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Analysis of methods for indicating strategy during the solving of anagram problems

Daniel B. Corts
The University of Montana

ANALYSIS OF METHODS FOR INDICATING STRATEGY DURING THE SOLVING OF ANAGRAM PROBLEMS

by

DANIEL B. CORTS

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Approved by:

R B Ammons
Chairman, Board of Examiners

Fred S Honkala
Dean, Graduate School

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789 East Eisenhower Parkway
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Ann Arbor, MI 48106 - 1346

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INTRODUCTION

Although the entire research area of problem solving in psychology is relatively "unpatterned" (Duncan, 1959), the most urgent and persistent appeals for further investigation have been in the area of methodology (Underwood, 1949, pp. 464-465; Gibson & McGarvey, 1937; Duncan, 1959, p. 419; Estes, 1960, p. 221). Leeper (1951, p. 739) states that "Not only do we need good methods for the study of cognitive processes, we also need to develop a constructive theory. Too much of the work in this field has been done at random, as it were, or just on negative problems." Reviewers of, and researchers within the field, request that tasks, situations, and procedures be standardized to facilitate relatively direct comparisons of the results of research. Gibson and McGarvey (1937) state that "Less ingenuity in inventing methods seems to have been exerted in this field than in almost any other." One researcher (Estes, 1960) believes that the similarity of experimental designs alone is responsible for comparisons that can be made at the present time.

In that nearly any task which puts Ss to work -- the correct response to stimuli not being readily available to S -- may be considered suitable for problem solving research, tasks have been borrowed from all areas of psychology. There is a definite need for standardization of suitable problem solving tasks which can present several levels of complexity (Underwood, 1949, pp. 464-465). Recently this has been achieved in the case of some of the more widely used tasks: mazes, perceptual discrimination apparatus, concept patterns, trouble shooting

tasks, construction tasks, and anagrams. Ray (1955) has compiled a list of complex tasks for use in problem solving research in an attempt to reduce and eliminate the large number of cumbersome and sometimes ineffectual tasks used up to now. The advantages and disadvantages of these tasks are reviewed, as well as other types of tasks discussed.

The anagram problem has been used in several different ways. It is now considered one of the better problem solving tasks (Ammons, 1962). Andreas states that anagrams are often considered games, and that "Subjects are often familiar with the nature of such tasks and are interested in performing them" (Andreas, 1960, pp. 509-510, 512). Generally, each method has been unique to the E using it. Duncan (1959) found "no thorough methodological study of anagrams" in his review of the problem solving field. Recently Ammons and Ammons (1959a, 1959b) developed the Standard Anagram Task (SAT) which meets many of the criteria of an adequate problem solving task. Extensive methodological research is being done with the SAT; the present study contributes to that effort. The SAT offers standard conditions for systematic problem solving experimentation and is flexible enough to accommodate experiments in related areas of this field. Other methodological experimentation on the SAT has preceded this study (Ammons & Ammons, 1959b; Ammons, Tebbe, Landgraf, Baty & Ammons, 1958; Corts, Dudden & McAvoy, 1961; Farnum, Heisel, Neel & Ammons, 1963; Koski, 1966; Reid, Van Nuys, Davies & Ammons, 1963; Robertson & Ammons, 1961), as well as numerous minor unpublished experiments, some of which were done by this E.

The concept of strategy occupies a very central position in the psychology of problem solving, as it does in the related fields of learning, perception, and cognition. It is an important aspect of the five (or so) conceptual stages of the problem solving process (Gagne, 1959, pp. 148, 163; Andreas, 1960, p. 502; Johnson, 1961, pp. 265-266; Hilgard, 1954, pp. 238-240), and has been studied in this and other fields of psychology as programs, modes of attack, variability, patterns of search, hypotheses, tactics, set, approach, and under other similar labels. Strategies are simply the methods animals and humans use for producing solutions to problems. In concept formation experiments by Bruner, Goodnow and Austin (1956), strategies are defined as "regularities in decision-making."

Generally, the individual's approach to problem situations is determined by the context of the problem and his past problem solving experience (Behavioral Sciences Subpanel, 1962). Considerations of the part played by transfer of training are not ignored by informed experimenters. Today's problem solving is probably always influenced by yesterday's learning (Johnson, 1955, p. 126). Johnson (p. 173) further specifies that remote preparation such as general knowledge or supply of information influences achievement in any problem area. Negative as well as positive transfer effects can be expected.

To help satisfy the need for task standardization, Ammons and Ammons (1959a) proposed the SAT mentioned earlier, and initiated a systematic, long-range research program investigating problem solving variables using the task. The basic task is suitable for a wide range of human problem solving experimentation, while the manipulation of

the relevant variables at various levels is left to individual researchers. The previously mentioned methodological experimentation has been carried far enough that a task is now available meeting the requirements for standardization specified by previous researchers. Numerous advantages are listed for the task as well as suggested variations for future research.

In a second paper, Ammons and Ammons (1959b) present a rational evaluation of the SAT as a laboratory analogue of 'real life' problem solving. By having psychology students list methods used by them to solve real life problem situations, the authors were able to show, in classroom analyses, close similarities of these methods to those the Ss subsequently used to solve anagram problems. These common problem solving techniques, or strategies, were consolidated and listed in a table.

In an earlier paper, Ammons, et al. (1958) conducted a comprehensive study to determine "... (a) difficulty of particular words or letter combinations, (b) consistency of performance by individual Ss, (c) magnitude and significance of differences between Ss, and (d) magnitude of practice effect from word to word when more than one word is used per session." Some 30 Ss worked through eight anagram problems. It was found that different basic letter combinations (BLCs) varied in difficulty; that Ss' performance was stable but that Ss differed significantly in levels of proficiency (fluency); and that practice effects within a series of six anagram problems were relatively small. Word or scrambled form of BLCs had only a slight effect upon productivity. Fluency of anagram solution correlated significantly with

verbal intelligence. It was estimated that stable estimates of BLC difficulty could be gained with as few as 18 Ss. A wide range of fluency was found from S to S although no single S approached the upper limit of solutions (estimated by combining the solutions by various Ss in a group). Useful indications of an individual's productivity were gained in trials as short as three minutes per BLC. The data from this study were utilized extensively by the present E in designing class experiments and pilot studies conducted prior to the investigation reported in this thesis.

Robertson and Ammons (1961) conducted a study to establish solution frequency norms for the SAT. Norms were obtained for six BLCs, and the stability of these norms was evaluated. The frequency of appearance of solutions was measured against the estimated frequency of usage of the solutions in everyday language (Thorndike & Lorge, 1944). Solution frequency norms obtained from groups of 40 and 80 Ss were found to be highly reliable. Solutions and their frequencies for the six problems (BLCs) were reported so that they could be used in further research. Two of the problems are used in the present study. Appreciable correlations were found between the frequency with which a solution occurred and the frequency of appearance of the solution in everyday language. Other ways of studying some basic issues in problem solving were suggested.

A class project was undertaken (Corts, 1961; Corts, Dudden & McAvoy, 1961) to determine processes involved in the repetitive solution of an anagram problem. The six Es served as Ss, working 30 ten-minute trials on the same BLC -- DWILBAEN. Upon completion of each trial, Ss recorded information such as: (a) conditions preceding the

trial and their effects; (b) intrusions, internal and external, that might have influenced the production of solutions during that trial; (c) phenomena encountered while producing solutions; (d) interpretations of the origin and effects of the phenomena; and (e) other information regarding the solutions, phenomena and the trial in general. The number of solutions increased as a function of trials and was still increasing at Trial 30. The number of new solutions produced was a decreasing function of the number of trials, although new solutions appeared on virtually every trial. Nearly one-third more different solutions were eventually produced by a single S than were produced by the pooled group of 80 Ss on a single trial in the previously cited study by Robertson and Ammons (1961) using the same BLC. Frequencies of solutions were determined and were found to correlate highly with frequencies obtained by Robertson and Ammons (1961). Order of solution production became more stable from earlier to later trials. S's written comments were consistent with Ammons and Ammons' (1959b) list of task characteristics, and indicated that a great many of the problem solving strategies mentioned by other writers (Andreas, 1960; Bartlett, 1958; Johnson, 1955; Osgood, 1953; Stephens, 1956; Thompson, 1959; Vinacke, 1952; Woodworth, 1938; Woodworth & Schlosberg, 1954) had been utilized. Individual differences between Ss' performances were pointed out, and a master list of anagram strategies was prepared by consolidating those reported by the various Ss. Strategies were discussed in detail and compared to general strategies used in other problem situations.

Thesis research investigating the effects of differential point reward on frequency of emission of classes of solutions of anagram problems has been completed (Koski, 1965), as well as a duplication of this study by Ammons and Ammons (personal communication). In both studies, it was found that point reward has a marked effect in increasing the frequency with which solutions falling in a rewarded class are emitted.

