One reason why we rarely forget a face*

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We wished to demonstrate that recognition memory for pictures depends at least in part on the perceiver's construction of a coherent organized perception, rather than only on some independently ascertained stimulus variables. To do this, we used the very high contrast drawings of faces developed by Mooney. Each of these appears as what initially looks like a random assemblage of black and white elements. But is it possible for the perceiver to organize the components into a structure—a structure in which a face is seen. These pictures are useful in this context because of their organizational ambiguity—something happens in the perceiver, not in the stimulus itself. Adult Ss were initially shown half of the pictures, which they inspected one at a time, and were asked for each if they saw a face or not. For recognition testing, they were then shown all of the pictures, again one at a time, and asked to indicate for each one whether it was new or old and if they saw a face or not. Recognition testing was given either immediately after the inspection series or delayed 3 days. A third group of Ss was tested with the pictures upside down. Recognition in all cases was significantly better for an old picture if the S saw a face in it during inspection and recognition testing. Further, a new picture was more likely to be called "new" if it was seen as a face during recognition. These results were also found after a 3-day retention delay. These, plus subsidiary analyses, were taken as strong support for the intended demonstration that organizational properties of *perceptual* memory are important determinants of the adequacy of that memory.

Previous studies of picture memory (e.g., Nickerson, 1965; Shepard, 1967; Standing, Conezio, & Haber, 1970) have indicated that people have a large capacity for visual information and a good retention of pictures (see Goldstein & Chance, 1973; Haber & Hershenson, 1973, for review). Recent work shown this to be limited mainly to meaningful coherent stimuli, and has found that meaningless pictures were more difficult to recognize (Goldstein & Chance, 1971). Wiseman & Neisser (1973) argued that good visual memory depends not just on a storage of raw visual features, but rather on the construction of a coherent organization of these features by the observer himself. They selected pictures that could be organized by the perceiver as a human face or might simply be seen as a collection of black and white elements. Since the stimulus was the same, it was the perceiver who made the construction. Wiseman and Neisser found that recognition memory was indeed higher for those pictures which the perceiver reported he saw as a face. The present experiments are a replication and extension of the Wiseman and Neisser research, using the same stimulus materials.

A total of 91 University of Rochester students from an introductory psychology course served as Ss in three separate conditions of 34, 30, and 27 Ss each. The pictures used were taken from Mooney (1957), who described them as drawings of the heads and faces of people. Each represented, in solid blacks and whites, only the salient highlights and shadows, such as would be revealed in strongly lighted photographs. There were 50 such pictures and 20 additional nonsense pictures that he made of similar graphic components but otherwise nonsensical. Figure 1 illustrates several of the pictures. Each picture was shown from 35-mm slides by a projector with an automatic timer. The exposure duration was 8 sec, with 7 sec of blank time for the Ss to respond. The room illumination was provided by two dim lights directly above the Ss, which permitted them to just barely see their answer sheets. The stimuli were viewed from a distance that yielded visual angles from 5.5 to 7.5 deg, depending on where the S sat in the room. The slides were divided into two sets of 34 and 35 each, balanced, on the basis of pretest data, in the ease with which Ss reported seeing faces in the pictures. One set was shown for inspection and then repeated during recognition testing (the "old" pictures); the other set was shown only during recognition testing (the "new" pictures).

The three conditions differed from each other in two ways. The first and second differed with respect to the delay between inspection and recognition testing—10 min in one case (N = 34), and 3 days in the other (N = 30). The first and third both used a 10-min delay before recognition testing, but all the slides in Condition 3 were projected upside down.

In all conditions, the inspection set consisted of 34 slides, 25 face and 9 nonsense pictures. A total of 15 sec was allotted for each slide; 8 sec viewing time and 7 sec for Ss to indicate their responses on an answer sheet with 34 lines. On that sheet, they merely had to check whether thay saw a face or not for each slide. For the recognition testing, the Ss viewed all 69 slides, at the same rate as before. The Ss were asked to report for each slide (69 lines on the answer sheet) whether they saw a face or not and whether or not the slide had been in the earlier inspection set.

