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Glenna F. Hasslacher

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by

GLENNA F. HASSLACHER

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GLENNA F. HASSLACHER

Approved:

Dr. L. James Tromater

Dr. Kenneth A. Blick

Dr. Robert J. Filer

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RETENTION AS A FUNCTION OF TRANSFER PARADIGM AND INTROVERSION-EXTROVERSION

by Glenna F. Hasslacher

University of Richmond

In an effort to investigate the effects of personality on paired-associate learning, sixty students from the University of Richmond were separated into three groups of extrovert, control, and introvert, on the basis of the Eysenck Personality Inventory (EPI). Five Ss from each group were randomly assigned to four paired-associate learning conditions (A-Br, A-C, C-B, C-D) and required to learn an A-B and a second paired-associate learning list to a criterion of one perfect score. Subjects were required to return to the lab after 24 hours for a retention test of both the second list and the original A-B list. Results of the experiment were exactly opposite of expectation, i.e., introverts rather than extroverts learned the A-B list in fewest number of trials to criterion, no significant difference between the personality groups and learning conditions was found, no significant difference between introverts and extroverts on the retention of the second and the original A-B list was observed. An explanation of the lack of significance was offered in terms of the small n (5) per cell, the learning habits of the Ss, the selection of the stimulus and response items, and the use of the paired-associate task for showing personality differences in learning.

It has been experimentally shown that there are statistically significant performance differences between introverts and extroverts in many activities (Spielman, 1963; Hogan, 1966; Claridge, 1966; Bakan, Belton and Toth, 1963; Rankin, 1963a, 1963b; Child, 1964; Furneaux, 1962; Lynn, 1959; Corcoran, 1964; Jawanda, 1966; and Skanthakumari, 1965).

In regard to verbal learning, Eysenck (1970) believes:

> any prediction for experimental work would consequently be very closely tied to the parameters of the work in question, but in general, and subject to modification as a result of unusual choice of inter-trial periods, we would expect extraverts to show better serial learning, paired-associate learning, and digit-span memory than introverts, provided the time interval between learning and testing was relatively short. Conversely, we would expect introverts to show better serial learning, paired-associate learning, and digit-span memory than extraverts, provided the time interval between training and testing was relatively long (p. 130).

McLaughlin and Eysenck (1967) found stable extroverts, defined as those scoring low on the Neuroticism (N) scale of the Eysenck Personality Inventory (EPI) and high on the Emotionalism (E) scale of the EPI, actually show fewer errors when learning a difficult verbal list than when learning an easy list, while stable introverts (those scoring low on the N scale and low on the E scale of the EPI) make over three times as many errors.

Jensen (1964) did a factor analytic study involving many

different types of learning and learning tasks, such as serial trigram learning, delayed digit-span, immediate digit-span, as well as the personality types extrovert and introvert, as measured by the Maudsley Personality Inventory and the newer, then unvalidated, Eysenck Personality Inventory. He found extroverts correlate positively with quick performance, as measured by the various learning and memory tasks mentioned above. Jensen found positive correlation between extraversion and immediate digit-span, but not between extraversion and delayed digit-span.

To date there has been little research using the personality variable extroversion-introversion, and paired-associate learning, and even less in the area of retention. However, Howarth (1969) and Bone (1971) both showed extroverts make fewer errors and take fewer trials to reach criterion than introverts when interference, in the form of re-pairing the stimulus items with different response items on succeeding learning lists, was present.

McLaughlin (1968) did a retention study involving paired-associate learning and personality variables. According to Eysenck's theory of performance differences, McLaughlin expected that the extroverts would learn the lists faster than the introverts, but that the introverts would retain more when tested one, two, or seven days later. The learning prediction was substantiated, but the retention prediction was not. McLaughlin explains the lack of significance as due to inappro-

priate learning material because the paired-associate items he used did not have high arousal terms such as those used by Walker (1958), the experiment McLaughlin was trying to replicate.