Also recently completed is a study by Reid, et al. (1963) investigating some scoring alternatives for use with the SAT. The problem was essentially to determine the sensitivity of the task to minor deviations by Ss from the rules. Effects of these deviations upon the reliability of various indices were also determined. Alternate means of computing ratio indices were investigated. It was found that reliabilities of the indices were not appreciably affected by the inclusion or exclusion of either definitely incorrect solutions, or borderline excluded solutions, or both. Two methods of computing ratio indices (adding across problems and then computing ratios vs. averaging ratios determined separately for each of the problems) gave comparable results. Giving credit for solutions formed by simple letter additions in direct violation of the rules was shown to have no important effect on the results. Thus, use of simpler, more rapid scoring and computational methods could be justified.

At the same time that the above study was reported, Farnum, et al. (1963) presented a paper reporting a preliminary evaluation of a number of possible indexes of originality of performance on the SAT. Although this study has no immediate bearing on the present study, it is important as a part of the program of methodological research with the SAT.

In a study preliminary to the present research, Corts (1963) evaluated the effects of trial duration as reported by others using the SAT, as well as results for similar anagram problems in a study by Bousfield and Sedgewick (1944). As a result of the analysis of the trial times of previous studies, and with awareness of the objectives of those studies, it was concluded that a trial duration of at least 15 minutes was necessary to study effectively the use of strategies. Use of trials longer than five or six minutes would force Ss to work beyond the time when solutions came readily to them, and thus they would probably try more strategies. It should be noted that no prior studies had used a trial time as long as 15 minutes with the SAT, while Bousfield and Sedgewick (1944) gave their Ss unlimited trial time.

Problem

The literature of the problem solving area, as well as that of the related areas of concept formation and reasoning, reveals a continuing interest in the strategies utilized to produce solutions. Particular importance is attributed to strategies as a method of transferring problem solving ability from one task to another (Bartlett, 1951; Harlow, 1949; Hilgard, 1954).

A considerable variety of methods have been used to obtain strategy information from Ss. The present study was undertaken to investigate the following general problem: How can the most fruitful, accurate and comprehensive strategy information be gained from Ss during the solution of anagram problems, with the least interference with performance of the basic task. Some more specific objectives of the study were to determine:

(1) effects on the production of acceptable solutions, errors, and strategy of various procedures for obtaining strategy information while actually solving problems;

(2) relations between strategy reports obtained after trials and strategy reports obtained during trials;

(3) which method of obtaining strategy information appears to interfere with the production of solutions the most, which the least, and in what ways;

(4) which method leads to, or facilitates, the collection of the most detailed and accurate strategy information;

(5) in which method of strategy reporting do the least errors occur (errors defined as solutions in violation of SAT rules, as well as repeated solutions);

(6) whether there are differences in strategy -- condition interactions between Ss with prior SAT experience and Ss with no previous anagram experience, and the degree and nature of these differences (sophisticated -- S, and naive -- N Ss);

(7) whether there are practice effects in solution production and strategy reports on succeeding problems (BLCs), both positive and negative.

Additional information will be gained during the experiment:

(1) a listing of strategies and strategy information which can be related to problem solving of other kinds;

(2) normative data for some further BLCs;

(3) suggestions regarding the possible value of various strategies and patterns of strategies in production of solutions;

(4) relationships between the number of strategies used, number of changes in strategies, and the number of acceptable solutions produced.

Method

Preliminary Analysis

Certain goals were set up to aid in deciding which methods of reporting strategy might best be studied:

(1) the methods should lend themselves to group use to permit efficient collection of data;

(2) the methods should permit recording of unique, nonanticipated kinds of strategy;

(3) the methods should be as simple as possible to facilitate accurate reporting by Ss;

(4) the methods should produce a valid record of actual task performance as well as a record of strategies.

In addition to the methods of gaining strategy information chosen for the experiment (to be described later) the following methods were considered and judged inappropriate for group use:

(1) EEG of S during problem solving; identification of various brain wave patterns could indicate gross thought alterations;

(2) S indicating changes of strategy by symbolic language of S's own invention, which later could be translated into understandable strategy information;

(3) verbal report of strategy by S while E records and interprets;

(4) S answers questionnaire at the end of trials, which

questionnaire is sufficiently specific to detect use of certain strategies (Burack, 1950);

(5) S selects from a printed checklist of strategies, indicating those he used by number (Johnson, Lincoln & Hall, 1961. Multiple choice format can be used similarly, Johnson, 1955, p. 41);

(6) S works on problem and, in a later interview with E, reports what strategies he used;

(7) E attempts to infer use of strategies directly from raw data;

(8) S works on problem while talking strategy information directly into tape recorder for subsequent analysis;

(9) mechanical (e.g., key pressing device) apparatus is used by S to report the use of strategies.

Pilot Study

A pilot study was conducted, utilizing 14 male and five female advanced undergraduate and graduate psychology students from a class in thought processes. All Ss had had prior practice at the SAT, as well as previous training in listing strategies used in problem solving. These experiences, along with their concurrent study of thought processes, made them reasonably sophisticated Ss, capable of useful evaluative comments concerning the prospective study. The aims of the pilot study were to:

(1) gain information regarding the adequacy of the conditions, as they had been tentatively formulated;

(2) determine in part what training would be needed to bring future Ss to the degree of competence required;

(3) evaluate the adequacy of some BLCs which might be used in the training phase;

(4) establish a checklist of commonly used strategies for use in one of the experimental conditions;

(5) develop norms for the training BLCs;

(6) obtain an idea of the types and numbers of strategies the various procedures would elicit;

(7) see how the number of solutions correlated with the number of strategies used;

(8) gain an idea of the overlap of strategies from trial to trial;

(9) obtain information as to the number of solutions certain strategies might produce;

(10) obtain Ss' comments and judgments regarding the utility of the various methods of indicating strategy (they ranked them from one to six, high to low respectively);

(11) gain information concerning the individual differences to be expected in reports of strategy;

(12) gain information regarding possible effects of work decrement over successive trials on use and reporting of strategies;

(13) note any significant sex differences in reporting strategy;

(14) generally refine experimental procedures.

The pilot study was conducted over a two-hour period, during which all Ss worked for a set amount of time on each condition. Six BLCs (taken because normative data were available from a previous study by

Ammons, et al., 1958) were used in six different trial conditions. Six methods of listing strategy were devised, which satisfied the goals (criteria) stated in Preliminary Analysis, for consideration for possible use in the main experiment. These conditions were:

(1) No Prior Information -- S was not told that he would be required to report strategies used, after the trial;

(2) Remember Strategy -- S was told that he would be required to recall strategies used after completion of the trial. Some Ss were allowed to look back at their solutions for cues and some were not;

(3) Prior Listing -- S was asked to list strategies he thought he would use prior to the trial, and then listed those he had used, after trial was completed;

(4) Few Words -- S was required to note strategies on the solution sheets beside the solutions obtained with them, and then to expand the notes into complete sentence after the trial was completed;

(5) Complete Sentence -- S was required to describe strategies beside the solutions obtained with them, in complete sentence form, as he worked on the problem;

(6) Checklist -- S worked on the anagram problem and then checked the strategies used on a checklist of strategies, at the completion of the trial.

For all conditions the trial time was eight minutes for working the BLCs. The amount of time allowed for recording strategy information varied in accordance with the requirements of the method, from five to

ten minutes. One minute was given for comments regarding the utility of the procedure. All Ss worked through all the methods, in the order listed above. This order was used in an attempt to minimize inter-method interference.

The results of this pilot study can be seen in Tables 1, 2, and 3. There appeared to be a rather significant decrement from condition

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Insert Tables 1, 2, and 3 here

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to condition, as indicated by the decreasing number of solutions from first to last problem, in Table 1. Interference from one BLC to another was evident from the number of solutions carried from trial to trial, although each BLC was different.

Sex differences in producing solutions were not formally evaluated in the pilot study because of the small number of females in the sample. Failure to find sex differences on anagram problems has been reported by Rhine (Duncan, 1959, p. 412). An indication of sex differences in reporting strategy was observed in the pilot study. Reports of strategies used by females were more thorough; thus could have indicated the use of more strategy.

A positive correlational trend was indicated between the number of solutions produced and the number of strategies used. This trend can be seen in Figs. 1 and 2.

Insert Figures 1 and 2 here

Three of the BLCs will be used during the training phase of the main experiment. Therefore, BLCs equivalent in difficulty were chosen

from these results. The conditions were found to be adequate and utilitarian, and were carried into the main experiment with relatively few basic changes. Effects of interference from one BLC to another were eliminated in the main experiment by limiting Ss to one single condition during the experimental phase, and to only two BLCs.

Since there were slight indications of sex differences in strategy production, males and females were approximately equal in number in each of the seven experimental groups in the main experiment.

These results were considered satisfactory, as were the conditions under which Ss worked. All major procedures were carried into the main experiment with some refinement, and the expansion necessary to test large groups of Ss.

The Main Experiment

Some definitions, not given previously, which are peculiar to the present study, are as follows:

Solutions to BLC -- the total number of acceptable (valid) solutions to one BLC.

Total Solutions -- the total number of acceptable (valid) solutions by one S to two experimental (Phase II) BLCs.

Errors -- the total number of errors to one BLC. These were violations of the SAT rules, repeated solutions and incomplete solutions. Solutions crossed out or erased by S were not considered errors.