At the beginning of the experiment, the Ss were informed as to what they would be expected to report in each situation, how long they would have, and the time interval between the inspection and recognition testing.

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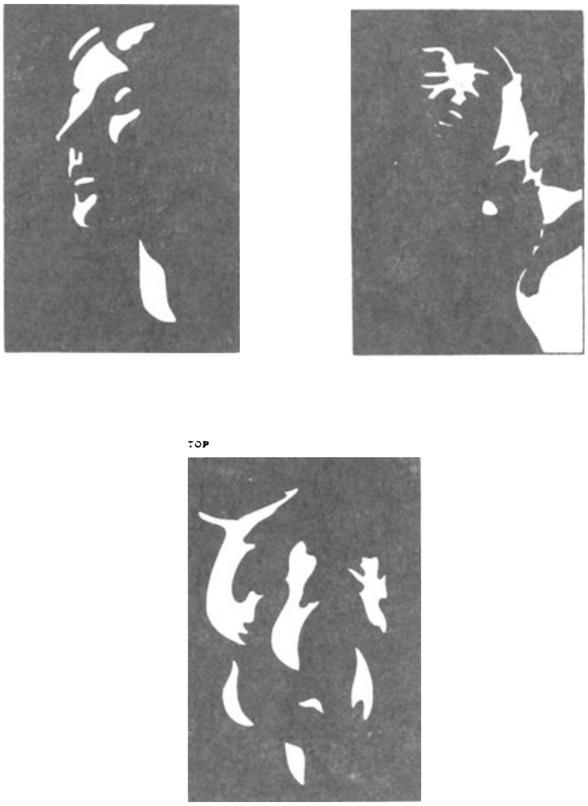

Fig. 1. Several examples of the drawings made by Mooney (1957). The first is an easy face to see, the second difficult, and the last a nonsense picture.

Table 1 presents the results for the three conditions as percentages of responses which fell in each of the categories listed, summed over Ss and face and nonsense pictures. Several comparisons are relevant to the construction hypothesis under investigation. First, Ss were more likely to say "old" to old pictures (a hit) when they saw a face on them than when they did not (Column 3 vs 4). These results are evident for both immediate and delayed recognition testing and even when the pictures were shown upside down. Second, Ss were more likely to call a new picture "new" when they reported seeing it as a face (Column 2 vs Column 1).

The only exception to this latter finding occurs when the pictures are projected upside down. Here, being able to see a face in a new picture leads to more false alarms, not less. It has been shown that recognition of faces is more difficult when they are viewed upside down (Hochberg & Galper, 1967; Yin, 1969). Apparently, being able to see a face is difficult enough, so a false recognition occurs in this condition.

Both the general results for hits and for false alarms suggests that being able to construct a face in a picture helps the perceiver remember the picture if in fact he has seen it before, or to tell it is unfamiliar if he has not seen it before.

Conventional statistical tests for categorical or proportion differences are difficult to apply to these data. Simply looking to see whether individual Ss recognized (e.g., said "old" to old pictures) a greater proportion of pictures when they saw them as faces yields highly significant effects by a sign test ($p < .001$). Thus, for the three conditions, respectively, 30 out of 34, 23 out of 30, and 25 out of 27 Ss had better recognition when they saw a face than when they did not. Wiseman and Neisser reported 27 out of 36 Ss.

As a more inclusive comparison, we used a signal detection analysis, in which the response "old" to old pictures was considered a hit and to new pictures a false alarm. The question is whether the strength of recognition memory is greater when d' is computed from Columns 2 and 3 (when S reports seeing a face in the picture) than when it is computed from Columns 1 and 4 (when S does not see a face in the picture). Accordingly, two d' measures were computed for each S in each condition (using the tables in Swets, 1964). Table 2 presents the means of these d' values, averaged over the Ss in each condition.

As is apparent, there are substantial differences favoring memory when a face is seen. This is significant for each of the three conditions beyond the $p < .01$ level using Scheffé's S method for the within effects. Further, the immediate testing condition has significantly greater d' ($p < .01$) than either of the two other conditions.