Hall (1971) presents four paradigms of transfer and the methods of data collection and expected results of the paradigms based on the experiments of many investigators. The first paradigm is attaching a new response to an old stimulus (A-B, A-C). This paradigm typically results in negative transfer, i.e. difficulty in learning the new list due to previously learned associations (Twedt and Underwood, 1959; Osgood, 1946). The second paradigm is attaching a new stimulus to an old response (A-B, C-B). This usually results in positive transfer, although under certain learning conditions it is possible to achieve negative transfer (Jung, 1963). The third paradigm is repairing a previously learned response with a different old stimulus, thus forming new pairs (A-B, A-Br). This paradigm has shown greater negative transfer than the A-C paradigm for many investigators (Twedt and Underwood, 1950; Postman, 1962; Jung, 1962) to name a few. The last transfer paradigm is the A-B, C-D paradigm, which is both new stimulus and response items. This paradigm is usually used for the control.

Considering the performance and learning differences between extroverts and introverts predicted by Eysenck in his postulates, it was logical to assume that a group of extroverts, a group of introverts and a control group would perform differ-

ently if they were involved in different learning conditions, such as the four paradigms of transfer presented in Hall. The expectations were that the first paired-associate list (A-B) would be learned in fewer trials for the extroverts than for the introverts, but that introverts would have more items correct on a recall test and that extroverts would learn the A-Br and A-C lists faster than introverts. No prediction was made for the retention of the A-Br, A-C, C-B, or C-D lists, although it was anticipated that the introverts would show better retention of the C-B list.

Method

Subjects. One hundred forty-four introductory psychology students from the University of Richmond were given the Eysenck Personality Inventory (EPI). The mean score of the E scale (the measure of introversion-extroversion) was 13.2 and the S. D. was 3.7. The top and bottom 30% of the scores were considered extrovert and introvert, respectively, and the 30% scoring around the mean were considered control subjects (Ss). However, in actuality, only those Ss scoring above and below 1 S. D. were used as extroverts and introverts, with the exception of two introverts who had a score of 10, and six extroverts who scored 16. Four of these six extroverts were replacements for Ss who did not return to the lab for the second part of the experiment. Only one introvert had to be replaced. Of the control Ss, six scored 12, seven scored 13, and seven scored 14 on the E scale. None of the control Ss had to be replaced.

Twenty extroverts, twenty introverts, and twenty control Ss were selected in all, making a total of 60 Ss. Only those students who indicated a willingness to participate in the experiment for extra credit were used as Ss. Five extroverts, five introverts, and five control Ss were then randomly assigned to one of four learning conditions. Neither sex differences nor neuroticism score was expected to be an important variable, although any N score exceeding 2 S. D. above or below the mean would have been automatically eliminated. There were 33 males and 27 females in the study, distributed in a way that resulted in 13 males and 7 females in the extrovert group, 10 males and 10 females in the introvert group, and 10 males and 10 females in the control group.

Apparatus. The Eysenck Personality Inventory, written by H. J. Eysenck and published by the Educational and Industrial Testing Service, San Diego, California, was used to divide the Ss into the three groups of extroverts, controls, and introverts. On form A of the EPI, the University of Richmond students had a mean score of 13.2 with a S. D. of 3.7 on the E scale which compares with American college students who had a mean of 13.1 with a S. D. of 4.1 and the general population which had a mean score of 12.1 with a S. D. of 4.4 as reported by Eysenck in the manual of the EPI. On the N scale, the University of Richmond students had a mean score of 10.6 with a S. D. of 4.4 whereas Eysenck reports American college students had a mean score of 10.9 with a S. D. of 4.7, while the general population had a

mean score of 9.0 with a S. D. of 4.8 on the same scale.

Five learning lists were used, and can be briefly described as follows:

The A-B List: This was the initial learning list which was given to all Ss, and it consisted of 8 CVC stimulus items and 8 two-digit response items.

The A-Br List: This was a negative transfer list which was made from the same stimulus and response items as the original learning list except the stimulus and response items were randomly re-paired, thus creating new items.