Total Errors -- the total number of errors by one S to the two experimental (Phase II) BLCs.

Strategy Score -- the total number of different strategies to one BLC.

Total Strategy Score -- the total number of different strategies to two experimental (Phase II) BLCs.

Sophisticated S -- an S who had known prior experience before this experiment, in anagram experimentation.

Naive S -- an S who had no known prior experience in anagram experimentation before the present experiment.

First or Second Problem -- the anagram problem (BLC) worked first or second in Phase II, independent of the specific BLC involved.

BLC - IBRYCETA or BLC - GUOCHNTI -- the specific BLC (problem) worked in Phase II. It could be first or second depending upon the randomization procedure.

Subjects. A total of 268 Ss were obtained from beginning psychology courses Spring Quarter 1964 at the University of Montana (UM) in Missoula and Montana State University (MSU) in Bozeman. Sophisticated (S) Ss were those who had had prior experience with the SAT and were all obtained at UM. Naive (N) Ss were those who had had no prior experience on the SAT. This group was made up of Ss obtained at MSU, an excellent source of naive Ss, as defined in this study. A numerical breakdown of Ss as to sex, anagram experience, and their random assignment to experimental groups is shown in the Results section.

Procedure. The general procedure will first be outlined, then details supplied. The main experiment had two phases. Phase I was a one-hour training phase during which Ss were given general instructions, SAT instructions, practice on the SAT, general and specific instruction on the nature of strategies in problem solving situations and in the SAT problem solving situation, and three practice problems

on the SAT. They practiced giving strategy information on the last two. The control groups received no strategy training nor did they list any strategies. One control group performed an interpolated neutral activity while Ss in other conditions learned principles of strategy or listed strategy. The other control group did nothing (rested) during the time others were dealing with strategy.

Phase II consisted of one hour of general instructions, then production of solutions to two BLCs successively, producing strategy information after or while solving each by means of one of the five different methods of listing strategy (the experimental conditions). Again, one control group performed interpolated neutral activity and another control group did nothing, while Ss in the five experimental conditions furnished strategy information.

The entire first hour, Phase I, was timed by E using a stopwatch and a 14-inch, classroom-type wall clock. Timing in Phase II was achieved through the use of the wall clock in combination with a tape recording which announced each minute throughout the hour. At the beginning of each new section of Phase II, S read:

> "TIME LIMIT -- ( ) MINUTES Check clock at front of room. Note here the time at which you are going to turn to next page:___"

The tape-recorded announcements coincided to the second with the time shown on the large clock, thereby furnishing Ss two opportunities to know the correct time. It was believed that, once S had written down the time at which he was to turn to the next section, the announcement would catch his attention more readily. S could check the time on the large clock to assure himself that he had heard correctly, then do

whatever was appropriate. Of the 268 Ss tested using this procedure, only three reported minor difficulties or errors. Data from these Ss was not used in the analysis because it was impossible to determine how long they had spent on any one section of the experiment.

Self-timing in Phase II was necessary because conditions varied in time allowed for reading instructions, and the order in which sections were presented was not the same from condition to condition. All Ss were given timing procedures in the Phase II General Instructions. They were advised to bring corrective lenses to the Phase II portion of the experiment since they would need to see the clock. Those Ss needing to sit close to the clock in order to see were allowed to do so. Booklet pages showing the timing procedures and the instructions for the seven conditions can be found in Appendix A.

The entire experiment was presented to S in booklet form. Phase I and II were presented as one booklet in proper sequence to each S. The booklets varied according to experimental condition. All the different pages from these booklets are included in Appendix A, along with a guide for assembling the pages to make up the booklets for the various conditions. The different pages in Appendix A are samples of all training, instructions, trial sheets, strategy recording sheets, and neutral activities.

Soft pencils were provided Ss to cut down on pressure marking of subsequent pages in the experimental booklets, and thus reduce interference from previous work. Solutions were scored by S in Phase I in order to foster competitive spirit and increase motivation. Ss realized there were scores involved and that there were many others being

tested. Motivation was further increased by offering experimental points for participation in the experiment whenever possible. Suggestions were made within instructions that scores would be compared. The Ss did not formally score their own work in Phase II.

The two one-hour phases of the experiment were conducted consecutively and approximately equal numbers of Ss from each condition were tested in each group. Testing was carried out in the late afternoon or early evening.

Phase I - Training Session

All experimental group Ss participating in this study were given a one-hour training session to familiarize them with the SAT and the nature of strategies. They practiced recognizing the use of strategy in their own solution of anagram problems by applying techniques presented in Strategy Training -- General and Specific (see Appendix A). Care was taken to present a conception of strategy sufficiently general to suggest no strategies specific to the anagram task.

The two control groups received all instruction, training and practice on the SAT, the same as experimental group Ss, but did not receive any strategy training or give strategy information. They worked at an interpolated neutral activity, or sat and rested, depending upon which control group they were in. The interpolated neutral activity consisted of modified, multiple-choice items abstracted from the Kuder Preference Record. Samples of this may be seen in Appendix A.

Phase I training followed the outline shown in Table 4 where the

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amount of time allotted for each part of the training is also given. The verbatim General Instructions, all materials used in strategy training, the SAT Instructions (Word Construction Game), and the BLCs used are included in Appendix A.

Phase II - Experimental Session

Prior to experimentation all experimental booklets were randomized, using a table of random numbers. Within each set of booklets of the seven different experimental conditions, the order of the booklets was always randomly determined. Within each multiple of seven booklets, a complete set of all seven different experimental conditions were represented. Example: RS, PL, FW, CS, CL, CM-1, CM-2 -- CM-2, RS, CL, CM-1, PL, FW, CS -- CL, FW, CM-1, CS, RS, CM-2, PL -- and so on. As a result, as testing progressed with each new group of Ss, approximately the same number of Ss were tested in each of the conditions. The booklets were distributed to Ss at each experimental session.

At the start of Phase II, all conditions received approximately three minutes of general instructions concerning the self-timing procedures. These instructions are given in Appendix A. The Phase II parts of the prepared experimental booklets were assembled in the order in which Ss were to work through them, as in Phase I. Timing was according to the tape recording-clock apparatus described earlier. Orders of the two BLCs -- GUOCHNTI and IBRYCETA -- were counterbalanced throughout the experimental booklets and randomly assigned within each condition. These two BLCs were judged to be approximately equivalent in difficulty based upon the number of vowels and consonants contained in each (two consonants and one vowel in common). Both problem

trials in Phase II were of 15-minute duration with the exception of the CS condition in which solutions and strategies were listed at the same time in final form for a total of 25 minutes per BLC. Ss in all conditions were allowed a total time of 10 minutes per BLC for listing strategy information, either by lengthening trials, or by giving time after cessation of actual work on the problems. The Ss in the two control conditions furnished no strategy information at all.

Time allotments for each condition may be seen in Table 5. A de-

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Insert Table 5 here
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tailed description of the procedure used in Phase II in each of the conditions follows.

Conditions: Control - Maximum Solutions (CM-1) and (CM-2)

In these two conditions, Ss did nothing other than solve the two BLCs. Since they had no strategy training, they did not provide any information. S's goal was to produce the maximum number of solutions possible to the BLCs without effects from attempts to report strategy information. All other experimental groups were compared to these two with respect to the total number of solutions produced.

The training session consisted simply of SAT training and practice on the SAT, and the experimental phase consisted of nothing more than producing as many solutions as possible to the two experimental BLCs. Effects of massing practice were eliminated through the use of interpolated neutral activity in Condition CM-1, and sitting "doing nothing" for the prescribed amount of time in Condition CM-2. The prescribed amount of rest or neutral activity coincided with the

amount of time during which Ss in other conditions were learning about or reporting strategies.

Two control groups, one resting and the other working at a neutral task, were considered necessary. It was guessed that resting and neutral activity could both have independent and unaccountable effects on S's performance. Two different groups would provide a basis for judgments regarding effects of common control procedures.

Condition: Remember Strategy (RS)

The distinctive characteristic of this condition was that Ss were told that they would be required to recall and record the strategies used to produce solutions to the BLCs. This strategy information would be given after each 15-minute trial. They were to keep this strategy information in mind until the trial was completed, then recognize and list the strategies they used to solve the problems.

Condition: Prior Listing (PL)

This condition incorporated the psychological concept of pre-availability -- a listing of available functions or functioning. A listing of intention has been found to facilitate the utilization of that intent (Duncan, 1959). In this condition, Ss had a three-minute period prior to working the problems and listing strategies during which they were to list possible ways they might attack and solve the problems. They were set to remember strategies during the course of solving the problems and had the usual ten minutes after writing down solutions, in which to list the strategies they had used.

Condition: Few Words (FW)

In this condition, Ss noted their strategies while solving the anagram problems. They did this by indicating a strategy for each

solution produced in the form of three or four words, or the number of the solution where the strategy had first been written down. After the trial was completed, Ss expanded their few-word indications of strategy into full-sentence explanations.

