placed before or behind the screen simply by reversing the spectacles.

Suitable light sources are miniature filament, 12-V, 100-W tungsten-iodine lamps. The filaments should be oriented vertically, to give maximum horizontal resolution, which is important for giving maximum information of depth through disparity.

Magnification of the normal x - and y -axes is given simply by the ratio of the distance of the object from the lights to the object from the screen. Magnification in depth (z -axis) can be controlled by the horizontal separation of the lamps. In practice a magnification of at least times 10 may be given; but the apparent size of the three-dimensional shadow-image is generally less than might be expected, because of perceptual size constancy.

When the object appears to be in space before the screen it looks smaller than when behind it, though the physical size is of course identical with either orientation of the polaroids. A further perceptual effect is most marked: when the observer moves his head, the stereo shadow-image appears to move with him, to slide across the screen, and rotate to follow the observer as though continuously aimed at him. This is because there is no motion parallax although the image lies perceptually in three dimensions: this corresponds to a normal object rotating to keep the same aspect to the observer though he moves. So he sees movement though his retinal images remain unchanged. When the observer moves away from the screen, the shadow-object does not shrink or lose its depth as might be expected; the reduced angle of convergence of the eyes evidently re-scales the retinal disparity mechanism, so that a given disparity between the retinal images gives greater visual depth. This is indeed fortunate, for the shadow-image appears very similar over a wide range of distance, and so it can be used with effect in a large lecture hall for demonstrating suitable objects. They may be moved or touched by the demonstrator, which makes this a technique having advantages over photographic stereo projection. It is also a useful tool for investigating perception of depth while the observer is moving, and can form the basis of simulators for experiments on the guiding of aircraft and space vehicles.

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Retroactive Interference in Short-term Memory

In investigating short-term memory (a term generally used to cover the period of from one to sixty seconds) an important question is whether or not retention is influenced by factors known to be important in long-term memory. One such factor is retroactive interference. Broadbent¹ has asserted that retention depends on the duration of the delay rather than the nature of any activity during the delay. But he rests his case on evidence that retention is impaired by increasing the delay while keeping the activity as constant as possible. Direct evidence that variation of the intervening activity is ineffective has been lacking, but Baddeley and Dale² have shown that in minimal paired-associate learning³ meaningful similarity fails to affect performance significantly, and this supports Broadbent's contention.

Recently Wickelgren⁴ has produced evidence suggesting that acoustic similarity does affect retroactive interference in short-term memory. His technique was to present rapidly (2/sec rate) four letters which had to be remembered, then eight which were to be copied down. Immediately the eight had been copied the subjects had to write

out the first four from memory. The crucial variable was the similarity of the eight letters which had to be copied to the four which were being remembered. The letters used were taken from two groups $F L M H S X$ and $B C D G P T V (Z)$. Conrad⁵ has shown that within each group acoustic confusions are common, whereas between the groups they are rare. (Z does not confuse with $B C$, etc., in English; but with its American pronunciation it is obviously similar to the others and Wickelgren added it.) Wickelgren's results indicate that when the letters to be copied came from the same group as those being remembered, memory was poorer than when they came from the other group. They are not clear-cut, however, since he had to introduce repetition. To illustrate this: if $B C D G$ were to be remembered and similar letters had to be copied, the only four letters available were $P T V Z$, so subjects were required to write each twice. With the ' P ' sub-group the problem was even more acute since there were only two spare letters.

The experiment reported here was carried out in order to confirm Wickelgren's findings. To avoid the problems already outlined here the subjects were given three letters to remember and six to copy down. The six always consisted of three different letters each repeated once. For this experiment the ' B ' group was pruned to $B C D G P V$. Forty trials were run, 10 with ' F ' letters to be remembered and ' F ' letters copied; 10 with ' F ' letters to be remembered and ' B ' letters copied; 10 with ' B ' letters to be remembered and ' F ' letters copied; and 10 with ' B ' to be remembered and ' B ' copied. Two series of trials were used. The first was prepared by randomizing the order of the 40 trials. The second was derived from the first by keeping the messages to be remembered constant and altering the messages to be copied, so changing $F-F$ to $F-B$, $F-B$ to $F-F$ and so on. Any influence of order of presentation was in this way controlled. All items were read out by the experimenter in time with a metronome beating at a 2/sec rate. A pause of one beat separated the memory message from the copy message. Ten seconds separated the end of one copy message from the beginning of the next memory message. Subjects were tested in two groups of 17. They wrote out all messages on a specially prepared form. An invigilator checked that they put down the copy message before the memory one.

Performance was scored by counting the number of letters in each memory message which were correctly recalled in both substance and position. The results showed a mean score of 59.4 per cent when the copied message came from a different group of letters to the memory message but only 38.7 per cent when the copied message came from the same group. The individual records of 31 of the 34 showed this effect; its statistical significance is, therefore, extremely high ($P < 0.001$). Thus Wickelgren's observation is confirmed and we must conclude that the principle of retroactive interference does apply to short-term memory. The form of the similarity which affects performance, however, would seem to differ from that which influences interference in long-term memory. Meaningful similarity is unimportant over these short periods, but similar-sounding items cause interference. Presumably the basis of coding for normal verbal learning with repeated presentations and with opportunity for rehearsal differs from that used for short-term storage following a single presentation.

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⁵ Conrad, R., *Brit. J. Psychol.*, 55, 75 (1964).