Table 1
Percentage of Responses "Old" to New and Old Pictures as a Function of Whether or Not Ss Saw a Face in the Picture for Three Conditions from the Present Experiment and from the Results of Wiseman and Neisser

	New Pictures (False Alarms)		Old Pictures (Hits)	
	1 Never Saw a Face	2 Saw a Face	3 Saw a Face*	4 Never Saw a Face
Immediate Retention (N = 34)	20	10	70	51
Delayed Retention (N = 30)	27	19	64	47
Upside Down Immediate Retention (N = 27)	17	22	66	32
Wiseman and Neisser (N = 36)	28	16	69	44

**Saw a face both times.*

Table 2
Mean d' Values

	Saw Face in Picture	Did Not See Face
Immediate Retention	1.82	0.87
Delayed Retention	1.31	0.56
Upside Down	1.33	0.56
Wiseman and Neisser	1.63	0.43

though the latter do not differ between themselves. There is no interaction between the conditions as to whether a face was seen or not. Thus, while delayed recognition testing shows a weakened recognition memory, the S's ability to construct a face in a picture does not help him protect that memory.

Two other analyses were carried out on the data from these experiments. For the old pictures, not infrequently, Ss would report seeing a face during the inspection set but not during recognition, or vice versa. These observations are not included in Table 1. For each condition, the hit rate was lower in this circumstance. This would seem to imply that seeing a face once, but not both times, resulted in a more unstable perceptual construction than one achieved when no face was ever seen.

The second test is most critical. If all Ss see faces in some pictures and no Ss see faces in some other pictures, then the effects reported above could still be due to stimulus variables in the pictures and not to the constructions carried out by the perceiver as he looks at each picture. To test this, a subset of pictures was selected in which no more than 80% and no less than 20% of the Ss saw a face. These can be considered ambiguous pictures, in the sense that whether a face is seen or not depends on the construction of the perceiver and not on the stimulus structure itself. Every comparison reported so far was found to be more extreme when tested on only these ambiguous pictures. Since the number of pictures is less, the significance levels are often lower but the magnitude of the effects is consistently greater. Hence, the constructability of perception appears to be a critical factor, and not simply the stimulus structure among the elements themselves.

A number of separate analyses each provide evidence that recognition memory is aided by perceiver-elicited organizations imposed on the material to be remembered. This is considered virtually a truism with linguistic stimuli, for which clustering, chunking, imagery, or any other type of mnemonic process almost always enables the S to remember more material and for longer periods of time. But this is nearly impossible to study with pictures. This is because of the difficulty of creating stimuli which are potentially organizable into a coherent structure but for which perceivers are not always able to create such a structure. In the natural environment, viewed by adult perceivers, such circumstances probably never exist--we are able to create coherence in everything we see. Psychologists in the laboratory have designed stimuli for which a coherent recognition memory would be expected to be poor. The present experiment provides a more appropriate test because the Mooney pictures lend themselves to the possibility (but not the necessity) that the perceiver will make a coherent structure out of its elements.

It should be noted that all of the findings and conclusions of Wiseman and Neisser have been supported in the present experiment. Even the absolute level of percentages agree closely. Wiseman and Neisser did not run a delayed recognition testing condition or examine the effects of turning the pictures upside down, and the present results extend the generality of the conclusions.

The results reported here are with adult perceivers. It seems likely, on a number of grounds, that perceptual development is marked by an increasing ability to create coherent organization out of unorganized visual elements or features. It is quite probable that with young children this experimental result would be even easier to demonstrate, since the potential for finding stimuli that are potentially, but not always, organized by children would be greater.

Of course, these data do not tell us much about how a perceiver creates such an organization. What happens when the organization "snaps into place?" Why is it virtually impossible to unsnap it and see the elements unorganized again? How are these visual representations processed, manipulated, related to labels or other representations, prior experience, and the like? Merely providing the demonstration here only poses these questions; it does not answer them.

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