The A-C List: A negative transfer list consisting of a new response item paired with an old stumulus item.

The C-B List: This was the positive transfer list. This list consisted of old response items paired with new stimulus items.

The C-D List: This was the control group, and the list consisted entirely of new stimulus and new response items.

The learning lists are presented in Appendix A.

All lists were constructed in the following manner: the stimulus part of the paired-associate item was selected from Noble's (1961) list of scaled meaningfulness between 1.75 and 1.95. Twenty-four of these CVCs were chosen by the author according to a table of random numbers to make up the three learning lists that were required to have new stimulus items. The response items were selected from Battig and Spera's (1962) list of numbers, and had an M value of between 1.00 and 1.61. Again, random selection was made by the author until 24 numbers had been selected.

There were 8 separate random rearrangements of each learning list to vary the serial position of the items. While the retention and test lists (L2) were a random rearrangement of the stimulus items only, the serial position of the test items was different from the stimulus words of the immediately preceeding trial. The 8 random sequences for the A-B list are presented in Appendix B.

A memory drum made by Psychological Instruments, Richmond, Virginia, was used to present the learning and test trials to the Ss. Each learning list, which consisted of both stimulus and response items, and test list, stimulus items only, and each of the random sequences for the five learning lists, was typed with pica type in capital letters on a scroll of memory drum paper. Changing from one learning list to another was a simple matter of either winding, or unwinding the scroll, until the desired learning list came into view.

Procedure. After the initial selection of the population which was done using group procedures, the training and testing, and retention portion was done on an individual basis.

Ss were told at the outset that they were participating in a verbal learning study that would require them to learn lists of nonsense syllables on two consecutive days, lasting about thirty minutes each session. Actually, the second day lasted about ten minutes, just long enough to recall the L2 list, the original A-B list, and to discuss the S's score on the EPI.

All Ss were required to learn the A-B list to a criterion of one perfect trial. Then each S was asked to learn a second list, depending on the group to which he had been assigned, to a criterion of one perfect trial. The Ss were told to return to the lab in twenty-four hours for the remainder of the experiment.

All learning lists were presented on a memory drum at the rate of 4 sec. with an intertrial interval of 12 sec. Subjects were given a test trial immediately following each learning list presentation. Presentation of the recall or test trial consisted of the stimulus item only being shown on the memory drum. The Ss were told to call out the anticipated response as soon as the stimulus item appeared in the memory drum window. The E kept a tally for each S marking items missed and items correctly recalled, on specially prepared tally sheets. Record was kept for each S of the number of trials to criterion for List 1, List 2, and the number of items correct on the retention tests. Subjects were also asked how

they memorized the paired-associate lists, and more specifically if they used mnemonic devices.

Design. This design required four analysis of variance (ANOVs). The first was a 3 x 4 which compared trials to criterion on the first list (A-B) for each personality type under each learning condition. It was expected that there would be a significant effect due to personality with extroverts learning the list in fewest trials and the introverts in most trials. No difference due to learning conditions was expected.

The second ANOV was also a 3 x 4 which compared trials to criterion on the second list for each personality group under each learning condition. A significant interaction effect (personality type X learning condition) would indicate that the personality types performed differently under different learning conditions.

The third ANOV was likewise a 3 x 4, but this one compared number correct on the retention trial for the second list. A significant interaction effect (personality type X learning condition) would indicate that the personality type retained the material differently under different learning conditions.

Finally, a fourth ANOV (3 x 4) compared number correct on the retention trial for the first list. The effect of personality type upon retention was tested. It was expected that introverts would retain the material best and that extroverts would retain least well.

Transfer was computed for trials to criterion using Murdock's (1957) formula: C-E/E+C x 100.

Results

Results of the analysis of variance (ANOV) of the number of trials to reach criterion on the A-B list for the three personality types showed a significant difference between personality groups, F (2,48) = 4.06, $p < .05$, which was expected. The results of the ANOV are depicted in Table 1.