Condition: Complete Sentence (CS)

This condition was much the same as the FW condition, in that strategies were listed, or referred back to by solution number, as S produced solutions. The major difference was that Ss wrote full-sentence explanations of their strategies while they were solving the anagram problems. After once writing out a strategy, Ss subsequently indicated it only by the number of the solution where it had first been written out. No time was allotted at the end of the trial for listing strategy information since the strategies were in final form by the time the trial was completed. Ss were allowed 25 minutes on each BLC to write down solutions with accompanying strategies.

Condition: Checklist (CL)

Ss worked 15 minutes on the anagram problem and then were given 10 minutes to check the strategies used during the trial on a checklist of known strategies. Space was provided at the end of the list for statements of strategies unique to the S, or which he preferred to word differently from those already listed.

Time relationships between and the sequence of activities within each of the above described conditions may be seen in Table 5.

The trial sheets for this experiment took two forms: one for the conditions in which the strategies were listed on separate pages, and another for the conditions in which the strategies were listed on the

same page as the solutions. Samples of the two types of trial sheets may be seen in Appendix A.

Ss were asked, at the completion of their work in Phase II, to fill out an evaluation questionnaire. This called for comments regarding their own behavior during the experiment, their opinions concerning the experimental condition in which they worked, and any observations regarding themselves (internal and external influences) which might provide information regarding the adequacy of the data produced. Reference to this evaluation may be seen in the Phase II instructions in Appendix A; actual form for the subject evaluation also may be seen in Appendix A.

Results

The main data from Phase II of this experiment were of three kinds:

(1) The number of correct solutions produced to each of the two BLCs (one score for each BLC). Correctness of the solutions was determined on the basis of the SAT rules and appearance in Webster's New Collegiate Dictionary (1958). Repeated identical solutions on one BLC were not counted. A listing of correct and incorrect solutions to each Phase II BLC may be seen in Appendix B.

(2) The number of errors (incorrect solutions) produced for each of the two BLCs (one score for each BLC). Errors were those solutions judged to be incorrect according to the SAT rules, as well as repeated solutions, unfinished solutions, and solutions using letters other than those given in the BLC.

Solutions not listed in Webster's New Collegiate Dictionary (1958) were counted as errors.

(3) The number of different, independent strategies listed for each of the two BLCs (one score each BLC). E determined the adequacy of and scored the strategies as ultimate judge, although two additional strategy scorers were used. Principles governing scoring may be seen in Appendix D, Method of Scoring Strategies. Scoring reliabilities are given in Table 21 and discussed later in this paper. Appendix C shows statements of strategy gained through literature search. Appendix A contains the checklist of strategies used in the experimental condition CL, which was also used as a reference during scoring. Each different, independent strategy was counted only once per BLC regardless of how many times it was used during work on that one problem (BLC).

Thus, each S in the two control conditions furnished four scores; i.e., two correct solution scores for the two problem BLCs and two error (incorrect solution) scores for their work in Phase II. Ss in the five experimental conditions furnished two additional strategy scores, one for each of the two Phase II BLCs, making a total of six scores.

Due to the large individual differences that characterize performance of Ss, relatively large groups were needed for the required degree of precision. Some variables were controlled (e.g., sex, unequal Ns in groups, problem order, and sophistication) as described in the following paragraphs.

A total of 268 Ss were tested in the seven conditions of the main study. Eleven of these Ss were eliminated for reasons such as obvious lack of English language skills (foreign students), not following instructions, and performance of extremely poor quality. Table 6 shows

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Insert Table 6 here
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these eliminations as they affected the number of males and females, the number of S and N Ss, and the number of Ss working the problems of Phase II in the G-I versus the I-G order. Numbers of Ss, from who satisfactory data were obtained, are as follows:

	Sophisticated (S)	Naive (N)	Total
Male	94	54	148
Female	44	65	109
Total	138	119	257

A chi square was computed for the above sample of S and N males and females which showed that the numbers of Ss falling into each category could not have occurred randomly ($\chi^2 = 12.611$; $df = 1$; $P < .001$). For some comparisons, which will be indicated, it was possible to utilize the entire 257 scores. For most of the other analyses, Ss were drawn from the sample according to the number available in the specific groups being compared. For example, scores of all Ss could be used for a t test comparing mean solution scores on the two BLCs; whereas in the major analyses of variance, some scores were eliminated in order to equalize the number of Ss in all groups. The number of Ss or scores utilized in the various statistical analyses are shown in Table 7. Ss

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Insert Table 7 here
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were eliminated randomly when reductions were made to equalize groups.

Analysis of most data was based primarily upon a three-dimensional design as shown in Fig. 3. When solution and error scores were

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Insert Figure 3 here

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analyzed, all cells of the Fig. 3 design were filled since all Phase II conditions yielded these types of scores. Strategy scores were analyzed through use of the design in Fig. 3, minus the shaded areas shown for Conditions CM-1 and CM-2, since Ss produced no strategy data in the control conditions. Reasons for specific analysis procedures will be given when the results are reported. Data from Ss' training in Phase I was not evaluated nor analyzed.

A *t* test for significance of a difference between correlated measures was made using the scores for the number of solutions to each of the two BLCs, to establish whether the two BLCs used in Phase II were equivalent with respect to the number of solutions ordinarily produced for each. Using 257 scores for each problem, the difference proved significant ($t = 19.02$; $df = 256$; $P < .001$) indicating nonequivalence of the two BLCs in Phase II. Mean number of solutions for BLC-GUOCHNTI was 28.87; mean number of solutions for BLC-IBRYCETA was 35.54. It should be noted that the two BLCs were counterbalanced in Phase II of the experiment so that order effects from this source would be controlled to some extent.

Additional *t* tests were made to evaluate sex differences in: (a) total solutions, (b) total errors, and (c) total number of strategies reported. Scores from the first and second problems were combined

in all cases. The results of these tests are shown in Table 8. Females

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Insert Table 8 here

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were shown to be superior to males in number of correct solutions to the BLCs (t = 3.03; df = 255; $P < .01$). Sexes were approximately equalized among the two control and five experimental groups as shown in Table 6. The t test calculated using total error scores between males and females was not significant (t = 1.63; df = 255; $P > .05$). The pilot study (N = 19) reported earlier indicated the possibility of a significant sex difference in number of strategies reported. A significant difference was not found in the main experiment (t = .84; df = 179; $P > .05$).

Four t tests were calculated to show sex differences in the production of solutions by S and N Ss. These results are also shown in Table 8. S females produced significantly more solutions than did S males (t = 2.81; df = 136; $P < .01$). N females also produced significantly more solutions than did N males (t = 2.16; df = 117; $P < .05$). No significant difference was shown between S and N males (t = 1.44; df = 146; $P > .05$), but the difference in solution production between S and N females was significant (t = 1.97; df = 107; $P < .05$).

A separate analysis was made to determine whether there was a significant difference in number of solutions given under the two control conditions (CM-1 and CM-2). Using solution to BLC scores on the first and second problems, a 2 x 2 analysis of variance was carried out (conditions x problems). Table 9 gives the mean number of solutions

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Insert Table 9 here

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produced in the two conditions to the first and second problems. The mean number of solutions under Condition CM-2 is significantly greater than the mean number of solutions produced by Ss in Condition CM-1, as shown by the results of the analysis of variance (see Table 10). The

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Insert Table 10 here

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control conditions were significantly different ($F = 6.01$; $df = 1/148$; $P < .025$), showing that performance is sensitive to apparently minor variations in control procedures -- in this case the filling of "rests" with neutral activity. No difference was shown between the first and second problems ($F = .04$; $df = 1/148$; $P > .20$) and interaction between problems and control procedures was not significant ($F = .14$; $df = 1/148$; $P > .20$). Since numbers of males and females were approximately equal in the conditions (CM-1, 23 males and 15 females; CM-2, 22 males and 16 females), sex related factors could not have been responsible for differences in numbers of solutions. It will be seen in the following analysis that a decision regarding possibly greater validity of one or the other control procedure is difficult on the basis of the quantitative data furnished by this experiment.

A 2 x 2 x 7 (problems x experience x conditions) mixed Type III analysis of variance (Lindquist, 1953) with independence of experience (S and N) and conditions, was carried out using solution to problem scores (see design of analysis of variance, Fig. 3). Scores of 33 Ss of the total of 257 Ss were randomly eliminated to equalize Ns in the conditions leaving 16 Ss in each of the cells (see Tables 6 and 7). Total Ss then numbered 224 and each S provided a solution to problem

score on each of the two BLCs, giving 448 solution to problem scores in all. Ss in each of the seven conditions numbered 32 -- 16 S and 16 N in each case.

A Bartlett test calculated for the 28 separate subgroups indicated that there was not a significant heterogeneity of variance of the solution to problem scores across the subgroups (B' = 21.18; df = 27; $P > .20$). The results of the analysis of variance are summarized in Table 11. Only one significant F ratio appears in the table -- that

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Insert Table 11 here

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for conditions (F = 6.28; df = 6/210; $P < .001$). No significant effect for problems was shown nor were any interactions significant.

