values omit the study trial but include the two trials to criterion. These differences due to list were significant, $F = 42.08$, $df = 3/93$, $p < .05$. Duncan's range test indicated that all these means were significantly different from each other. In addition, List by Replication interaction was significant, $F = 4.87$, $df = 3/93$, $p < .05$. None of the other effects was significant.

The difference between the mean overall number of trials to criterion for the four lists combined for women (16.08) and for men (19.04) was significant, $t = 3.11$, $df = 46$, $p < .05$. A t test was performed on number of errors for low- vs high-frequency stimulus word pairs within each list for the two replications combined. The differences were not significant for any list.

DISCUSSION

The present study clearly confirms a general relationship between PAL and FAS. The range of values of absolute normative frequency was considerable—from 2% to 77%. Ranks varied only from 1 to 4. The relationship was found using conventional PAL procedures, with each of two presentation rates, and for both men and women. Further, each list contained words of high and low LF and there were no significant differences in PAL for high and low LF stimuli. The present findings do not confirm those of Postman (1962) who found faster learning of strong than of weak associates only with low LF stimuli, nor are they consistent with those of Martin (1964) who found no differences between strong and medium FAS pairs regardless of LF. Why has the present study found a simple relationship between FAS and PAL when other researchers have failed to do so? Two procedures may be responsible for these differences. The present study utilized a complex indicator (CI) of associative strength: (1) the relative frequency of the response word, and (2) the absolute frequency of the response word as well as that of an additional response in the hierarchy. The use of a CI to define FAS seems to have merit. The choice of the components of CIs and their relative weighting must remain an empirical matter.

In the present study the following specific rankings had been predicted (from best to poorest learning): S-R1 > S-R2 > S-R3 > S-R4. Complex rules may sometimes be required to determine associative strength from combinations of the FAS indicators. In the present case, predictions for S-R1 pairs were clearcut. Pairs with the strong FAS, high rank in the hierarchy, and few strong competitors should be readily learned. The predictions for S-R2, too, were relatively simple. These pairs had relatively strong FAS, were high in normative rank, and had only one stronger competitor. Determining the relative strength of S-R3 and S-R4 in the present context was more difficult. Was the associative strength of a S-R3 pair with a response of relatively low rank, low FAS, with two moderate (a total of 40%) more frequent competitors stronger than that of a S-R4 pair, where the response was of still lower rank and FAS, but with one very strong and two relatively weak (a total of 85%) more frequent competitors? The total more-dominant FAS competition, disregarding the pattern, suggested the superiority of S-R3 to S-R4. This ordering of associative strength, although confirmed in the present study, is inconsistent with the findings of Shapiro (1968), who found shorter latencies in the learning of nondominant responses with strong dominant competitors.

The present study utilized homogeneous PAL lists, since it was reasoned that such lists would facilitate a response set similar to that in the WAT. Such a set would make associations available during WAT highly probable and should facilitate learning of all S-R pairs. It seems likely that Ss would have more available the high-frequency/high-rank responses than the low-frequency/low-rank responses because it is easier to isolate the "correct" word when it is a highly dominant primary with few competing responses. Presumably when the to-be-learned response is one of several words that could "go with" the stimulus and not necessarily the one highest in S's own response hierarchy, additional rules specific to individual pairs may be required, a process which might require additional time. The failure to find a significant interaction between FAS and presentation time suggests that if response set is a factor, it operates similarly for all levels of associative strength.

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Rigidity and instructions in relation to two-flash fusion measures

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It has been suggested that scores from constant-stimuli procedures with signal-detection analyses may be influenced by a personality variable termed "rigidity." To test this in connection with the discrimination of temporally paired flashes, high-rigidity and low-rigidity Ss were given both facilitating and inhibiting instructions with the two-flash fusion task. Signal-detection analyses indicated significantly higher threshold measures under both conditions for low-ridigity Ss. Inhibiting instructions raised both threshold and criterion scores for both groups, the low-rigidity group showing the greater criterion shift.

Recent papers have indicated the feasibility of signal-detection procedures for the study of two-flash fusion threshold (TFF) (Dorosh et al, 1970), the significance of signal-detection measures for the investigation of drug effects (Gruzelier & Corballis, 1970), and induced autonomic change (Boissonneault et al, 1970). Treisman & Watts (1966) developed a signal-detection model, based on a method of constant-stimuli presentation format, which offers certain practical advantages for TFF work. The Treisman and Watts procedure enables the isolation of three scores, namely, threshold, criterion, and sensitivity (D'Amato, 1970,

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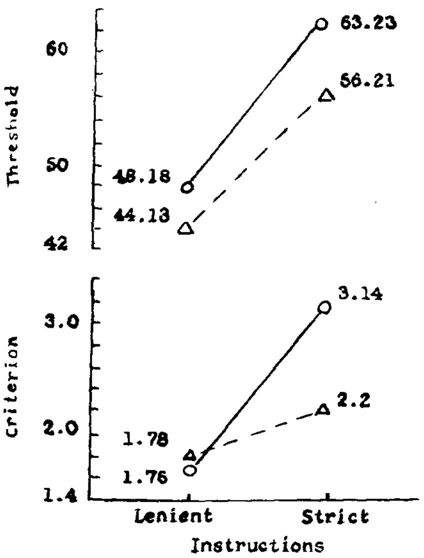

Fig. 1. Mean scores in msec for high rigidity (------) and low rigidity (——) Ss, under two levels of instructions.

p. 177). The latter two have been shown to correlate highly with corresponding scores from traditional signal-detection procedures for TFF (Dorosh et al, 1970).