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Insert Table 1 about here

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A Newman-Keuls test of ordered means performed on the personality group means showed a significant difference between the introverts and the controls. Significance was judged on the basis of comparison with a critical value computed in the Studentized Range Statistic. The results of the Newman-Keuls Test are shown in Table 2.

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Insert Table 2 about here

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Since the significant difference was exactly opposite of expectation, with introverts learning the lists in the fewest number of trials, the difference can only be attributed to the small n and the few extreme scores caused by both lack of concentration and poor learning methods on the part of the subjects.

An F Max Test, a method of comparing subgroup variability, was performed on the twelve cells of the first ANOV. The F Max .95 (4, 12) = 13.86, which was not significant, indicating

Table 1

Analysis of variance: Personality type X learning condition for A-B Learning (Trials to criterion)

Source	SS	d f	ms	F
Between	405	11		
P	210.70	2	105.35	4.06*
L	101.93	3	33.97	1.31
P X L	92.37	6	15.39	.59
Within	1243.60	48	25.90	
TOTAL	1648.60	59		

*$p < .05$

Table 2

Newman-Keuls Test of Differences Between

All Pairs of Means for A-B Learning

Category		1 Introvert	2 Extrovert	3 Control
	Means	8.75	11.95	13.2
1	8.75		3.20	4.45**
2	11.95			1.25
3	13.2			
$\sqrt{\text{MS error}/n}$			r = 2	r = 3
	q .95 (r, 48)		2.86	3.44
	q .95 (r, 48)		3.26	3.93

*MS error = 25.90

n = 20

**$p < .05$

homogeniety of variance within the cells.

The results of the second ANOV, personality X learning condition on the L2 learning, revealed no significance due to personality groups, learning conditions or interaction effects. Table 3 represents a summary of this ANOV.

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Insert Table 3 about here

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Again, in the third ANOV, personality X learning condition on the L2 retention, the expected significance was not shown. There is no significant difference between the retention of extroverts and introverts on the second list learning. A summary of the third ANOV is depicted in Table 4.

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Insert Table 4 about here

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Results of the fourth ANOV, personality X learning condition for A-B retention, show a significant difference between lists, F (3, 8) = 3.75, $p < .05$, but not the expected difference between personality groups. Table 5 shows the results of this ANOV.

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Insert Table 5 about here

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Table 3

Analysis of Variance: Personality type X Learning Condition for L2 Learning (Trials to Criterion)

Source	SS	df	MS	F
Between	115.94	11		
P	37.44	2	18.72	1.64
L	53.94	3	17.98	1.57
P X L	24.56	6	4.09	.35
Within	547.99	48	11.41	
TOTAL	663.93	59		

do not reject Null

Table 4

Analysis of Variance: Personality type X Learning Condition for L2 Retention (number of Items correct)

Source	SS	df	MS	F
Between	31.60	11		
P	15.70	2	7.85	2.21
L	6.	3	2.0	.31
P X L	9.9	6	1.65	.46
Within	170.80	48	3.55	
TOTAL	202.40	59		

do not reject Null

Table 5

Analysis of Variance: Personality type X Learning Condition for A-B Retention (Number of items correct)

Source	SS	df	MS	F
Between	25.65	11		
P	.1	2	.05	.02
L	22.98	3	7.66	3.75*
P X L	2.56	6	.42	.20
Within	98	48	2.04	
TOTAL	123.65	59		

* Sig. at $p < .05$

A Newman-Keuls run on this data showed a significant difference between the A-C and the C-B list. A glance at the data sheet reveals more items remembered of the C-B list (67) than of the A-C list (41). This difference is typical of C-B (positive) and A-C (negative) transfer paradigms of verbal learning as presented in Hall, but shows no effect of personality in learning these lists. The results of the Newman-Keuls are presented in Table 6.

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Insert Table 6 about here

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An F Max test of subgroup variability was computed on the L2 Retention data, with the result that a significant difference F Max .95 (12, 4) = 61.50 between the variability of the cell showing C-D learning for introverts and the cell showing A-C learning for the control group was verified. The significant difference between these two cells clearly indicates a violation in the basic assumption of the analysis of variance, namely, homogeniety of variance.