The difference attributed to experience should be interpreted with caution due to the high probability of error with an F ratio accepted at the 20 per cent level. However, this F ratio should be borne in mind in a later analysis where the BLCs are evaluated in their respective orders, when a F ratio is reported that shows a significant difference for Ss of different experience. Mean numbers of solutions, as related to experience, were 32.91 for the S group and 31.70 for the N group. Since the F ratio for experience approaches the .10 probability level, consideration should be given to the possibility of a significant difference between Ss of varying experience on the basis of this analysis.

As a result of the significant F ratio for conditions, differences in mean correct solutions among the two control and five experimental conditions were further tested by means of Duncan's New Multiple

Range Test (Edwards, 1960, pp. 136-140; Li, 1957). The results of this test may be seen in Table 12. The low mean number of solutions pro-

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Insert Table 12 here

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duced by Ss in the FW Condition was primarily responsible for the significant F ratio. This mean (M = 26.72) was significantly different from the means under the other six conditions. None of the other differences between conditions in mean number of correct solutions produced are statistically significant. It should be noted that the difference in mean number of solutions produced under the two control conditions was not shown to be significant by this test. The 2 x 2 analysis of variance reported previously (Table 10) showed these two means of solutions produced to be significantly different. Since the Duncan New Multiple Range Test loses sensitivity as the number of means tested grows larger (Edwards, 1960), emphasis will be placed upon the results given by the earlier analysis of variance (also larger N before random elimination of Ss) as a more powerful technique.

In view of the significance of the difference in the numbers of solutions produced from the two BLCs (t test reported earlier), two separate analyses of variance were calculated -- one for all solution scores of Ss who worked the problems in G-I order and one for those who worked the problems in the order I-G. Because of the BLC difference, it was believed that a division of the data with regard to the order in which the BLCs were worked might show the differences between the conditions more clearly (variance within the cells caused by counterbalancing might be reduced).

The original sample of 224 Ss was divided into two groups -- those Ss who had worked the problems in the order G-I into one, and those Ss who had worked the problems in the order I-G in another. After random elimination of 56 Ss, 84 Ss remained for each analysis. Each of the two analyses had scores of 12 Ss in each condition (6 S and 6 N) who furnished a score for both BLCs. Table 7 and Fig. 3 show information regarding the number of Ss and the design.

Table 13 gives the results of the G-I order analysis of variance

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Insert Table 13 here
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which was a 2 x 2 x 7 (BLCs x experience x conditions) Type III (Lindquist, 1953) with independence of experience (S and N) and conditions. A significant difference was found for BLCs, which supports the t test for correlated measures reported earlier and thus, was expected ($F = 121.46$; $df = 1/70$; $P < .001$). The A x C Interaction (BLCs x conditions) was found to be significant ($F = 2.79$; $df = 6/70$; $P < .025$) which was not shown by the combined analysis reported previously (Table 11). One other F ratio was found to be significant -- that for conditions ($F = 2.93$; $df = 6/70$; $P < .025$) which also supports the combined analysis of solution to problem scores which disregarded the order of the BLCs (see Table 11). The cautiously interpreted difference for experience reported in Table 11, was not supported by this analysis.

The significant difference for conditions reported above, was further tested by means of Duncan's New Multiple Range Test (Edwards, 1960, pp. 136-140; Li, 1957). The results of this test are shown in

Table 14. The results are essentially the same as those reported

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Insert Table 14 here
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earlier (Table 12). Differences between Condition FW and Conditions CS, RS, and CM-2 as a group, were responsible for the significant F ratio. However, this test does not show Conditions CL, CM-1, and PL to be significantly different from Condition FW as was shown in Table 12. The reduced number of Ss in this separated analysis, based on BLC order, could be responsible for the reduced sensitivity of the test.

Results of the I-G order analysis of variance can be seen in Table 15. This analysis was a 2 x 2 x 7 (BLCs x experience x condi-

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Insert Table 15 here
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tions) Type III (Lindquist, 1953) with independence of experience and conditions. Again, as in the order G-I analysis, a significant difference was found for BLCs ($F = 29.64$; $df = 1/70$; $P < .001$) supporting the previously reported t test for correlated measures between the two Phase II BLCs. A significant difference was found between Ss of varied experience ($F = 8.98$; $df = 1/70$; $P < .005$) which explains the previously reported and cautiously interpreted F ratio for experience (see Table 11). It should be remembered that the F ratio for experience in Table 11 closely approached the .10 level of significance. Again, the difference between conditions was found to be significant ($F = 7.38$; $df = 6/70$; $P < .001$) as in both previous analyses (see Tables 11 and 13). No interactions were significant in this analysis.

Duncan's New Multiple Range Test (Edwards, 1960, pp. 136-140; Li, 1957) was again used to further test the difference between

conditions. Results of this test can be seen in Table 16. These re-

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Insert Table 16 here

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sults show exactly the same differences as were indicated in the combined analysis reported previously (see Table 12). Condition FW was significantly different from all other conditions. No other differences were significant.

Error scores were tested by means of a 2 x 2 x 7 (problems x experience x conditions) mixed Type III analysis of variance (Lindquist, 1953), again with independence of experience (S and N) and conditions. Scores from the same 224 Ss were used as in the earlier combined analysis of solutions produced. Ss numbered 32 in each of the seven groups; 16 S and 16 N with numbers of males and females approximately equal due to random assignment in the seven conditions (see Tables 6 and 7, Fig. 3). Two scores for each S on the first and second problems, gave a total of 448 scores in the analysis. Variance of the scores within the 28 subgroups was significantly heterogeneous as shown by a Bartlett test ($B = 73.41$; $df = 27$; $P < .001$). That heterogeneity of variance is not a sufficient reason for abandoning the analysis of variance technique is suggested by the results of a study by Norton (Lindquist, 1953, p. 83). Marked heterogeneity may be compensated for by requiring a more stringent level of significance in interpreting results. Bartlett's test was used in this experiment to determine whether interaction effects existed within the groups of Ss used in the 28 subgroups.

As may be seen in Table 17, no significant effect of problems on

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Insert Table 17 here
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number of errors was found (F = 0.00; df = 1/210; $P > .20$). No interaction was significant. Significant F ratios are shown for experience and conditions. Sophisticated Ss made significantly more errors than did Naive Ss (F = 7.34; df = 1/210; $P < .01$). Mean numbers of errors for S and N Ss were 3.73 and 2.72 respectively.

As the numbers of errors differed significantly among conditions (F = 2.27; df = 6/210; $P < .05$), differences between conditions were further tested by means of Duncan's New Multiple Range Test (Edwards, 1960, pp. 136-140; Li, 1957). A summary of these results may be seen in Table 18. It was found that one significant difference was primari-

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Insert Table 18 here
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ly responsible for the significant F ratio. The number of errors under Condition FW was significantly lower at the .01 level than the number of errors in Condition CM-1. Since it appeared that other ranges might prove significant at a less stringent level, the shortest significant ranges were recalculated for the .05 level of significance. Two additional ranges were shown to be significant. Condition CM-1 Ss produced significantly more errors than did Ss in both Condition CM-2 and Condition CL.

The number of strategies produced under the five experimental conditions were evaluated by means of a 2 x 2 x 5 (problems x experience x conditions) mixed Type III analysis of variance (Lindquist,

1953). The independent measures were experience (S and N) and conditions. The analysis served to evaluate differences in the numbers of strategies listed by S and N Ss in the five experimental conditions on the first and second anagram problems.

Ss numbered 160 for the five conditions, with 16 S and 16 N Ss in each condition. All furnished two scores, one for each of the anagram problems, making a total of 320 scores. Males and females were approximately equally distributed across the groups (see Tables 6 and 7, Fig. 3).

Bartlett's test for homogeneity of variance was carried out for the 20 groups of scores. Heterogeneity of variance was indicated by a B of 50.87 (df = 19; P < .001). For reasons given by Norton (Lindquist, 1953), this test was used merely as an indication of the variability of Ss' performance within the groups.

Table 19 summarizes the analysis of variance of strategy scores.

Insert Table 19 here

A significant difference was found between problems (F = 6.39; df = 1/150; P < .025). In the case of certain conditions, this may be due to a practice effect from the first anagram problem to the second. The mean number of strategies given on the first problem was 8.36, and on the second problem, 8.84. Checklist Ss claimed strategies on the first problem and were free to use all strategies that they had seen during the first listing, on the second problem and claim them. Had this not been the case, perhaps no significant problem effect would have appeared as well as no problem by condition interaction. However, since

there is a significant problem by condition interaction ($F = 4.63$; $df = 4/150$; $P < .005$), practice effects may well have operated for some of the conditions and were either nonexistent or reversed themselves in others. The mean number of strategies in each condition for each anagram problem, reveals the apparent cause of the significant interaction effect:

	RS	PL	FW	CS	CL
1st Problem	5.88	5.91	4.72	6.00	19.31
2nd Problem	5.66	5.81	5.28	6.13	21.34

Fatigue could have easily been responsible for the very slight decreases in strategies given for the second anagram problem in the case of some of the conditions. Decreases are shown in the case of two of the conditions -- RS and PL -- and an increase in three of the conditions -- FW, CS, and CL. The relatively large increases under Conditions FW and CL were probably responsible for the significant interaction effect. The decreases from the first to the second problem appear to be rather minor -- certainly not large enough to cause real statistical differences between the first and second problems.

