Table 2
Mean Inches of Movement Reported and Results
of Analysis of Variance for the Three
Significant Main Effects

Variable	Condition	Mean	F ¹
Window	Large	14.8	
Size	Small	12.2	7.88*
AKL	10 sec	10.4	
Duration	20 sec	16.6	32.40**
Trial	1	14.6	
Blocks	2	12.3	6.41*

¹ $df = 1/18$ for all comparisons

* $p < .025$; ** $p < .001$

other main effects, however, were significant (see Table 2). More movement was reported for the larger window, the 20-sec AKL duration, and the first trial block.

DISCUSSION

The results of this study indicate that Ss do tend to make larger judgments when the AKL is presented in a large rather than a small window. The question, however, may arise as to whether this result could be due to an afterimage produced by the instruction light when it illuminated the AKL screen. Such an afterimage might provide an excellent quasiexternal frame of reference for judgment of the AKL. However, E was unable to observe any such afterimage when he tested himself under the experimental conditions. Furthermore, failure to find a significant interaction of window size with either of the temporal variables (AKL duration and trial blocks) or a triple interaction involving the three variables (all Fs were less than 1.0) tends to render the afterimage interpretation less plausible, since the afterimage would be expected to fade with time during a trial (AKL duration) and to increase in intensity with time in the dark (trial blocks).

The present results lend support to the idea that the amount of movement reported in the autokinetic situation is at least partly determined by the cognitive aspects of the situation, i.e., what S "knows" is likely to happen. If this interpretation can be shown to have general value in future experiments using a variety of means of giving S information about the AKL, then it would perhaps be feasible to integrate certain of the findings with this phenomenon, particularly those in which the effect of various social variables has been reported. Thus, information about the light may come from other Ss in the situation (Sherif & Sherif, 1956), the E (Cautela & Vitro, 1964), generalization from an experience with real movement under similar conditions (Hoffman, Swander, & Rohrer, 1953), or S's own cognitive assessment of the physical possibilities in the situation (the present experiment).

In other words, on the basis of whatever information is available, S develops a frame of reference for interpreting the physiologically determined experience of instability in the AKL, which then operates to affect his judgments, i.e., his relation of the experience to the external scale (e.g., inches) imposed by the E.

Future research might explore either the importance of different sources of information (e.g., cognitive vs social) in the establishment of frames of reference, or perhaps, the range of sources of cognitive information which can affect S's judgment.

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Mediational construction vs. mediational perception in paired-associate learning

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Noun paired associates were presented for one study trial under instructions to construct sentences containing the pairs (construction), to listen to and to repeat ready-made sentences containing the pairs (perception), or merely to read the pairs aloud (control). Recall was greater for construction than for perception. Recall in the construction group was not significantly greater than in the control group, and it was conjectured that this might be due to spontaneous mediational construction in the latter group. The hypothesis that the construction of mediation by the S himself is more effective than the perception of a ready-made mediational link was supported.

There is evidence that instructions to mediate facilitate paired-associate (PA) learning (Paivio & Yuille, 1967; Yarmey & Csapo, 1968; Yuille & Paivio, 1968). There is also evidence that the perception of a ready-made mediational link facilitates PA learning (Jensen & Rohwer, 1963). The

phenomenon of mediation raises important questions as to the nature of the thought process and the role of relations in learning. What is it about mediational links that facilitates learning? New facts need to be discovered to further our understanding of this organizational process.

It can be asked whether or not the construction of the relation by the S himself is itself an important factor, or if the mere perception of a relation is just as adequate as construction. Bühler (Humphrey, 1963, p. 63) claimed that when one is induced to actively think, memory is much improved. He showed that proverbs are remembered excellently, and he theorized that the proverbs made his Ss think, and that the thought is remembered where sheer sensory material would be forgotten. On this basis, it was hypothesized here that the construction of a relation by the S would be superior to the perception of a ready-made mediational link.

This hypothesis has recently been tested, but not supported, in an experiment by Lieberman, Walters, & Cox (1968). They presented 42 pairs once at 10-sec intervals.

The Ss in one group were instructed to think of or to picture something that would relate the two words together and were given an example. The Ss in the other group were told that they would be given a way of memorizing each pair as they looked at it. On the test trial, the S was presented with the first word of each pair and asked to recall the second word, having as much time, up to 1 min, as he wanted for each response. No significant difference in the mean number of recalled words was found between the two groups.