Computation of the percentage of transfer reveals some interesting and unexpected results. For instance, on the A-Br list, extroverts showed negative transfer rather than the hypothesized positive transfer, while introverts showed positive transfer rather than the hypothesized negative transfer. Both extroverts and introverts showed positive transfer on the A-C list which usually elicits negative results, but can,

Table 6

Newman-Keuls Test of Differences Between

All Pairs of Means for A-B Retention

Category		(1) A-C	(2) C-D	(3) A-Br	(4) C-B
	Means	2.73	3.6	3.8	4.47
(1)	2.73		.87	1.07	1.74*
(2)	3.6			.2	.87
(3)	3.8				.67
(4)	4.47				
			r = 2	r = 3	r = 4
$\sqrt{\text{MS error}/n}^{*} =$		q .95 (r, 48)	2.86	3.44	3.79
.37		q .95 (r, 48)	1.06	1.28	1.41

*MS error = 2.04

n = 15

**$p < .05$

according to Hall, result in positive transfer if the m value of the response item is too low. This result is a clear indication to this author of the inappropriateness of these particular paired-associate lists to show the effects of personality on learning. All groups, extrovert, introvert, and control, showed positive transfer on the C-B list, which was expected. Table 7 illustrates the transfer data.

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Insert Table 7 about here

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Discussion

In regard to the central hypothesis, it is interesting to note that the results are completely opposite of the prediction. For example, extroverts were predicted to learn the A-B list in fewest trials, but the introverts actually did. This result is also completely orthogonal to the findings of McLaughlin (1968) who found extroverts to learn paired-associate lists in fewer trials to criterion than introverts.

Extroverts were also predicted to learn the A-Br list and the A-C list in fewer trials to criterion than introverts, but the second ANOV showed no significant difference between personality groups, learning lists or any interaction. These findings are opposed to those of Howarth (1969) and Bone (1971), both of whom showed extroverts to have fewer errors and take fewer trials to reach criterion than introverts when learning an A-Br list.

Table 7

Percentage of Transfer for L2 Learning

for Each Personality Type

Personality Type	Transfer Condition		
	A-Br	A-C	C-B
Extrovert	- 2.5 %	9.8 %	20 %
Introvert	11 %	25 %	25 %
Control	- 6 %	- 4 %	9 %

Introverts were predicted to retain more items of the original A-B list after a 24-hour retention period than the extroverts. But the results of the fourth ANOV showed no differences due to personality groups. This finding is consistent with the lack of significance found by McLaughlin (1968).

A possible explanation of the lack of significance between personality and learning condition can be made in terms of the small n (5) in each group. With such a small n, the raw extreme scores had the power to create a large within error term which minimized the effect of the personality groups and the interaction between personality group and learning list. This large within group variation was verified by the significant F Max.

The significance revealed by the F Max test deserves further investigation. The raw scores of the cell introvert learning of the C-D list were 8, 5, 21, 9, 3, while the raw scores of the cell control learning of the A-C list were 5, 5, 7, 6, 5. Obviously the range difference of the scores of the first cell (21-3 = 19) far exceeds the range of scores contained in the second cell (7-5 = 2). Some explanation for the extreme scores, other than the small n, can be provided. In the notes the E kept on each S's performance, two entries are of interest for the S with the score of 21. First of all, that S's learning trial was interrupted several times by lost persons entering the room. Secondly, it was observed that this subject tried to learn all the items on the list at one

