were two random orders of the 150-picture inspection sequence; each was used in half of the subjects in each condition. Approximately 2 min following presentation, a serial yes-no recognition test was administered. This test included 30 targets (selected equally often from the first and second halves of the sequence) randomly mixed with 20 distractors (pictures not previously seen). Distractors that did not bear a close resemblance to any of the stimuli were chosen. Pictures in the recognition test were presented for 3 sec each. Subjects were instructed to adopt a strict criterion and to write yes if they recognized a picture and no otherwise.

Two different sets of targets were used, and each set was presented to half of the subjects in each condition, to serve as an internal replication.

Results and Discussion

The mean and median proportion of correct yes responses for each condition are presented in Table 1. Also in Table 1 are the proportion of false yes responses (incorrect yes responses) and the proportion of correct no responses (correctly rejected, correct guessing).

Consistent with research showing that both stimulus duration and ISI affect recognition accuracy, the highest proportion of correct yes responses was obtained in the 6-sec continuous condition, decreased in the blank-ISI condition, and remained further in the 110-msec continuous condition.

The change in total study time, however, had a significantly greater effect on performance than did the change in exposure duration. This is consistent with the fact that recognition memory performance is affected by the number of eye fixations made on a picture.

The proportion of correct yes responses, TP, is the corrected proportion of yes responses, TR, the proportion of yes responses to blank pictures, and TP' is the proportion of yes responses to distractors.

All analyses were conducted on arcsine transformed proportions in this and the following sections.

The formula used to correct for guessing was TR = (TP - TP')/(1 - TP'), in which TP is the corrected proportion of yes responses, TP' is the proportion of yes responses to old pictures, and TP' is the proportion of yes responses to distractors.

Note: ISI = Interstimulus interval; TP = Mean corrected proportion of yes responses; TP' = Mean corrected proportion of yes responses calculated in a manner similar to that used in the blank-ISI condition.
with this observation, Potter (1976) de-
monstrated that when briefly exposed pictures were interspersed with presenta-
tion of a colorful visual noise mask, recog-
nition memory far surpassed that obtained when the same pictures were presented in a continuous sequence. Evidently, pro-
cessing of a picture with duration of at
least 110 msec can continue despite the
onset of a meaningless visual noise mask or a meaningful picture that repeats throughout the sequence.

When processing of a picture is more likely to continue following its offset if the visual scene that replaces it does not itself require the same level of attention. A blank field, a to-be-ignored repeating picture, or a repeating visual noise mask (as in Potter's, 1976, experiment) would not be expected to elicit the same depth of processing as the novel pictures that the subjects were instructed to remember. That is, in the picture-filled- ISI condition, where memory for the briefly presented pictures was good, successively presented pictures did not all require like processing as they did in the 110-msec continuous condition. Further support for the process-
ing demand requirement is provided by recent research in which a new to-be-
ignored picture was presented during the ISI each time. Although recognition mem-
ory performance for the briefly presented stimulus was slightly lower under this con-
tdition than when a repeating picture was presented during the ISI each time, recog-
nition memory did not approach the low level obtained following rapid continuous presentation. This level was only reached when attention instructions were altered, placing greater emphasis on memory for the 1.5-sec ISI pictures as opposed to memory for the briefly presented stimuli (Intraub, Note 1). This suggests that the necessity for like processing of successive pictures may be one source of the dis-
ruption of encoding that occurs as rate is increased. The way in which this disruption is manifested was examined in Ex-
periment 2.
report mirror reversal was selected because in addition to providing a more stringent test of visual memory, reversing a picture alters neither spatial relations within the picture nor the picture's meaning. If encoding is an all-or-nothing process, the ability to detect mirror reversal of correctly recognized pictures should remain constant, regardless of the duration of stimulus off time and the proportion of remembered pictures. If encoding is a continuous process that allows for a more detailed and complete representation in memory as more time is allowed, detection of reversal among remembered pictures should diminish when stimulus off time is reduced.

Method

Subjects. Subjects were 60 undergraduates from Brandeis University reporting normal or normal- corrected vision.

Stimuli. The stimuli were 16 picture exhibiting asymmetry about the vertical axis. There were no alphanumeric characters that would indicate normal orientation.

