Response modification by "irrelevant" stimulus attributes[1]

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In a category rating study, pure tone anchors of 1 sec duration, but varying in intensity, were compared as to their effects on judgments of the duration of white noise series stimuli of 2, 4, 6, 8, and 10 sec. The study postulated an effect on judgment related to the presence of an "irrelevant" attribute. The hypothesis was supported: An anchor stimulus of greater intensity than that of the series exerted the greatest effect (p = .04) when compared to the no-anchor condition and to other anchor conditions. A less intense anchor also had a significant effect (p = .04) compared to the no-anchor condition, whereas an anchor of equal intensity to the series did not have a significant effect (p = .28). The introduction of anchor stimuli lowered duration judgments throughout.

Category rating studies employing anchor stimuli (AS) usually differentiate between them and series stimuli (SS) on the basis of two criteria: extremity with reference to a single attribute, and the fact that SS are rated whereas AS may or may not be. Thus, if SS are tones, AS normally would also be tones, either less or more intense than any of the SS, and if they were to be judged, it would be in the same terms as those used for the SS (e.g., relative loudness).

The typical paradigm for such studies involves comparisons between different anchor values with reference to their effects upon shifts in judgments made about SS. A point which is particularly relevant to the present study is that differences between AS normally would relate to the response dimension; that is, with reference to the foregoing example, one anchor might be 70 dB, another 50 dB, each value relating to a single psychological dimension of loudness. Thus, such studies are psychophysical in a classical sense, making an implicit assumption that response dimensions have their congruent stimulus dimensions. Such a view probably developed through a history of sensory emphasis which fostered concepts such as those of adequate stimulation and specific energies.

Studies of intermodal effects have, of course, liberalized the foregoing view. Thus, London (1954, p. 549), in reporting on Soviet sensory interaction studies, stated that "this research appears to demonstrate that all modalities undergo various modifications of sensory response on appropriate application of an accessory stimulus."

The present study was concerned with a somewhat different conjecture, attempting to determine the contribution to a response made by a stimulus attribute normally considered irrelevant to the response dimension. Thus, in the present case, Ss were to judge the duration of bursts of white noise, the "relevant" stimulus attribute being actual duration. Interspersed between the noise presentations were AS, pure tones, which differed in intensity, the presumably "irrelevant" attribute. The prediction was that there would be an effect on the judgment of duration which would be a function of the intensity of the AS. The direction of the effect was unspecified.

METHOD

Twenty-four Ss, juniors and seniors at Florida Atlantic University, were assigned randomly to four groups of six each. Their task was that of estimating durations of white noise bursts according to a nine-point scale ranging from "very, very short" to "very, very long." The actual durations involved were 2, 4, 6, 8, and 10 sec, each presented 20 times according to a random schedule, over a test series of 100 trials. The test series was preceded by a set of 20 practice trials, during which each duration was presented four times in random order. The bursts of white noise were presented at 8-sec intervals.

For three of the groups, a pure-tone signal (2000 cps for 1 sec) was sounded 4 sec before the onset of white noise. Ss were told that the short tone would signal the subsequent burst of noise. A control group (c) did not receive the tone. For all groups the intensity of the white noise was at 60 dB (sound pressure level). The three test groups were designated as follows: A > S, for which the anchor tone was at 80 dB; A = S, for which the tone was at 60 dB; and A < S, for which the tone was at 40 dB. No Ss experienced difficulty in hearing any of the stimuli, which they received in an acoustic chamber (1 AC Model 401A). Thus the sole variable was the intensity of the anchor stimulus.

Control of stimulus presentation was through a program tape and Hunter timers which closed speaker leads from an oscillator and a white noise generator.

RESULTS

Psychometric functions for the four groups are shown in Fig. 1. It would appear from them that the presence of anchor stimuli other than A = S, depressed judgments of duration. This was supported by analysis of the data. Individual adaptation levels (ALs: those stimulus values corresponding to a judgment of "medium") were determined for all Ss. Group median ALs were as follows: C, 5.19; A = S, 5.30; A < S, 5.52; A > S, 6.66. A Kruskal-Wallis one-way analysis of variance by ranks (1952) yielded H = 9, p < .01. Postmortem analysis compared median ALs for all groups using the Fisher exact probability test (1936). The test yielded the following results: C vs A < S, p = .04; C vs A < S, p = .04; C vs A = S, p = .28. A > S was also significantly different from the other two anchor groups (p < .04), whereas other differences were not significant.

In summary, A > S, and A < S were significantly different from C with A > S showing the greater effect on judgments of duration.

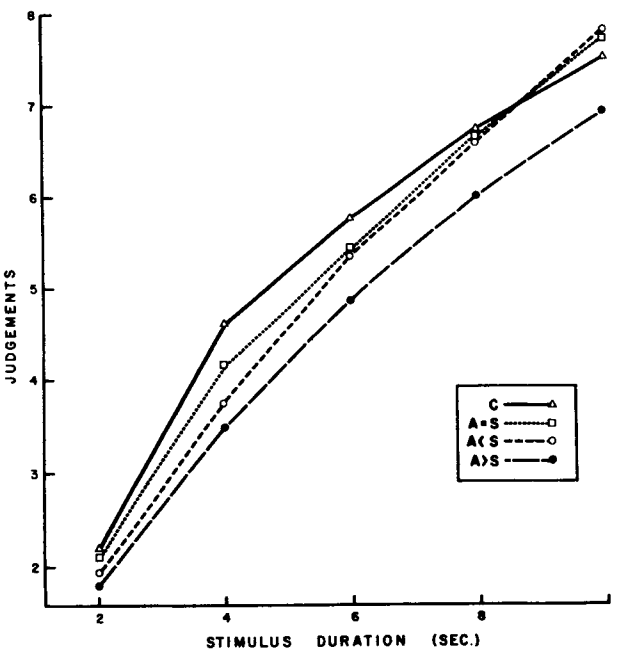

Fig. 1. Category rating curves for a no-anchor group (C) and three-anchor groups.