time, and whereas the stimulus and response items were learned in relatively few trials, the S had difficulty attaching a response to the correct stimulus. This S was not unique. Many Ss had the same problem. However, those Ss who indicated using mnemonic devices, such as changing the nonsense syllable to a meaningful word to help them remember, learned the list in relatively few trials. On the A-B list the most frequently used associative devices were: WAQ = wack, or hit, LOH = low, and a high number, MIF = Miss, CEW = Sue, KOV = a Russian name, DOY = boy (and sometimes toy), GUC = Gus, DOJ = Dodge, a type of automobile. It was thought that the use of mnenomic devices would be dependent upon the personality type of the S. Each S was asked the question "Did you use mnemonic devices to help you learn the A-B list?" at the termination of the tasks on the first day. A 2 x 3 Chi square was computed using this categorical data. However, X^2 (2) = .167, did not exceed the tabled value of 5.99 necessary to indicate a significant difference between personality type and the use of mnemonic devices. According to the X^2 analysis, the use of mnemonic devices is not an explanation of the non-significance. The raw data for the X^2 analysis is recorded in Appendix C.

Those Ss who tried to learn all 8 items at once ended up in a state of confusion, taking more trials to reach criterion, i.e., 20, 24, 27, as compared to those Ss who learned one or two items per trial, i.e., 3, 5, 7, 8. Some Ss stated they started using associative devices to help them

remember after the first five or six unsuccessful trials. These Ss took 9 to 16 trials to reach criterion.

Another reason for the lack of significance between personality type and learning condition lies within the learning lists themselves. Of the eight stimulus items of the A-B list, four of them contained an "O" between the two consonants, i.e., LOH, KOV, DOY, DOJ. Two of the stimulus items started with a D (DOY and DOY). Such similarity was found to be very confusing by many Ss. Of the response items, four of them were reversals of each other, i.e., 26, 62, 34, 43. The confusion was further compounded by the fact that DOY was paired with 62, and DOJ was paired with 34.

A final explanation of the lack of significance of personality on learning may be that the paired-associate task is too easy. McLaughlin and Eysenck (1967) showed extroverts to have fewer errors when learning a difficult list, and more trials to criterion to learn an easy list than introverts. But, in this experiment the results of the percentage of transfer which was positive on the A-C list, for both introverts and extroverts, would indicate that the lists were too easy.

It seems curious to this author, that McLaughlin (1968), who conducted a paired-associate learning study which was cited in this paper, and who also used the Eysenck Personality Inventory as a means of personality differentiation, likewise did not achieve the desired significance he sought. Further-

more, differentiating individuals as introverts and extroverts is a very narrow and simplistic approach to the study of personality. Therefore, it appears that besides the obvious changes already suggested concerning personality factors in the paired-associative task, a more logical approach to personality study would be to employ techniques that would result in a broader view of personality and utilize personality tests other than the EPI. A correlational study employing such personality measures as the Edwards Personal Preference Schedule, the Guilford-Zimmerman, the Comrey Personality Scales, the Psychological Screening Inventory, or the MMPI in addition to the Eysenck Personality Inventory along with learning tasks involving inductive and deductive reasoning, would be most productive. Such a multivariate study would enable the investigator not only to utilize all of his data from many different aspects or angles, but also to look at trends involving personality and learning.

APPENDIX A

The Five Learning Lists

The A-B List

WAQ - 54

LOH - 79

MIF - 43

CEW - 91

KOV - 82

DOY - 62

GUC - 26

DOJ - 34

The A-Br List

WAQ - 82

LOH - 43

MIF - 26

CEW - 79

KOV - 34

DOY - 54

GUC - 62

DOJ - 91

The A-C List

WAQ - 93

LOH - 42

MIF - 61

CEW - 23

KOV - 78

DOY - 41

GUC - 52

DOJ - 35

The C-B List

WOC - 54

YAS - 79

JAT - 43

CEG - 91

SUY - 82

NUZ - 62

LAH - 26

KEV - 34

The C-D List

RIQ - 72

PEX - 38

QOT - 92

JEK - 61

BAZ - 56

ROH - 94

CIZ - 51

LOJ - 68

APPENDIX B

Random Sequences of the A-B List

Order 1	Order 2	Order 3	Order 4
WAQ - 54	LOH - 79	MIF - 43	CEW - 91
LOH - 79	DOY - 62	DOJ - 34	GUC - 26
MIF - 43	CEW - 91	WAQ - 54	DOY - 62
CEW - 91	KOV - 82	GUC - 26	LOH - 79
KOV - 82	WAQ - 54	DOY - 62	DOJ - 34
DOY - 62	MIF - 43	LOH - 79	WAQ - 54
GUC - 26	DOJ - 34	KOV - 82	MIF - 43
DOJ - 34	GUC - 26	CEW - 91	KOV - 82