Apparatus. Subjects were seated in an anechoic chamber approximately 60 cm from a rear projection screen. A three-channel projection tachistoscope driven by a digital timer was used for sequences in which the ISI was 385 mos and longer. A filtered (8-mm) sequence was used in the condition requiring continuous presentation. During the recognition test, an impulse to the stimulus shutter triggered a Heath digital clock. Vocal responses into a microphone stopped the timer. In all conditions, the pictures were presented in a 112 X 112 field.

Procedure. There were six conditions of presentation with 10 subjects randomly assigned to each condition. In the 5-second continuous condition, pictures were presented for 5 sec each with no ISI. In the remaining five conditions, stimulus duration per picture was always 100 mos with ISIs of 4,890, 1,390, 620, 345, or 0 mos. A homogeneous medium-gray field was projected during the ISI. Two pictures from the general picture set were included at the beginning and two at the end of each sequence as buffers for praxis and memory effects. Recognition of those four pictures was not tested. The same order of presentation was used in all conditions. Subjects were instructed to attend to each picture and to try to remember as many as possible because a recognition test would follow the inspection sequence. Prior to viewing the stimuli, subjects were shown an example with an eight-picture sample sequence to familiarize them with the viewing conditions.

Table 2

<table>
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<tr>
<th>Stimulus</th>
<th>duration</th>
<th>ISI</th>
<th>M</th>
<th>F</th>
<th>CPDR</th>
<th>CPDR</th>
<th>FR</th>
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<td>.02</td>
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<td>.08</td>
<td>.17</td>
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Note. ISI = interstimulus interval; M = mean corrected proportion of pictures recognized; FY = false yes responses; CPDR = conditional probability of reversal detection; CPDR, = corrected conditional probability of reversal detection; FR = false-rejected responses.

Results

Recognition accuracy (yes responses). The effect of total study time on recognition memory for pictures was similar to that observed in Experiment 1. The corrected proportion of pictures recognized and the proportion of false yes responses for each condition are shown in Table 2. A small significant decrease in recognition
memory was obtained when duration was reduced from 5,000 to 110 msec with total study time held constant. (t(18) = 2.56, p < .025 (two-tailed). A more pronounced drop in recognition was obtained when the ISI was diminished. F(1, 45) = 24.6, M.S. = 14,378.6, p < .001. An analysis of variance conducted on the proportion of yes responses and the proportion of false yes responses for each subject revealed that overall when duration was 110 msec, recognition memory was better than chance. F(1, 45) = 45.6, M.S. = 2,037,630.0, p < .001. At all rates every subject made more hits than false alarms.

Reversing a picture during the recognition test did not significantly affect the subject's ability to tell that the picture had been seen before (Wilcoxon matched-pairs tests). Overall, an average of 3.7 out of 8 normally oriented pictures and 3.5 out of 8 reversed pictures were recognized. Mean response latencies to correct yes decisions are shown in Table 3. No difference in response latency was obtained among the five 110-msec conditions, F(4, 45) = 1.37. Also shown in Table 3 is the mean response latency to normal and reversed pictures in each condition. The overall mean latency to yes responses was 1,152 msec for normal pictures and 1,234 msec for reversed pictures. This tendency for longer response times to reversed pictures did not reach significance, F(1, 45) = 3.81, M.S. = 243,422.0, p < .06, nor was there a significant interaction with condition (F < 1). When only those pictures correctly identified as being reversed or normal were included in the analysis, there was still not a significant difference in latency.

Reversal detection. Contrary to the all-or-nothing hypothesis, ability to detect a correct reversal recognized picture was mirror reversed diminished not only when stimulus duration was reduced but when stimulus duration was held constant and ISI was reduced. When a reversed picture was recognized, the probability that the subject detected its reversed orientation is shown in Table 2 for each condition. When stimulus duration was decreased from 5,000 to 110 msec (with total study time held constant), the conditional probability of reversal detection decreased by .24, t(18) = 2.77, p < .025 (two-tailed). Recall that the decrease in recognition of the pictures themselves, regardless of orientation, was only .12. At stimulus duration of 110 msec, as the ISI was reduced, the conditional probability of reversal detection dropped still further, F(4, 45) = 7.26, M.S. = 1,271.33, p < .001.