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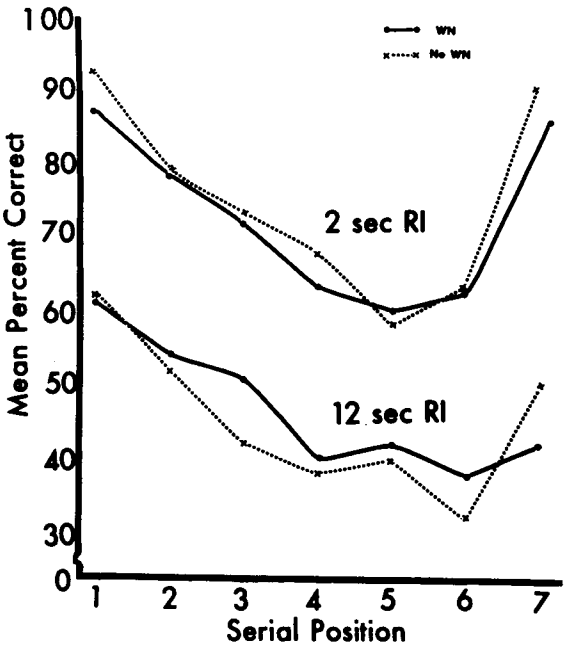

Fig. 1. Mean per cent correctly recalled digits as a function of serial position, white noise and retention intervals.

averaged over Ss, were 5.3 and 5.1 for the 2-sec RI and 3.1 and 3.1 for the 12-sec RI for the top and bottom quartiles, respectively. Again, no disruption effect was found even with differing physiological responsiveness. Although Sloboda and Smith reported a physiological measure which correlated with the onset of white noise (latency of onset for the largest GSR during the 12-sec RI), no such evidence was found in the present study.

One possible explanation for a lack of differential physiological activity to the white noise–no white noise variation may be that the warning which Ss received prior to the beginning of the white noise condition eliminated the surprise or startle-value of the white noise and resulted in quick adaptation.[1]

The negative results reported both in this study and in that of Sloboda & Smith (1968) suggest that 72-dB intensity white noise has little, if any, effect on short-term memory when rehearsal is minimized. These two studies taken together appear to indicate that 72-dB white noise can neither influence a reverberation nor consolidation process.

In order to obtain some measure of interindividual performance an "arousal level" was computed for each S. This value was the average of the background skin resistance (BSR) in ohms at the onset of the white noise and no white noise blocks. The performance measure was the per cent of correctly recalled digits for the two blocks. Each of the 17 Ss was ranked on the basis of arousal level and per cent of correctly recalled digits. Higher ranks were given to higher BSR values and poorer performance. For the 12-sec interval, a Spearman rho correlation of $-.86$ ($p < .01$) was found between the two sets of ranks, while for the 2-sec RI a nonsignificant rho of $+.25$ was obtained. The significant negative correlation which was obtained for the 12-sec RI indicates that Ss with lower BSR levels (i.e., those Ss showing greater arousal) performed more poorly than those with higher BSR levels (lower arousal) in this RI. When the RI was shortened to 2 sec this inverse relationship between arousal level and performance did not hold.

Two explanations are suggested for these results. First, no significant correlation was found for the 2-sec RI because the task was too easy and did not differentiate performance sufficiently between the Ss. The second and perhaps more plausible explanation is that two memory systems may be involved, each with its own physiological indicators. For the 12-sec RI, performance appears to be a function of the tonic, stable arousal level of an organism. For the shorter, 2-sec RI, performance seems to be independent of the GSR level and is probably correlated with some more dynamic, shorter latency fluctuation in the physiological state of the organism.

Weiner (1966) has reported a series of studies which investigated the effects of motivation on memory by changing the quality and magnitude of incentive. Weiner concluded that "Stimuli a priori considered to be highly arousing because of their association with an affective consequence are more likely to be recalled after a relatively short time interval than stimuli considered to be relatively low in arousal value [p. 20]." Since no physiological measures of arousal were employed, further research using Weiner's methodology as well as concomitant physiological measures may provide a clearer picture of the relationship between arousal and memory.

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NOTE

1. Sloboda & Smith (1968) reported that in a pilot study, significant amplitude differences were found between white-noise/no-white-noise trials when they were interspersed. No differences in recall were found, however.

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DISCUSSION

The effectiveness of anchor stimuli in modifying judgments of duration supported the main conjecture of this study. A tentative conclusion may be that Ss respond to attributes of stimuli which are commonly considered irrelevant to the response dimension, or, more generally, that the concept of relevance should be extended across stimulus dimensions as well as across modalities.

The direction of the effects was somewhat surprising, since, regardless of anchor intensity (excepting A = S), judgments of duration were lowered from the control function. A highly tentative explanation is that a pure tone has qualities which may make it more salient in perception than an interval of noise, presumably a more diffuse stimulus. An additional assumption, that perceived discrepancy from the series stimuli enhances the distinctiveness of the anchor stimulus and, hence, its effectiveness, may account for the disparity between A = S and the other anchor conditions.

Further work under consideration in this area will investigate the combined effects of anchor stimuli differing both in attributive qualities, as expressed in this paper, and in modality.

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NOTE

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