However, there was no assurance in this study that the Ss in the first group were, in fact, able to construct mediators for every pair in the 10-sec interval allotted. In the present study, the interval was long enough to insure the construction of mediators for almost all pairs. There is also the possibility that the mediators given to the second group were in some way better than those made up by the Ss in the first group, who were pressed for time (although the authors state that the mediators invented by the Ss in the first group were in many cases quite similar to the ones used in the second group). In the present study, the mediators were matched between groups by giving each S in one group the mediators that had been constructed by one S in the other group. Furthermore, it is possible that Ss in the second group were inadvertently induced to construct mediation, for they were often asked to think or to picture something in connection with the pairs. In other words, the two groups might not have really differed on the crucial variable of construction. In the present study, sentences incorporating the words of the pair (which had been constructed by other Ss) were merely read to the Ss.

In a study designed to test the effect of mediation on PA learning (the items were colored pictures) in children, there was no difference between a condition in which E recited a meaningful sentence that combined the names of two pictures within a pair and one in which the S was told to make up his own sentences (Milgram, 1968). However, in this study, Ss reached the learning criterion of two perfect trials in an average of 2.79 trials in both conditions. It is possible that the PA lists were so easy to learn that differences between these two conditions did not have an opportunity to be revealed. And again, the mediators were not matched between conditions.

It was hypothesized, in the present study, that instructions to construct a sentence incorporating the two words of a pair would be superior to the perception of such a mediational link and would also be superior to no instructions at all regarding mediation.

METHOD

Sixty students from introductory

psychology classes at the State University of New York at Albany served as Ss. They were assigned randomly to three groups of 20 Ss each: construction, perception, and control. Each S was run individually.

Seventy-two nouns with A or AA frequency were selected from the Thorndike & Lorge (1944) tables and were paired randomly. Each of the 36 pairs, as well as each stimulus word alone, was typed in capital letters on 4 x 6 in. white cards. They were presented by hand on a commercial study stand.

All Ss were told that they would be shown a number of pairs of nouns, and that their task would be to learn them in such a manner that, when shown the first word in each pair, they could respond with the second word.

The Ss in the construction group were instructed: "In order to help in learning the material, as you are shown each pair I want you to formulate a sentence containing the two nouns, such that the first word of the pair is either the first word of the sentence, or is preceded by only one of the articles, a, an, or the, and the second noun of the pair is the last word of the sentence. Any such sentence will do fine. I want you to recite this sentence to me just as soon as you can. Do not attempt to make any other connection between the words of the pair except the sentence you recite."

The Ss in the perception group were instructed: "In order to help in learning the material, as you are shown each pair I am going to recite a sentence to you which contains the two nouns. I want you to repeat the sentence after me. Do not attempt to make any other connection between the words of the pair except the sentence you repeat."

The Ss in the control group were instructed: "As you are shown each pair, I want you to read the nouns aloud to me."

The Ss in the construction and perception groups were paired in regard to the sentences in that each S in the perception group heard the sentences that had been formulated by one S in the construction group. In those few cases where an S in the construction group was unable to construct a sentence for a noun pair within the time interval, when his sentences were given to his counterpart in the perception group, the missing sentence was filled in from the protocol of the S in the construction group run just prior to him.

There was one study trial and one test trial. Each pair was presented for 20 sec in the study trial, during which time the S either constructed a sentence, heard and repeated a sentence, or merely read the words aloud, depending on the group he was in. After the study trial, each S was told that he would be shown the first word of each

pair, and that he was to try to recall the second word. A 25-sec interval separated the study and test trials. During the test trial, the first word of each pair was presented for 10 sec, in a different randomized order from the study trial. Afterward, the Ss were informally questioned.

RESULTS AND DISCUSSION

The mean number of correct anticipations for the construction, perception, and control groups were 25.70 (SD = 4.61), 20.45 (SD = 6.25), and 23.00 (SD = 7.95), respectively. An analysis of variance revealed a significant effect of treatments ($F = 3.34$, $df = 2/57$, $p < .05$). A t test comparison revealed a significant difference between the construction and perception groups ($t = 3.02$, $df = 38$, $p < .01$). The difference between construction and control groups was not significant ($t = 1.31$, $df = 38$, $p < .10$), nor was the difference between control and perception significant ($t = 1.13$).

The results support the hypothesis that mediational construction is more effective than mediational perception in PA learning.

The difference between the construction and control groups in this study might, in the context of the results of Yarmey & Csapo (1968), who used a similar control group, be interpreted as not due to chance. On the other hand, they used a 5-sec study interval, and such a long learning interval as was used here might increase the probability of spontaneous mediational construction among college students when no instructions to mediate are given.

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