

Arousal and memory: A comment¹

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A study by Maltzman, Kantor, and Langdon and one by Yarmey did not obtain the Kleinsmith and Kaplan finding of poor immediate recall of high arousal material. However, on both methodological and theoretical grounds their results are not inconsistent with this previous finding. Important methodological departures from the Kleinsmith and Kaplan design include the free recall procedure in one case and rapid presentation rate in the other. Further, both studies failed to use a concurrent measure to classify the items for each S, making assessment of the relevance of their results difficult.

Two recent articles dealing with arousal and memory relationships (Maltzman, Kantor, & Langdon, 1966; Yarmey, 1966) raise several important questions concerning previous work by Kleinsmith & Kaplan (1963; 1964). Maltzman et al question the generality of the Kleinsmith and Kaplan studies on two grounds. First, they argue that "these paired-associate studies confound the effect of arousal during learning and retention, since the stimulus words, high or low arousal are presented as cues in the retention test as well as in the single learning trial" (p. 445). However, analyses of our data not reported in the published articles show that the GSRs at recall do not correlate with the GSRs at training. The recall GSRs do not predict recall performance; the training GSRs do. (The unreliability of the GSRs has other implications which will be discussed below.)

In order to avoid this presumed source of confounding, Maltzman et al used free recall of familiar words rather than stimulated recall of unfamiliar paired associates. This is a major procedural change; while the results of studies of this kind are of undisputed interest in their own right, there is little reason to expect the results to be comparable. Free recall of familiar words involves selection of certain material well represented in memory; paired-associate learning presumably involves the formation of new bonds or representations. Results of research in our laboratory using free recall agree with Maltzman et al's finding of superior recall for high arousal material (McKusick, 1965).

The second criticism they raise concerns the possibility that recent data on the functioning of the reticular formation raise doubts about the concept of nonspecific arousal. While the reticular formation is undoubtedly more complex than was originally thought, the possibility that some portion of this structure mediates nonspecific arousal has certainly not been ruled out. Recent evidence in support of this concept comes from Riklan, Levita & Cooper (1966) and from Wilson & Radloff (1967). Considerable confusion about

this concept may have been generated by undue reliance on EEG data. Podvold & Goodman (1967) have demonstrated that extracranial EEG does not correlate with behavioral alertness while deep recording does. The appropriateness of GSR as an index of reticular activity is supported by the physiological data of Bloch & Bonvallet (1960).

Another source of confusion may be theoretical. Arousal has too often been equated with drive in the Hullian sense. This equation is not entirely satisfactory either theoretically or empirically. The theoretical basis of the original articles concerns the way in which arousal may enhance learning; it carries no implications of arousal as a multiplier of habit. This "reinforcing" function of arousal, like Miller's "go-mechanism" (Miller, 1963), has its primary effect following the presentation of the stimulus to be learned. Our position, then, is in basic agreement with Maltzman's more recent statement: "Our evidence indicates that conductance level is a measure of arousal, but arousal is not drive, at least in its role as a multiplier of habit" (1967, p. 109).

A major difference between these studies and the Kleinsmith and Kaplan research is the way in which the determination of the high arousal items is made. Although Maltzman et al recorded GSR, they did not use this procedure to determine their high arousal grouping. Yarmey also used an a priori grouping; he did not record GSR. There is a considerable variation in GSR to any particular item; there is also variation for the same S and the same item on different occasions. The theory concerns the arousal reaction at a particular point in time (soon after the item was presented); the fact that an item in general elicits a large GSR is of less importance. The original studies depend solely on high and low GSRs for each S to determine his high and low arousal items. The results based on a priori breaks are unreliable.

Words that in general lead to a greater GSR reaction may have certain special properties in common. For example they may be high in "emotionality" (Noble, 1958). The study of the effect of emotionality on memory is itself an interesting topic. It is not equivalent to the study of arousal and memory.

It is almost certainly the case that the Yarmey results are based on special properties of the items presented rather than on an arousal effect. Since he presented his items every 2 sec and since the GSR effective in predicting recall often occurs considerably later than 2 sec after the presentation of the item, GSRs stimulated by a given item would

often not occur until after the next item had intervened. We have found that including GSRs within 12 sec of the presentation of an item yields the best prediction for recall. Levonian (1966), in a study which confirms both the short-term inaccessibility and the superior long-term retention for high arousal material, systematically varied scoring intervals. He found that a 30 sec period yielded the best recall predictions. While his material, traffic safety films, is obviously quite different from that employed by Yarmey, it also points to the likelihood that any effect that must occur within 2 sec of the onset of presentation is unlikely to be an arousal reaction.

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Note

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