T_1	T_2	T_3	T_4
DOY	DOJ	GUC	WAQ
KOV	CEW	MIF	LOH
DOJ	MIF	WAQ	CEW
LOH	WAQ	DOY	DOJ
MIF	GUC	LOH	KOV
CEW	KOV	DOJ	DOY
WAQ	DOY	CEW	GUC
GUC	LOH	KOV	MIF

Order 5	Order 6	Order 7	Order 8
KOV - 82	DOY - 62	GUC - 26	DOJ - 34
WAQ - 54	KOV - 82	MIF - 43	CEW - 91
DOJ - 34	GUC - 26	KOV - 82	LOH - 79
DOY - 62	DOJ - 34	WAQ - 54	MIF - 43
CEW - 91	MIF - 43	LOH - 79	GUC - 26
GUC - 26	CEW - 91	DOJ - 34	KOV - 82
LOH - 79	WAQ - 54	CEW - 91	DOY - 62
MIF - 43	LOH - 79	DOY - 62	WAQ - 54

T_5	T_6	T_7	T_8
LOH	MIF	CEW	KOV
DOY	DOJ	GUC	WAQ
KOV	GUC	LOH	DOY
GUC	CEW	KOV	MIF
WAQ	DOY	DOJ	CEW
MIF	LOH	WAQ	GUC
DOJ	KOV	MIF	LOH
CEW	WAQ	DOY	DOJ

APPENDIX C

RAW DATA FOR X^2 SQUARE

Personality Group	YES	NO
	Obs. (Exp.)	Obs. (Exp.)
Extrovert	8 (10.33)	12 (9.67)
Control	11 (10.33)	9 (9.67)
Introvert	12 (10.33)	8 (9.67

$$X^2 = \frac{(O - E)^2}{E}$$

not sig.

REFERENCES

Bakan, P., Belton, J. A., and Toth, J. C. Extraversion-introversion and decrement in an auditory vigilance task. In: D. N. Buckner & J. J. McGrath (Eds.): Vigilance: A Symposium, New York: McGraw Hill, 1963. Cited in Eysenck, H. J. The Biological Basis of Personality, Springfield, Ill.: Charles C. Thomas, 1970.

Battig, William F. and Spera, Annette J. Rated association values of numbers from 0-100. Journal of Verbal Learning and Verbal Behavior, 1962, 1, 200-202.

Bone, Ronald R. Interference, extraversion-introversion and paired-associate learning. British Journal of Social & Clinical Psychology, 1971 (Sept.), Vol. 10 (3), 284-285.

Child, D. The relationships between introversion-extraversion, neuroticism and performance in school examinations. British Journal of Educational Psychology. Cited in Eysenck, H. J. The Biological Basis of Personality, Springfield, Ill.: Charles C. Thomas, 1970.

Claridge, G. S. The excitation-inhibition balance in neurotics. In H. J. Eysenck (Ed.), Experiments in Personality (Vol. 2), New York: Prager, 1960. Cited by Eysenck, H. J., The Biological Basis of Personality. Springfield, Ill.: Charles C. Thomas, 1970.

Corcoran, D. W. J. The relation between introversion and salivation. American Journal of Psychology, 1964, 77, 298-300.

Eysenck, H. J. The Biological Basis of Personality. Springfield, Ill.: Charles C. Thomas, 1970.

Furneaux, W. D. The psychologist and the university. Universities Quarterly, December 1962. Reprinted in Research and experiment in education. Newcastle, Dept. Educ., King's College. Cited in Eysenck, H. J. The Biological Basis of Personality. Springfield, Ill.: Charles C. Thomas, 1970.