In the development of their model, Treisman and Watts investigated the relationship of a personality variable termed "rigidity" (Luchins & Luchins, 1959) to the criterion scores derived from an auditory-detection task, reporting a significant correlation. As the nature of instructions used by E influence both threshold and criterion for TFF, it is apparent that the interpretation of standard instructions by S could also vary according to some personality factor, with corresponding effects upon the dependent variables. The following experiment was designed to test the effects of different types of instructions on two personality groups for the two sexes.

HYPOTHESES

The hypotheses were: (1) Ss classified as high rigidity and as low rigidity will differ in respect to threshold and criterion scores with the TFF procedure; (2) under strict-instruction conditions the threshold and criterion scores will be higher than under lenient-instruction conditions; and (3) criterion differences brought about by different forms of instruction will be greater for the low-rigidity group.

APPARATUS

A dark room with a display screen was used for S, with a separate control room for E. The TFF apparatus has been described elsewhere and is similar to that used by other workers (Dorosh et al, 1970). All scores are in terms of interflash intervals in milliseconds.

PROCEDURE

Undergraduate students were administered the Luchins water-jar test (Luchins & Luchins, 1959) for the purpose of personality classification. Sixteen Ss (eight males and eight females), who were not able to solve the extinction trial, Problem 9, within 45 sec, were allocated to the high-rigidity group, and eight males and eight females who satisfactorily solved the problems were allocated to the low-rigidity group. Each S was tested for TFF under both instruction conditions at the same test session, 16 Ss receiving lenient instructions for the first test and the others receiving strict instructions for the first test. All sessions took the form of a 5-min dark-adaptation period followed by a training series, during which 160 paired flashes were presented randomly as one or two distinctly perceptible flashes. S's response of "one" or "two" was acknowledged by E as "true" or "false." The test series followed a 5-min rest period. S received four blocks of 40 trials, separated by 1-min rest periods. Each block contained a randomized presentation of flashes of 0-msec IFI (single flashes) and two of each IFI from 10 to 100 by 10-msec intervals. S was required to state "one" or "two" at each presentation and received no feedback.

S was given standard general instructions and then one of two special instructions, according to the test condition. For lenient instructions, he was told, "Report two flashes if you are fairly certain two flashes occurred," and for strict instructions, "Report two flashes only if you are absolutely certain two flashes occurred."

ANALYSES

Using the Treisman & Watts (1966) procedure, the probability, p(T), of reporting two flashes at each IFI was calculated for each S for each test condition. Each p(T) was then expressed as a probit score (Finney, 1952). After eliminating any p(T) of 0 or 1, straight lines representing least-square linear regressions of probits on IFIs were calculated. The probit scale is defined to have a mean of 5.0 and a SD of 1.0. The value of I1, representing threshold and a detection probability of .5, can be taken as the IFI point from the regression line, where the probit value is 5.0. I2 is the IFI point corresponding with a probit score of 6.0. The threshold score (I1), criterion score $[I1/(I2 - I1)]$, and sensitivity score $[1/(I2 - I1)]$ were calculated for each S for each condition.

RESULTS

Three 2 by 2 by 2 analyses of variance with repeated measures were undertaken for the three dependent variables to determine the effects of sex, rigidity, and instructions. The significant main effects were for instructions on both threshold and criterion ($p < .001$ and .007, respectively) and for rigidity on threshold ($p < .05$), but the F value for the effect of rigidity on criterion was at the .1 level of p. Only one interaction approached significance, that of Rigidity by Instructions ($p < .1$) for threshold. As was expected, in no instance was sensitivity significantly changed. The mean threshold scores for the main cells are given in Fig. 1.

DISCUSSION

The increase in threshold and criterion brought about by strict (or inhibiting) instructions was in line with previous TFF results (Dorosh et al, 1970). The personality variable of rigidity, however, differentiated significantly only with the threshold measures, which were consistently higher for the low-rigidity group under both levels of instructions. The rigidity variable resulted in no differences in the criterion measure under lenient instructions but in marked differences under strict instructions, with a corresponding greater change for the low-rigidity group, as would be expected. The indications for TFF research are quite clear. Instructions must be very standardized and preferably of lenient format to equate for the personality factor. Strict instructions will increase the variance of the criterion scores. Conversely, however, the usage of the criterion score to explore personality factors, as suggested by Treisman & Watts (1966), will apparently pay off only under strict-instruction conditions, at least as far as TFF is concerned.

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