Rather than reflecting a reduction in the ability to detect reversal, the decline in conditional probability could be an artifact of a guessing bias. An artificial decline in the probability of reversal detection would be obtained if subjects (a) made more recognition guesses as rate was increased (resulting in more lucky hits) and (b) tended to call these guesses nor-
mal due to the instruction bias. To test this, a guessing correction that takes into account the proportion of false alarms that are called normal and those that are called reversed was applied to the probabilities. The corrected scores, shown in Table 2, do not support the guessing bias hypothesis. If anything, the corrected scores show a more pronounced decrease in the conditional probability than do the raw scores.

The proportion of normal stimuli falsely called reversed (false reversed responses) in each condition is shown in Table 2. Although reversal detection was better than chance overall, P(1, 15) = 30.66, M, S = 20,649.69, p < .001, this was not the case in all the conditions. Whereas all subjects made more correct yes responses than false yes responses, the number of subjects (out of 10) with more correct reversed than false reversed responses was 9, 10, 8, 5, and 5, in the slow to fast conditions, respectively. At a stimulus duration of 110 msec, reversal judgments were better than chance only in the ISI-4,890-msec and ISI-1,930-msec conditions (p < .04, sign test, two-tailed).

Discussion

The results show that rather than being an all-or-nothing process, pictorial encoding involves in part the establishment of an increasingly detailed memory representation of a picture over time. Although subjects could successfully recognize some pictures following all of the presentation rates employed, the ability to detect which of these pictures were reversed was lost when the time between to-be-remembered pictures was reduced. This occurred even though stimulus duration was held constant at only 110 msec, preventing the subject from scanning the picture while encoding was taking place.

Since verbal or numerical configurations did not appear on any of the stimuli, it is unlikely that the left-right orientation of any of these pictures was relevant to its meaning. Ever so, subjects frequently retained this semantically "unimportant" information when the total study time was 1,500 msec or greater. Subjects reported to their own surprise that certain pictures simply looked backwards. Whether or not the reversal was detected, reversing a stimulus did not interfere with recognition (a finding also reported by Standing, Conzejo, & Haber, 1970). This casts doubt on a description of recognition memory as a template-like matching process. Although there was some suggestion that response latencies were longer to reversed than to normal targets, this effect was not as strong as might be expected if subjects were "mentally rotating" the target to match a memory image. Response time, however, was taken to the yes-no decision and not to the normal-reversed decision. A precise image match, therefore, may not be necessary for general recognition, although it might be used in reversal detection. What the results do indicate is that when stimulus duration or stimulus time is decreased, less complete visuo-spatial information about a picture is retained.

The results also stress the importance of test sensitivity in measuring memory. For example, in the present experiment, the disparity in retention between the 5-sec continuous and the ISI-4,890-msec conditions was considerably more pronounced when reversal detection as opposed to recognition memory was tested. When a traditional serial recognition test is used to measure memory, it cannot be assumed that recognition implies retention of even a global visuo-spatial characteristic such as left-right orientation. Indeed, the observation that reversal neither affected recognition of a picture nor significantly inflated

The conditional probability of reversal detection is obtained by FFR/FFS, where FFR is the proportion of yes responses to reversed pictures, and FFS is the proportion of yes responses to normal pictures. To correct the conditional probability for the guessing bias described in the text, using the formula in Footnote 1, FFR was corrected using the proportion of yes responses to distractors (F) and FFR was corrected using the proportion of yes responses to distractors (FF).
reaction time suggests that recognition can be based on conceptual characteristics and limited visual information about a picture. (Note that covert naming is unlikely at the fastest rates employed.)

The issue of test sensitivity may also apply to the interpretation of the Shaffer and Shiffrin (1972) study. In that experiment where the ISI was varied between 1 and 4 sec, no effect of ISI on recognition accuracy for pictures was obtained. Weaver (1974) and Tversky and Sherman (1973), on the other hand, obtained an effect of ISI when similar stimulus durations and ISIs were used. In the latter experiments, however, distractors that were visually similar to the targets were employed, whereas in the Shaffer and Shiffrin experiment (as in the experiments presented in this article) dissimilar distractors were employed. In the present experiment the ISI = 4.990 and ISI = 1.909-msec conditions are similar to two of the conditions used by Shaffer and Shiffrin, and consistent with their results, s plates in recognition accuracy was reached at those rates. In principle, if Shaffer and Shiffrin had decreased the time between pictures further, using the same recognition test, or if they had maintained the same ISIs but used a more difficult test (such as those used by Weaver, 1974; and Tversky & Sherman, 1975), an effect of ISI might have emerged.