Hall, John F. Verbal Learning and Retention. J. B. Lippincott Co.: New York, 1971.

Hogan, J. J. Influence of motivation in reactive inhibition in extraversion-introversion. Perceptual and Motor Skills. 1966, 22, 187-192.

Howarth, Edgar. Extraversion and increased interference in paired-associate learning. Perceptual and Motor Skills. 1966, 22, 187-192.

Jawanda, J. S. Age, sex and personality variables in verbal conditioning and its modification by drugs. Unpublished doctoral thesis. Punjab University, 1966. Cited by Eysenck, H. J. The Biological Basis of Personality. Springfield, Ill.: Charles C. Thomas, 1970.

Jensen, A. Individual differences in learning: Interference factor. U. S. Dept. Health, Education and Welfare, Project Rep. 1867, 1964. Cited in Eysenck, H. J. The

Biological Basis of Personality. Springfield, Ill.: Charles C. Thomas, 1970.

Jung, J. Transfer of training as a function of degree of first-list learning. Journal of Verbal Learning and Verbal Behavior, 1962, 1, 197-199.

Jung, J. Effects of response meaningfulness (m) on transfer of training under two different paradigms. Journal of Experimental Psychology, 1963, 65, 377-384.

Lynn, R. Two personality characteristics related to academic achievement. British Journal of Educational Psychology, 29, 213-216. Cited in Eysenck, H. J. The Biological Basis of Personality, Springfield, Ill.: Charles C. Thomas, 1970.

Murdock, B. B., Jr. Transfer designs and formulas. Psychological Bulletin, 1957, 54, 313-326.

McLaughlin, R. J. Retention in paired-associate learning related to extroversion and neuroticism. Psychonomic Science, 1968, 13(6), 333-334.

McLaughlin, R. J. and Eysenck, H. J. Extroversion, neuroticism and paired-associate learning. Journal of Experimental Research in Personality, 1967.

Noble, C. E. Measurements of association value (a), rated associations (a'), and scaled meaningfulness (m') for the 2100 CVC combinations of the English alphabet. Psychological Reports, 1961, 8, 487-521.

Osgood, C. E. Meaningful similarity and interference in learning. Journal of Experimental Psychology, 1946, 56, 132-143.

Postman, L. Transfer of training as a function of experimental paradigm and degree of first-list learning. Journal of Verbal Learning and Verbal Behavior, 1962, 1, 109-118. Cited in Hall, J. F. Verbal Learning and Retention. J. C. Lippincott Co.: New York, 1971.

Rankin, E. F. Reading test performance of introverts and extraverts. 12th Yearbook, National Reading Conference, 1963.

Rankin, E. F. Reading test reliability and validity as function of introversion-extraversion. Journal of Developmental Reading, 1963, 6, 106-117. Both articles cited in Eysenck, H. J. The Biological Basis of Personality. Springfield, Ill.: Charles C. Thomas, 1970.

Skanthakumari, S. K. Personality differences in the rate of forgetting. Journal of the Indian Academy of Applied Psychology, 1965, 2, 39-47. Cited in Eysenck, H. J. The Biological Basis of Personality. Springfield, Ill.: Charles C. Thomas, 1970.

Twedt, H. M., and Underwood, B. J. Mixed vs. unmixed lists in transfer studies. Journal of Experimental Psychology, 1959, 58, 111-116.

VITA

Glenna Fitzsimmons Hasslacher was born in Staten Island, New York, September 13, 1932. She was the daughter of an army lieutenant colonel. By the time she reached college, Glenna had lived in twenty-eight states and spent three-and-a-half years in post-war Germany. She received a BA degree in psychology from Randolph-Macon Woman's College in 1954. After graduation, Glenna taught school for one year in Milford, Connecticut, and one year in Charlottesville, Virginia. She married James Gilliam Hasslacher in 1955 and they settled in Richmond, Virginia in 1958. She and her husband have four children, two boys and two girls.