Differences between conditions in numbers of strategies reported were found to be significant ($F = 176.46$; $df = 4/150$; $P < .001$). Inspection of the above means makes apparent the condition responsible for the significant F ratio. The fact that Ss had merely to claim strategies from a checklist of strategies enabled them to claim strategies that they ordinarily would not have been able to recall, strategies that they could not verbalize themselves, and perhaps even strategies they would have liked to use. Ss in the checklist condition

reported the use of a great many more strategies than did Ss in the other conditions.

Further analysis of differences between conditions by use of Duncan's New Multiple Range Test ascertained whether other significant differences contributed to the F ratio. As seen in Table 20, a summary

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Insert Table 20 here

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of the ranges between the conditions shows no significant differences other than those differences between the checklist condition (CL) and all of the other conditions. No other differences approached significance. Adequacy of these conditions, less the checklist, will need to be judged on bases other than the number of different strategies reported as used. Since the number of comparisons made in this test were reduced to five (the control conditions made no report of strategy) perhaps significant studentized ranges should have been selected at the .05 level rather than the .01. However, it was subsequently found that the differences would not have exceeded the shortest significant ranges had this been done.

Pearson product moment correlation coefficients were calculated in order to estimate the reliability of the measures. The first reliability estimate was calculated using solution to BLC scores of all 257 Ss between the first and second anagram problems (Phase II). This reliability determination disregarded specific BLC order. A breakdown of the sex and experience of Ss is provided in the Subjects section of Method (see also Tables 6 and 7). Linearity of the two sets of scores correlated is strongly suggested by the scatterplot in Fig. 4. The

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Insert Figure 4 here

"alternate form" reliability (Technical recommendations, 1954, p. 28) of the measures (yielding a coefficient of equivalence) is shown by $r = .363$. The standard error of this statistic is .054.

Since this coefficient is based upon a correlation between two BLCs that have been proven statistically not to be equivalent by the t ratio for correlated measures reported earlier ($t = 19.02$; $df = 256$; $P < .001$), the reliability coefficient was, in effect, reduced considerably. (Note the spread of scores in Fig. 4 compared to the spread of scores shown in Figs. 5 and 6 where scores were separated according

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Insert Figures 5 and 6 here
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to problem order.) The fact that the problems were counterbalanced throughout the conditions accounts for the low reliability reported above.

To correct for this artifact, two additional correlations were calculated to establish reliability for the two over-all groups; that is, one group consisting of those Ss who worked the anagram problems in the order G-I and a second group who worked IBRYCETA first, then GUOCHNTI. Linearity of these measures is strongly suggested by the scatterplots shown in Figs. 5 and 6. The G-I correlation coefficient was calculated using 127 pairs of scores -- 130 pairs of scores were used in determining the correlation coefficient for the I-G group. The reliability of the measures increased considerably ($r_{GI} = .723$; $\sigma_r = .04$; $r_{IG} = .688$; $\sigma_r = .05$) as a result of separation of the data according to BLC order.

A listing of all valid and invalid solutions produced on the two BLCs may be seen in Appendix B.

Reliability of the scoring of strategy was determined by correlating the scoring of E with that by two other scorers -- EMC and CM. Scorer EMC was reasonably familiar with the experiment and had helped with the mechanics of preparing experimental booklets for testing, tried out the different conditions, and typed manuscript. Scorer CM had had nothing to do with the experiment and scored a sample of experimental booklets solely on the basis of instructions shown in Appendix D.

Table 21 shows the Pearson product moment correlation coeffi-

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Insert Table 21 here
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cients for these reliability determinations and the standard error of each. The reliability of strategy scoring for each of the five experimental conditions is shown for each scorer. E is listed as scorer DBC. Scorer EMC checked her scoring a total of three times. Scorer DBC scored once as did scorer CM.

Discussion

SAT Problems and BLCs

The results of this experiment showed the two anagram problems used in Phase II to be nonequivalent in the sense that Ss could not produce approximately the same mean number of solutions to each. Although many of the difficulties arising from this unfortunate fact were minimized through the counterbalancing of BLCs in Phase II and statistical allowances for the difference, this difference should

always be considered in interpretation of the results. The difference between the BLCs was not a factor when comparisons were made between the seven conditions since the analysis of variance technique collapses the two separate problem scores into the total solution score defined earlier. Approximately equal numbers of Ss worked the problems in each BLC order as shown in Table 6.

Table 11 shows that when problems (which disregards BLC order) is the variable under consideration, there is no significant difference between the first and second. This rules out practice effect on the two different problems. Tables 13 and 15 show the results of analysis of the two Phase II BLCs in the two different orders in which they were worked. Both differences are highly significant because the A-dimension in these two analyses show differences between the specific BLCs and not randomly ordered problems. This significant difference, then, is not practice effect between a first and a second trial but is the same difference that is shown by the reported t test ($t = 19.02$; $df = 256$; $P < .001$) for correlated measures comparing the mean number of solutions produced by all Ss to the two Phase II BLCs.

In all analyses, other than the two investigating the effects of BLC order (Tables 13, 14, 15, and 16), the variable under study was BLCs in random order, or problems as defined earlier. Comparisons between the seven conditions and between S and N Ss were always based upon total solution, total error, and total strategy scores on the two problems which nullifies any effects of nonequivalence of the two BLCs.

Nonequivalence of the two Phase II BLCs masked the reliability of the number of solutions produced to each problem until BLC order was

taken into consideration. Discussion of the artificial spreading of the scores for the two problems (see Fig. 4), due to nonequivalence of the Phase II BLCs, will be postponed until reliability is discussed later in this section.

The problems were essentially "alternate forms" and, as such, all correlation coefficients were "coefficients of equivalence," as defined in Technical recommendations (1954, p. 28).

A difference in the number of solutions which can be produced to BLCs is BLC difficulty, in one sense of the term "difficulty." However in this experiment, difficulty of the problems referred to and was governed by, the amount of time Ss were required to continue to solve each problem. Pilot studies indicated that a 15-minute trial period would force Ss to continue to work beyond a point during the trial time when solutions would come easily, and thereby necessitate the discovery and/or use of additional strategies which would allow them to produce more solutions.

Sex Differences

Although evaluation of sex differences in the production of solutions, errors, and strategies was not a primary purpose for conducting this study, available data made some determinations possible. Observation of the performance of female Ss in the pilot study suggested the possibility of superior female output in number of solutions and the number and quality of reported strategies. No hypotheses concerning sex differences were formulated.

Contrary to a report by Rhine in 1957 (Duncan, 1959, p. 412), that sex of S was not related to the number of solutions to anagram

problems, this experiment showed that, in general, females do produce more solutions to anagram problems than do males (see Table 8). Table 8 shows that superior performance of females was independent of the amount of prior anagram experience since both S and N females were superior to males of comparable experience in the production of solutions. In that males were observed to make additional emotionally toned solutions which were generally withheld and avoided by females, supports and adds to the case for superior performance of females. Bra, bitch, and similar others are examples of solutions in this category.

To what extent female superiority is a function of intelligence and/or motivation is indeterminate on the basis of the data. Some comments regarding observed motivation of N female Ss will be made in later discussion of S and N Ss. Ammons, et al. (1958) reported verbal fluency as a factor in producing solutions to anagram problems; and it is known that females score higher in the verbal areas than do males "... in almost every aspect of language development which has been studied" (Anastasi & Foley, 1949, Chap. 19, p. 651; Berelson & Steiner, 1964, pp. 219-220). It may be concluded that sex differences in producing solutions indicated by these results, is supported by research concerning sex differences in verbal fluency.

Pilot study observations that females may report more strategies than males were not supported in the main experiment. Although Table 8 shows a higher mean number of strategies reported by females, the difference was not found to be significant. E judged females to perform this type of experiment in a more diligent manner; their greater attentiveness to the experiment and problems presented could account

for their higher rate of strategy production. Females are known to be more persistent at routine tasks than are males and perhaps remain interested in producing for generally longer periods of time. Quality of strategies reported was not quantified, but observation of strategies listed by females indicates a more conscientious effort to perform adequately in the experiment.

No significant sex difference was found based on the number of errors made during solution production. That errors was considered an inadequate, or at least a weak measure in the experiment will be seen in later discussion.

Sophisticated and Naive Ss

Owing to conclusions based upon the analyses of sex differences discussed previously, certain reservations regarding differences between Ss of varied experience need to be pointed out. Referring to the numerical breakdown of Ss according to sex and experience (shown in Results), the chi square reported shows that the number of Ss falling into each category could not have occurred through random sampling. Approximately the same ratio of male to female Ss should have been drawn at each institution; i.e., roughly two males to one female. Sophisticated Ss obtained at UM adhere to this ratio; however, it may be seen in the breakdown that the N Ss do not. The ratio for N Ss is approximately one male to one female. The female ratio at MSU was inflated by nursing students enrolled in required psychology courses, thereby increasing the female ratio in the courses from which Ss were drawn.