In Experiment 1, none of the results obtained in Experiment 1 may reflect a lack of test sensitivity. Presenting a picture instead of a blank interval during the ISI did not affect recognition accuracy when a traditional recognition test (with dissimilar distractors) was used. A more sensitive test of recognition, however, might pick up a difference in the level of encoding. This possibility was tested in Experiment 3.

Experiment 3

Recognition memory performance and reversal detection were measured following inspection conditions in which either a homogenous field or a picture was presented during the ISI. If the occurrence of the ISI picture disrupts encoding of visual details (perhaps particularly visuospatial details that do not directly bear on the picture's meaning), then reversal detection should drop when the ISI contains a picture.

Method

Subjects. Subjects were 32 undergraduates from the Massachusetts Institute of Technology reporting normal or normal-corrected vision.

Stimuli and apparatus. The same pictures and viewing conditions were used as in Experiment 1, except that only two fields of the tachistoscope were employed.

Procedure. Subjects were tested individually and were randomly assigned to either the blank-ISI or picture-filled-ISI conditions. Subjects in both conditions viewed six pictures for 11 msec each with an ISI of approximately 3 sec. The same two ISI pictures employed in Experiment 1 were used; each was viewed by half of the subjects in the filled condition. The same order of presentation was employed in both conditions.

The procedure and viewing instructions were identical to those of the corresponding condition in Experiment 1. The recognition test and recognition instructions were the same as in Experiment 2. Once again subjects were informed about the reversal task only after having viewed the inspection sequence.

Results

Reversal detection was not significantly affected when a picture rather than a blank field filled the ISI. When a reversed target was recognized, the probability that the reversal was detected was .59 (false yes responses, .11) in the blank condition and .52 (false yes responses, .02) in the filled condition, $t(30) < 1$. After correction for guessing (see Footnote 4), the conditional probability of reversal detection was .59 and .51, respectively.

Unlike the corresponding condition in Experiment 1, a slight decrement in recognition memory was obtained in the picture-filled-ISI condition. The proportion of pictures recognized (corrected for guessing) was .92 and .81 for the blank and picture-filled-ISI conditions, respectively, $t(30) = 3.64, p < .01$: the false alarm rates were .02 and .05. The mean number of normal and reversed pictures recognized (yes responses) was 7.4 and 7.2, respec-
Table 4

<table>
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<th>Correct Details</th>
<th>Minor Errors</th>
<th>Gross Errors</th>
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<td>4.42</td>
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<tr>
<td>SD</td>
<td>1.21</td>
<td>0.71</td>
<td>0.19</td>
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<tr>
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<tr>
<td>SD</td>
<td>1.32</td>
<td>0.73</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Note: ISI = interstimulus interval.

The slight decrement in recognition memory in the picture-filled-ISI condition in Experiment 3 might reflect a subtle degradation of the subject's initial understanding of each picture or a limit in the number of fine details available for encoding after the picture is no longer present. If so, the subject’s immediate description of a briefly presented picture should be superior when the picture is preceded by a blank field rather than an ISI picture. This hypothesis was tested in the following experiment.

Method

Sixteen subjects (Massachusetts Institute of Technology undergraduate volunteers) viewed each stimulus picture in Experiment 3 for 110 msec and were then required to write a description of the picture in as much detail as possible. Half of the subjects were presented with a blank field following each picture and half were presented with one of the ISI pictures following each picture. They received as much time as they required to write a full description, before the next stimulus was presented.
Results and Discussion

Descriptions were generally several sentences long and often included schematic drawings. The time required for each ranged from about 30 sec to several minutes. A strict scoring procedure was employed, using a judge who was blind to condition. The groups were compared with respect to the number of correct details reported, the number of minor errors made, and the number of gross misinterpretations. These scores are shown in Table 4. No difference was obtained on any of these measures between groups (Mann-Whitney U statistics were 130, 67, and 117, respectively, \( n_1 = n_2 = 8 \)). Subjects in both groups made both types of errors. Minor errors included such things as errors in color or describing a woman as smiling when actually her mouth was merely open showing teeth. Gross misinterpretations, which were infrequent, were defined as a distortion of the gist of the picture, for example, describing a ballet scene as a baseball game. Despite such errors, when a recognition test was subsequently administered to half of the subjects in each group, performance was perfect except for a single recognition failure (one failure out of 128 trials). No false yes responses were made.

