

Retention in paired-associate learning related to extroversion and neuroticism

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Extroverts were predicted to learn a paired-associate list faster than introverts, but retain less than introverts when tested one, two, or seven days later. 75 college students were tested and the results indicated that the extroverts learned the list to criterion significantly faster than the introverts. The component analysis indicated superiority in the associative stage for the introverts, superiority in the integration stage for the extroverts, but no differences in response learning. The retention data did not support the prediction.

Walker (1958) has presented a theory of arousal and trace consolidation which maintains that in learning situations, stimuli with high arousal value will show poorer immediate retention and superior delayed retention than stimuli with low arousal value. Studies of Kleinsmith & Kaplan (1963, 1964), Kleinsmith, Kaplan & Tarte (1963) and Walker & Tarte (1963) provide evidence which shows that arousal is a critical variable in the retention of verbal material. Learning under conditions of low arousal results in a typical forgetting curve, immediate recall is excellent, but recall ability decreases rapidly with time. High arousal learning, on the other hand, shows a marked reminiscence effect, poor immediate recall, but strong permanent memory. These results have been interpreted as supporting Walker's theory of consolidation of neural traces. The poor immediate recall for high arousal learning is accounted for by making the assumption that actively consolidating neural traces are relatively unavailable for recall until the consolidating process has ceased.

Eysenck (1963, 1964, 1967) has presented a theory of personality which places major emphasis on the dimensions of introversion-extroversion and neuroticism. On the basis of evidence from EEG recordings, evoked potentials, CFF and drug studies, he has argued that introverts can be characterized as more highly cortically aroused than extroverts. Neuroticism or anxiety is conceived of as a predisposition to strong autonomic activation, and is thought by Eysenck to produce higher cortical arousal, both directly and through the reticular formation.

McLaughlin & Eysenck (1967) hypothesized that these personality associated states of arousal may have similar effects as stimulus produced arousal. In other words, introverts would be predicted to react in a fashion analagous to ambiverts, that is, those persons who score in the middle range of the introversion-extroversion continuum, when confronted with high-arousal words and syllables, whereas extroverts would be predicted to react in a fashion analagous to ambiverts confronted with low-arousal words and syllables. This relationship was tested on groups of introverts and extroverts both high and low on the neuroticism scale, on both an easy and a difficult paired-associate list. The results showed that extroverts, who were hypothesized to be under a low state of arousal and faster in consolidating, did learn the lists faster than the introverts.

The present study is attempting to: first, replicate the effects of these personality variables with American students rather than English students who were previously tested; secondly, to analyze the components of the paired-associate task into a response learning, associative and integration stage to shed light on the relationship of personality variables to the components of the paired-associate task; and finally, having

substantiated the prediction of the relationship of personality associated states of arousal to immediate learning, it is necessary to determine if the remaining portion of the theory can be substantiated. That is, introverts are hypothesized to be at a disadvantage with immediate recall but when time is allowed for consolidation to occur their performance should increase and show the reminiscence effects demonstrated by other investigators with stimulus-produced states of arousal.

METHOD

Subjects

The Ss were 141 undergraduate college students at Southern Illinois University, Edwardsville. On the basis of the Eysenck Personality Inventory (Eysenck & Eysenck, 1964) which was administered in freshman and sophomore psychology classes, the students were put into four groups: low neuroticism-extroverts, high neuroticism-extroverts, low neuroticism-introverts, and high neuroticism-introverts. Ss scoring between 8 and 10 on the neuroticism scale and/or 11 and 13 on the introversion-extroversion scale were excluded. Also, Ss were restricted to students 24 years old and under to eliminate the possible confounding of age and personality. Seventy-five students with the most extreme scores were then tested individually on the paired-associate list.

Procedure

The P-A list consisted of 12 pairs with three-letter words as stimuli (hat, pen, bag, ten, etc.) and 40% association value nonsense syllables as responses (Glaze, 1927). The list was presented on a memory drum at a 2:2-sec rate with a 6-sec intertrial interval to a criterion of 10/12 correct responses for a maximum of 36 trials. The Ss were given standard instructions (Runquist, 1966) which were modified to have the Ss pronounce the stimulus members (words) and spell the response items on the first trial, and to anticipate by spelling the response items after the first trial. The Ss were preassigned on a random basis in order of appearance at the laboratory to one of the four recall intervals: immediate, one, two, or seven days.

