THIS REPORT HAS BEEN DECLASSIFIED AND CLEARED FOR PUBLIC RELEASE.

DISTRIBUTION A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION UNLIMITED.

UNCLASSIFIED

AD _____

DEFENSE DOCUMENTATION CENTER

FOR

SCIENTIFIC AND TECHNICAL INFORMATION

CAMERON STATION ALEXANDRIA, VIRGINIA

DOWNGRADED AT 3 YEAR INTERVALS:
DECLASSIFIED AFTER 12 YEARS
DOD DIR 5200.10

UNCLASSIFIED

AD No. 6047
ASTIA FILE COPY

THE ROLE OF LANGUAGE IN BEHAVIOR

Technical Report Number 4

THE EFFECT OF VERBAL ASSOCIATION ON TACHISTOSCOPIC RECOGNITION[1]

W. M. O'Neil

University of Sydney

I. The Problem

Jenkins and Russell (2) have shown that the sequences or clusterings in which words are reproduced are related to associations between those words as indicated by norms for the Kent-Rosanoff Word Association Test. Such norms, however, show the frequency with which a given word has another word as its presumably strongest associate in a group of people. A refinement required for the more precise establishment of the relationship reported is some technique for measuring the relative strengths of association in each of the individuals. This study is a preliminary investigation of one of several possible techniques.

It was thought that an associated word used as a 'context' might aid the tachistoscopic recognition of another word and that the stronger the association the greater this effect. A basic assumption, which wisdom after the event shows to be ill-founded, was that the 'context' word would suggest its associate before the exposure of the test word. The subject would thus have an hypothesis for testing against the information supplied in the brief exposure of the test word.

In a few instances in Kent-Rosanoff data, a distinction can be made between forward and backward associations. Thus the stimulus loud frequently elicits the response soft, but the stimulus soft frequently elicits the response hard and rarely elicits the response loud. Thus loud-soft and soft-hard are forward associations, whereas soft-loud is a backward association. (More frequently we find cases like black and white where each elicits the other with great frequency; these might be termed symmetrical or reciprocal associations). It was thought that forward and backward associations might be treated as two degrees of strength of association.

---

1. This study is part of a larger series of studies of verbal behavior being conducted at the University of Minnesota. This series is being sponsored by the Office of Naval Research (Contract Number N8 onr-66216) under its policy of encouraging basic research. The experiment was conducted in the Department of Psychology, University of Minnesota, while the writer was a Fulbright visiting scholar. His especial appreciation is due to Drs. J. J. Jenkins and Wallace Russell for help, advice and stimulation.

II. Procedure

Two lists of words paired between the lists were prepared -- five practice and 18 trial pairs. The trial pairs consisted of six triplets, each of which had a forward, a backward and a non-associated pair of words (in terms of the Schellenberg norms (3) for the Kent-Rosanoff). The test words (the second member of each pair) in each triplet were matched in respect of mean frequency in the Thorndike-Lorge magazine and semantic counts (4) and in respect of Howes' correction (1) for number of letters and of syllables, 'hard' and 'easy' letters and repeated letters. All eighteen words were of approximately the same recognition difficulty on these criteria combined. The matching was confirmed by tachistoscopic tests done in the normal way using six subjects. The context and test words used are presented in Table I.

Table I

CONTEXT AND TEST WORDS

Trial Pairs*

Context Word	Test Word	Type of Association
NEEDLE	THREAD	FORWARD
HOUSE	COTTAGE	BACKWARD
HEAVY	INNOCENT	NON-ASSOCIATED
SWEET	BITTER	BACKWARD
SQUARE	RAGE	NON-ASSOCIATED
ROUGH	SMOOTH	FORWARD
SCISSORS	FLAME	NON-ASSOCIATED
CABBAGE	VEGETABLE	FORWARD
WATER	OCEAN	BACKWARD
MUTTON	SHEEP	FORWARD
FLOWER	BLOSSOM	BACKWARD
MOUNTAIN	CLERK	NON-ASSOCIATED
SOFT	LOUD	BACKWARD
SWIFT	QUANTITY	NON-ASSOCIATED
GREEN	GRASS	FORWARD
THIRSTY	CANDLE	NON-ASSOCIATED
CARPET	RUG	FORWARD
ANIMAL	LION	BACKWARD

Practice Pairs

RAIN	FLOOD
FAMILY	MESSAGE
MOMENT	INSTANT
TRAFFIC	HIGHWAY
DOOR	ACCUSTOM

(* Words were presented in typewritten capitals).