Table 8 shows both S and N female Ss to be superior to male Ss in the production of solutions to the anagram problems. This becomes

very important when considering that the sample of N Ss has a one to one ratio of males and females while the sample of S Ss has two males to each female. As a result of this characteristic of the sample, all solution to BLC differences between S and N Ss are not as pronounced as they would have been had the male to female ratios been more similar. The greater proportion of females in the N sample tends to bring the mean number of solutions produced closer to that produced by the S Ss.

Probably as a result of past experience in solving anagram problems, S Ss produced a higher mean number of solutions to each problem than did their N counterparts (Sophisticated -- M = 32.91; Naive -- M = 31.70). Table 11 shows an F ratio for experience which is significant at the 20 per cent level. In view of the foregoing discussion of the sex ratios in the sample, it is felt that this F ratio indicates a real difference between Ss of varied experience. The t test reported in Table 8 shows a significant difference between S and N females, but the t test between S and N males was not found to be significant. Means shown in Table 8 indicate the relationship of the differences between male and female Ss taken from the two institutions.

Tables 13 and 15 show experience differences when solutions were analyzed separately according to BLC order. When the problems were worked in the order G-I, no significant difference was found between Ss of varied experience as seen in Table 13. However, when the problems were worked in the order I-G, S Ss produced significantly more solutions than did N Ss (see Table 15). Although the reasons for these differences, based upon the order of BLC presentation, are not altogether clear, the data indicates that presentation of the BLCs in the order I-G offered some advantages to S Ss which were not advantages

in the same sense to N Ss. As previously stated, more solutions could be made to the BLC -- IBRYCETA. Since these results indicate that prior experience facilitates the solution of anagram problems, it is apparent that when S Ss were given the "richer" BLC first, they were more equipped to make best use of the BLC than were N Ss. The less "rich" BLC -- GUOCHNTI -- apparently nullified prior experience advantages, as indicated by the nonsignificant F ratio for experience shown in Table 13.

The foregoing indicates a real difference in the production of solutions by S and N Ss. Although the N group had the advantage of a larger proportion of female Ss, as a group they did not exceed S Ss in the production of solutions. E judged the diligence, or motivation, of N Ss also to be a factor in favor of that group. The observed difference in motivation between Ss in the two groups was extremely pronounced. The majority of S Ss from UM in Missoula had participated in many prior experiments. A large share of their motivation came from gaining experimental points awarded for participating in a two and one-half hour experiment. The experiment was not special to them in the same sense as it was to the N group from MSU in Bozeman. The N Ss had had no opportunities to perform in psychological experiments prior to this one, and many participated without the benefit of extra class points or other incentives from instructors. They were largely motivated by curiosity and interest. Their desire as a group to do well in the experiment was manifest. With this apparent advantage, plus the female ratio advantage, it would seem that, if there were no real differences due to prior experience, the N group would have

surpassed the S group in solution production. In that the S group produced more solutions, the real difference between Ss of varied experience in the production of solutions, is obviously minimized and masked by the somewhat inconclusive F ratios.

Table 17 shows a significant difference between S and N Ss in errors made during solution of the anagram problems. N Ss made significantly fewer errors (Sophisticated -- M = 3.73; Naive -- M = 2.72) possibly reflecting the more deliberate kind of performance observed by E. Fewer errors can also indicate a less "adventurous" or varied approach to problem solving which, in one sense, is more deliberate. No significant difference was found between S and N Ss in strategy production (see Table 19), so it is assumed that neither the S group nor the N group was more varied in their approach than the other on the basis of strategies reported. The number of errors made during solution is linked to the number of solutions made. To this extent, it is concluded that the lower number of errors made by N Ss is a result of fewer solutions produced and the more deliberate, conscientious and perhaps nonspontaneous approach discussed previously.

Since no Ss, S or N, had had prior experience in listing strategy before this experiment, the nonsignificant F ratio comparing the strategies of Ss of different experience is not revealing. All Ss in the experiment listed strategy on the basis of training given to them in Phase I. A significant difference for Ss of varied experience in listing strategy would reflect differences for the S and N groups in the way in which they were able to utilize their strategy training. Differences in this type of performance were neither expected nor desired.

Training given to all Ss in Phase I was equivalent. All had the same practice on the SAT and those in the five experimental conditions had the same amount of practice listing strategy. It appears that this amount of practice was not sufficient to bring N Ss to the level of performance that the S Ss had achieved. E's prior experience with this task (Corts, 1961; Corts, et al., 1961) showed that a single S gains in solution production through 30 trials on the same BLC. It is therefore reasonable to conclude that solution production is cumulative, whether S is solving the same or different anagram problems.

On the basis of the foregoing, it is concluded that it makes little difference whether Ss used in this type of problem solving research are with or without experience as long as S's prior known anagram experience is determined by E and S and N Ss are not lumped indiscriminately into experimental groups. Since it is yet undetermined what S's advantages are as a result of varying amounts of prior practice, N Ss are probably more desirable for this kind of research. As long as they are given sufficient practice to enable them to perform the task with a clear understanding of what they are to do, and some opportunity to try the task before their performance is evaluated experimentally, they are as adequate as are Ss with prior experience. The results of N Ss experimental performance should be more distinct since their prior experience is less diverse and involved. The minimum amount of training and practice necessary to perform the task adequately is suggested for research of this type. Berelson and Steiner (1964, p. 206) state that "... the more general and abstract the previous learning, the more help and the less barrier it is likely

to prove in future problems." They further caution against the mechanical learning of specific procedures in preparation for problem solving and recommend the learning of principles. The emphasis on strategy and problem solving principles in Phase I training in the main experiment, was consistent with the above.

Control Groups and Procedures

Control groups in the main experiment, were control groups in the usual sense in that they received no differential experimental treatment as did the five experimental groups. However, problems resulting from massing of practice were anticipated (possible varied amounts of time between problems in different conditions) causing some indecision regarding what control Ss were to do while Ss in experimental groups were learning the meaning of "strategies" and listing those used on the training BLCs. They could either be required to perform neutral activities while experimental group Ss worked with strategy (which should have nullified advantages gained by resting), or they could sit quietly and "do nothing" during this time. Since no adequate basis was available to E for deciding between the two procedures, both control procedures were used. Had the groups proved to be equivalent in performance, E could have concluded that it makes little difference what control Ss do during "off" time. In Fig. 7 it is seen that the two

Insert Figure 7 here

control groups were quite different in their performance in the main experiment.

Condition CM-1 Ss worked upon Kuder Preference Record-type items during off periods. This task was chosen as a good neutral activity

for paper-and-pencil-type experiments with anagrams. The items were of a vocational preference type, examples of which may be seen in Appendix A. Control Ss worked on the anagram problems at approximately the same time intervals as did experimental Ss. Fatigue factors should have been approximately equalized across experimental conditions.

Condition CM-2 Ss were instructed to rest and not attend to the experiment during their "off" periods. This control condition was expected to minimize external influences to some extent and to space Ss' work periods on the SAT to coincide temporally with the work periods of Ss in the experimental conditions.

In Fig. 7 it may be seen that Ss in Condition CM-2 performed in a generally more productive manner than did Ss in Condition CM-1. Table 9 shows the mean number of solutions produced to the first and second problems. The superior performance of CM-2 Ss is very distinct with regard to solutions. Table 10 shows the results of an analysis of variance testing the difference between the two control conditions and the significant F ratio for conditions proves the superior performance of Ss in Condition CM-2. The three analyses of variance for solutions shown in Tables 11, 13, and 15, all show significant differences between the conditions in solution production. However, the results of the Duncan New Multiple Range Tests shown in Tables 12, 14, and 16, do not show Conditions CM-1 and CM-2 to be significantly different from one another, although Condition CM-2 is nearly always the highest in mean number of solutions produced and Condition CM-1 is usually close to the lowest. The more sensitive analysis of variance reported in Table 10 proves that the differences between the two control conditions in solution production is real.

The analysis of variance using error scores shown in Table 17, shows a significant difference between conditions. Differences between individual conditions were further analyzed with Duncan's New Multiple Range Test and the results are shown in Table 18. A significant difference can be seen between Condition CM-1, with the largest mean number of errors, and Condition FW which had the fewest. The .01 level of significance was selected prior to the main experiment for comparing differences using the Duncan New Multiple Range Test because the level of significance is calculated into the shortest significant ranges during computation. However, exclusively in the case of the ranges of error scores between conditions, testing at the .05 level of significance shows other ranges to be significant. At the .05 level, the range of 1.92 between Conditions CM-1 and CM-2 is significant. Also the range of 1.68 between Conditions CM-1 and CL is significant at the .05 level. These ranges were checked at the .05 level because they appeared so large and because of particular interest in the difference in error scores between the two control conditions.

It is now seen at once that Condition CM-1 produced significantly fewer solutions than did Condition CM-2, and produced a significantly greater number of errors. A dual conclusion is possible regarding the results of Ss' performance in the two control conditions.

The above results suggest, somewhat weakly, that the influence of the interpolated neutral activity used in Condition CM-1 was disruptive, either in the mechanical sense of word and letter interference, or in an emotional sense. Reports by Condition CM-1 Ss in the Subject Evaluation show a belief that the experiment was a study of

personality characteristics influencing Ss in psychological experimentation. Interference in both of the above senses could have been factors contributing to the moderate to low performance of Ss in Condition CM-1.