After learning the P-A list to criterion the Ss depending on the retention interval were either tested immediately or asked to return at a later time to be tested on another type of task. For the delayed recall groups the instructions worked adequately well with only eight Ss indicating that they expected that recall of the original list might possibly be required at the second session. The recall task consisted of three parts: (a) a blank sheet to write down anything which was remembered (free stimulus and/or response recall), (b) a sheet which listed the stimulus items with blanks for the responses, and (c) a multiple-choice test which had each of the stimulus items and four possible response items. The response alternatives all had the same beginning consonant but different vowels and final consonants (e.g., VAB, VEF, VOT, VIX). A questionnaire asked for information concerning discussion with others about the experiment before the retest, guessing about the nature of the study before the retest and the amount of rehearsal of the list during the recall interval.

RESULTS

The number of trials to reach criterion of 10/12 correct responses was analyzed for the effects of introversion-extroversion and neuroticism. Table 1 shows the mean number of trials to criterion for each group. An analysis of variance of this data showed extroverts to have learned the list significantly faster than introverts ($F = 6.41$, $df = 1/71$, $p < .05$). These data were further analyzed into a response

Table 1
Mean Number of Trials to Complete the Response Learning, Associative and Integration Stages and Reach Criterion, for Each of the Four Personality Groups

	Low Neuroticism Extroverts	High Neuroticism Extroverts	Low Neuroticism Introverts	High Neuroticism Introverts
Trials to Criterion				
\bar{X}	16.00	19.19	24.69	22.84
SD	5.27	8.38	6.99	8.96
Response Learning				
\bar{X}	7.81	8.39	10.32	9.32
SD	2.75	3.12	2.79	4.21
Associative Stage				
\bar{X}	1.04	.72	.30	.32
SD	.97	.89	.42	.48
Integration Stage				
\bar{X}	3.08	4.07	7.54	5.47
SD	2.14	3.36	3.01	3.96

learning, associative and integration stage. Response learning was defined as the mean number of correct responses until each response was given correctly. The associative stage was defined as the mean number of trials between the trial on which the response was first given until it was first given to the appropriate stimulus. The integration stage was defined as the mean number of trials between the trial in which the response was first given to the appropriate stimulus until the response was last given incorrectly.

The differences in mean number of trials to complete the response learning stage yielded no significant differences. In the associative stage, the difference of greater trials for the extroverts was significant by an analysis of variance test ($F = 6.70$, $df = 1/66$, $p < .05$). Similarly, the analysis of the integration stage yielded significant differences ($F = 4.65$, $df = 1/66$, $p < .05$), but this stage was completed faster by the extroverts.

The retention data were analyzed for differences between the number of stimulus and/or response members recalled, the number of responses recalled when the stimuli were presented and the number of responses recognized in the multiple-choice test. In five separate analyses of variance the only variable found to have an effect was Days. Thus, the retention data failed to show any differential effects attributable to personality as had been hypothesized.

DISCUSSION

The number of trials to criterion support the previous finding that extroverts are superior to introverts in the acquisition of the paired-associate list. The retention data, however, indicate no significant differences at any of the four retention intervals. The extroverts who learned the list to criterion significantly faster than the introverts did not have significantly higher recall scores even at the immediate retention interval. The criterion for learning the list was deliberately set at less than perfect learning to allow for any reminiscence effects, but little was found except at the immediate recall interval.

A recent study (Maltzman, Kantor, & Langdon, 1966) has questioned the research findings of Kleinsmith, Kaplan, Walker, et al, and has argued that there is a confounding of arousal during learning and retention. Kaplan & Kaplan (1968) have answered this argument showing that the GSRs which were used to measure arousal at training, did not correlate with the GSRs at the time of recall. In the present study the

personality-associated states of arousal would necessarily be confounded with a correlation of arousal for the learning trials and recall tests. Since no differences were attributable to personality in the present study, the implications of this confounding cannot be readily determined.

The analysis of the components of the acquisition data yielded the curious effect of a longer associative stage for the extroverts despite an overall superiority in learning the list. This might possibly relate to differences in risk-taking behavior supporting Cameron & Myers (1966) finding that Ss with extroverted traits are much more likely to take risks than Ss with introverted traits. The Ss were instructed to "give responses even if you are not sure of them." If a S gave a response as soon as it was learned, however, it would have a higher probability of being incorrectly associated and reflected in a longer associative stage.

This finding of differences in the component analysis of paired-associate learning indicates that this learning task is perhaps inappropriate for studying the relationship of arousal or personality factors to retention. Response learning, verbal discrimination and other learning tasks should be explored to determine if they would be more appropriate for studying the effects of arousal on retention. Although the present retention data do not support the arousal hypothesis, further research is warranted both on the acquisition and retention of learning, before any definite conclusions are warranted.

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