What these results clearly show is that the occurrence of a repeating ISI picture does not degrade the quality of information available for encoding. If it did, then more minor errors of interpretation, and fewer correct details should have been observed in the filled condition. Since presentation of the ISI picture reduced neither the ability to detect reversal (Experiment 1) nor the ability to describe the stimulus (Experiment 4), perhaps the slight decrease in recognition observed in Experiment 3 should be attributed to subjects' occasional failure to ignore the ISI picture.

Note that requiring the subject to immediately think about and write a description of each picture following presentation greatly enhanced performance on the recognition test as compared with performance obtained in Experiments 1-3. Perhaps this relatively intense activity strengthened the memory trace of each picture, functioning as a type of rehearsal. It should also be pointed out, however, that because the recognition test employed similar distractors, remembering the written descriptions alone could have produced excellent recognition memory. As a final note it should be emphasized that in other research, using pictures from the same stimulus pool, the availability of a single verbal code (a one-word label) was found to have no effect on either recognition memory or free recall (Intraub, 1978). Enhancement in the present experiment was probably due to a more complex set of events than simply naming a picture and remembering the name.

General Discussion

Three issues were addressed regarding pictorial encoding: (a) the relative importance of stimulus duration and total study time (stimulus duration plus ISI), (b) the conditions in the visual field that disrupt encoding, and (c) the way in which disruption is manifested— as a change only in the number of pictures encoded, or as a change in the quality of encoding of each picture.

It was established that important aspects of the encoding process extend beyond the duration of the stimulus, continuing in the time between stimuli. Even when stimulus duration was only 110 msec, memory was extremely good when sufficient time between pictures was allowed. As the ISI was reduced, although recognition memory remained above chance even at the fastest rate of presentation, the ability to detect that a picture in the recognition test was mirror reversed decreased sharply, reaching chance at the three fastest rates. This indicates that the ISI was used in part to encode information concerning visuospatial attributes of the pictures. Encoding of this information occurred without benefit of additional fixations and continued beyond the period of iconic persistence. In fact, encoding of information necessary for
reversal detection continued beyond a 62h-msec ISI.

No surprisingly, however, memory was better when pictures were presented for a full 5 or 6 sec each than when they were presented for the same total study time but with a duration of only 110 msec followed by a blank interval (Experiments 1 and 2). In the former case the subject could continually scan the picture while encoding additional details (Lofthus, 1972; Loftus & Bell, 1975; Loftus & Kallman, 1979). What the present results show is that encoding of additional visual detail is not confined to the duration of the stimulus nor is it necessarily dependent on the number of eye fixations made on a picture. Both recognition accuracy and accuracy in detecting reversal decreased by a relatively small amount when duration alone was radically reduced from 5 sec to 110 msec. The decrease in performance on these tests was much more pronounced when duration was held constant and total study time was reduced.

The hypothesis that encoding is terminated by the occurrence of a substantial change in the visual field was not supported, nor was the suggestion that backward masking is the primary cause of poor memory following rapid continuous presentation of pictures. Presentation of a repeating picture during the ISI interfered only minimally with recognition memory and did not affect reaction time to recognize pictures. Ability to detect reversal, or ability to report details of a picture (Experiments 1, 3, and 4) did seem to be influenced by whether or not a following visual event will disrupt processing of a previous picture is whether or not it also requires attention. There is evidence that attention to a nonvisual can also disrupt memory for pictures. For example, Rowe and Rogers (1975) obtained a decrease in recognition memory and free recall of pictures when subjects were required to shadow (repeat) spoken letters during acquisition. Similarly, Lofthus (1972) observed a decrease in recognition memory for pictures when subjects were required to count backwards by threes while viewing the inspection sequence.

In Experiment 2 it was found that increasing the time between to-be-remembered visual events led not only to the retention of more pictures but also to storage of more information per picture. Just which pictorial features are encoded and in what sequence remains to be clarified. Recognition tests (such as the reversal detection task) in which the similarity of targets and distractors is varied along other visual and semantic dimensions (cf. Mandler & Johnson, 1975) might reveal what type of information is encoded as the total study time for a picture is extended.

Reference Note

References


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Received April 13, 1979
Revision received August 9, 1979