The order of the three types of pair was systematically varied from triplet to triplet in the list, and as a further safeguard against practice effect contaminating the results, the list was worked through from item 1 to item 18 with odd-numbered subjects and from 18 to 1 with the even-numbered subjects. Nine subjects, volunteers from an introductory Psychology class, were used.

A Gerbrands tachistoscope was fitted so that the 'context' word would be exposed steadily in the pre-exposure and post-exposure periods (of the test word). The test word was exposed twice at each time period beginning at 0.09 second and increasing by 0.03 second. The subject was instructed to give any information he could about the test word after each exposure -- what he thought the word might be, or how long it seemed to be, or that it seemed to contain such and such letters, or that he was positive that it was so and so. Exposures were continued until the subject twice in succession was positive and correct. The duration time of the first of these two exposures was taken as the measure for that word.

Nothing was said by the experimenter about some of the pairs being associated, but most subjects spontaneously remarked upon the fact either during the trials or at the end when they were encouraged to give an account of how they had worked at the task and of what they thought the experiment was about. It was clear from these remarks that the subjects could not have deliberately given the experimenter the results he wanted.

III. Results

The measures for the six words exposed in the same type of 'context' were summed to yield three measures for each subject: total time taken to recognize all forward associations; total time for backward associations, and total time for non-associations. The means and standard deviations of each of these scores for the sample of nine subjects are shown in Table II.

Table II

MEANS AND STANDARD DEVIATIONS OF RECOGNITION TIMES (IN SECONDS) FOR THE TOTAL FORWARD, TOTAL BACKWARD AND TOTAL NON-ASSOCIATED WORDS OVER THE NINE SUBJECTS

Context	$\bar{X}$	s
Forward	1.303	0.330
Backward	1.250	0.236
Non-Assoc.	1.720	0.241

F, obtained by dividing the mean square between 'contexts' by the mean square for interaction between 'contexts' and subjects, is 10.7 which at 2 and 16 degrees of freedom has a $p < .01$. The differences between the mean of the non-associates and that of each of the other 'contexts' is significant beyond the one per cent level (t test allowing for correlation), but the difference between the means of forward and backward associates is not significant ($t = 1.28$, d.f., = 8, $p < .30 > .20$).

IV. Discussion

Two general comments may be made. First, in assuming a difference between the effect of forward and backward association, it was overlooked that the explicit task was not to associate with the 'context' word, but to read the test word. As described by the subjects the process seemed somewhat as follows. The subject catches a glimpse of some feature of the test word; then and usually only then does some other word come to mind, elicited it would seem jointly by the 'context' and the cue from the test word. Thus once when the 'context' was thirsty and the test word the non-associated candle, the subject's report quite early in the series was "A five or six letter word beginning with CA; it could be camel". His next few responses were of the form "I think it's camel". At about the point where he was usually sure of his word, he gave one response "I'm positive it's camel", but his next was unsure. Some exposures later he switched with uncertainty to candle. Similarly another subject read loud as liquid or liquor with the 'context' soft for a number of exposures after an early identification of the initial L and a probable terminal D. A great deal of conjecture could be released but scarcely supported by the quantitative and qualitative data obtained. It seems best to rest at the moment with the very broad generalization — a word used as a 'context' aids the recognition of another word if it is associated with that word.

Second, with the unseating of the prior thinking about a differential operation of forward and backward associations, the data are unable to show whether the effect varies with the strength of the association. Further, this study was not meant to show whether the technique would yield a measure of strength of association for a given subject. Nevertheless it does indicate that a more time consuming experiment directed at this very point would be justified. The best scheme so far considered is to build in associations of pre-determined strength (as measured for instance by number of learning trials) between artificial words and to use these words in an experiment similar to the one described except that relative strength of association would be one of the independent variables.

References

1. Howes, D. H. The definition and measurement of word-probability. Unpublished thesis, Harvard, 1950.

2. Jenkins, J. J. and Russell, W. A. Associative clustering during recall. J. Abnorm. Soc. Psychol., 1952, 47, 818-821.

3. Schellenberg, P. E. A group free-association test for college students. Unpublished thesis, Univ. of Minnesota, 1930.

4. Thorndike, E. L. and Lorge, I. The Teacher's Word Book of 30,000 Words. N. Y., Bureau of Publications, Teachers Coll., Columbia, 1944.