A much stronger conclusion possible in this case is best described in terms of "making hay while the sun shines." Although Subject Evaluations of Condition CM-2 Ss suggested boredom, frustration, agitation, and disappointment as disruptive influences upon their performance during the experiment, statistical evaluation of Condition CM-2 data shows the performance of Ss in this condition to be extremely satisfactory. As described above, they produced the greatest mean number of solutions and nearly the lowest mean number of errors. The consistently high number of solutions produced by Condition CM-2 Ss suggests that the "do nothing" type of rest activity contributed favorably to the production of solutions on the two Phase II problems. During their rest periods, these Ss possibly thought about ways in which they could produce more in the experiment, whether they consciously desired to think about the experiment or not. Any disruptive effects of strategy training and listing were absent, as were internal disruptive influences possibly experienced by Ss in Condition CM-1. It is concluded that, in the case of most Ss in Condition CM-2, the rest periods contributed favorably to subsequent performance.

It is believed that Condition CM-1 approaches more closely the accepted definition of experimental control in this type of study. Some neutral activity is required during the "off" periods which matches the amount of work performed in the experimental conditions in order to avoid the inflated performance shown by Condition CM-2

Ss in this experiment. As indicated by these findings, the control procedure outlined for Condition CM-2 is not believed to be good practice because of factors which are difficult to account for, cannot be readily measured and which would be prohibitively cumbersome to neutralize during experimentation.

Evaluation of Five Experimental Conditions for Listing Strategies

Condition RS. Condition RS required Ss to solve the problems and remember the strategies used in order to be able to list them when the trial was completed. This method has been used frequently in past problem solving experimentation. Strategies have been reported in various ways such as: writing them down, reporting orally, selecting strategies from a given assortment, and so on. The predominant common characteristic of these methods is that S is not required at any time during the actual solving of the problem, to do anything other than attempt to remember what strategies he is using.

Fig. 7 shows Ss in Condition RS to have produced a greater mean number of solutions than Ss in any of the other four experimental conditions, although only the difference between Conditions RS and FW was shown to be statistically significant. The mean number of errors was relatively low but was not significantly different from that under any of the other conditions. The mean number of strategies reported by Ss in this condition was not shown to be significantly different from those reported under any condition other than Condition CL. Condition CL exceeded all other conditions in the mean number of strategies reported by a statistically significant difference.

This method of gaining strategy information is relatively simple and generally is the first method occurring to Es. It was shown to be

suprisingly productive in relation to other more involved methods of gaining strategy information. One disadvantage of the method was that no indication was given regarding where particular strategies occurred during the trial. Specific solutions were not linked to any specific strategy through mere inspection of the data. Perhaps information of this kind could be elicited once the trial was completed. Es using this method should guard against delaying reports of strategy unnecessarily in order not to increase the effects of forgetting. Ss in this condition reported no difficulties remembering strategies used to solve the anagram problems. Reports of Ss in the Subject Evaluation were generally favorable. Table 2 shows that in the pilot study prior to this experiment, advanced and graduate student Ss working all six conditions ranked Condition RS third most desirable in terms of ease of performance and production of solutions and strategies. Little role diffusion exists in this condition, as the required performance is distinct and simple.

Condition PL. Condition PL was originated to study the effects of response preavailability on the production of strategy information. Ss were required to state their intended use of strategy for each of the two trials in Phase II. Although this method introduced an additional factor in the use and listing of strategies, it was believed that an investigation of this process would be valuable if it enabled Ss to solve problems to an extent not readily achieved by Ss using less involved methods.

Fig. 7 shows performance in Condition PL to be approximately equivalent to that in Condition RS; the mean number of solutions

produced was not significantly lower than those produced in Condition RS. The total number of solutions was not significantly different from any condition other than Condition FW. Error scores were depressed slightly covarying with the fewer mean number of solutions produced. The mean number of errors was not significantly different from those in any of the other conditions. The number of strategies reported differed significantly from the mean number of strategies reported in the checklist condition only.

It is concluded that the use of response preavailability has little value when the solution of problems is a matter of degree and/or extent, as in this experiment, rather than a solve or nonsolve situation. Reports of the value of preavailability are linked to problem solving situations where solution to problems is of an all or nothing nature. This method does have the advantage of keeping Ss attentive to the situation during the trial periods. However, of all methods compared in the present experiment, Condition PL required the greatest amount of time for basic performance of the task. Time comparisons with other conditions may be noted in Table 5. It is believed that the extra time required for this method would be justified in problem solving experiments where the solution to the problem was of a complex nature. There is little need for this added factor of response preavailability in anagram experiments of this type. No indication of the location of use of strategies is provided by this method.

Ss' evaluations of this method were relatively neutral, with the exception that comments relating to the length of the entire experiment were noted more frequently by E with respect to Condition PL. Ss were

required to work harder and longer than Ss in any other condition. As seen in Fig. 7, the added effort and time involved furnished no more real data than the simpler methods. Perhaps this condition would prove somewhat more valuable if the data were evaluated for quality of performance. A certain degree of role diffusion existed to the extent that Ss were constantly required to shift from instructions to problems to strategy more frequently than were Ss in other conditions. If Ss were prone to errors in self-timing procedures, it would certainly occur oftener using this method than other methods investigated in the present study. However, instructions can be made relatively simple to follow. No problems were reported concerning self-timing procedures in this experiment. Since there are many more instructions to contend with, this could definitely be a source of difficulty in a longer experiment.

Pilot study Ss ranked this method fifth out of six in ease of performance and productivity (see Table 2).

Condition FW. This condition was originated to provide Ss with an opportunity to make notes to themselves about strategies used during problem solving, which they could expand into full statements of strategy when the trial was completed. Data from this method would provide E with a full strategy report and provide added information designating where strategies were occurring during the trials. It was expected that this method would provide the greatest amount of information with the least interference or complexity.

Fig. 7 shows comparitive results of the use of this method. Mean number of solutions produced was significantly less than all other

conditions. The mean number of errors was significantly lower than those produced by Ss in Condition CM-1, as shown in Table 18. The mean number of strategies reported was significantly different only from those reported on Condition CL, as seen in Table 20.

This method had no provision for listing strategies used which did not produce solutions to the problems. Arrangements could be made to gain this additional information, but would complicate the instructions.

Fig. 7 definitely indicates that this method of listing strategies severely interferes with maximum solution production. E noted that solutions produced in this condition appear very mechanical and lack the spontaneity of the solutions produced in other conditions in which Ss were not concerned with giving strategy information during the trial. In those types of experimental conditions, solutions could just "run off" without interfering activity which forced Ss to interupt solving in order to make a strategy report. It should be remembered that Ss in Condition FW were required to provide a strategy for each solution made.

This method eliminates all strategy not specifically linked to the mechanics of solving the BLCs. Ss were limited in the report of secondary, or personality type, strategies. Other conditions allowed relatively free report because strategies were not tied to specific solutions. Because of Condition FW requirements, it is possible that S reported a strategy whether or not he knew the nature of those used.

Instructions for this method are somewhat involved, as seen in Appendix A, but caused no difficulties. Table 2 shows this condition

to be rated second out of six in ease of performance and productivity by pilot study Ss.

Although expectations for this method were high, it proved definitely not an adequate method for this type of problem solving task. It could possibly be quite useful in other problem solving situations. Solutions were low, errors were high with respect to solutions, and it was not particularly good for production of strategies. Apparently the attempt by Ss to make notes regarding their use of strategy disrupted the flow of solutions somewhat severely. They could not quickly consolidate their strategy ideas into few-word statements. The disruption caused an abnormal number of errors to be made. The notes were often trite and insufficient for expansion into strategy statements. Strategies listed were judged no more unique and comprehensive than those listed in other conditions. It is concluded that this procedure has limited value for anagram experimentation and should be used with caution on other types of problem solving tasks.

Condition CS. This condition was originated as an expansion of Condition FW. Since it was presumed that Ss would have little difficulty writing few word indicators of strategy, conceivably, Ss could complete the entire statement of strategy during solution of the problems and thereby relieve the requirement of writing full sentence strategy descriptions after the trials were completed. To equalize time spent upon the task, Ss were given the entire 25 minutes to work the BLC and concurrently report strategies. Note information in Table 5 comparing time allotments for the conditions in Phase II. Condition CS provided E with a full strategy report with additional

information showing where the strategies were used during problem solving.

As seen in Fig. 7, results of Condition CS performance compare favorably with results of other conditions. In mean number of solutions produced, Condition CS exceeds only Condition FW by a significant difference (see Tables 12, 14, and 16). It is not significantly different from any other condition in terms of the mean number of errors made. Ss in Condition CS produced significantly fewer strategies than Ss in Condition CL but did not differ significantly from the other experimental conditions.

This condition had no provision for listing strategies which were unsuccessful in producing solutions to the problems. Arrangements could be made for this additional information, as was possible in the case of Condition FW. For Condition CS, the effort would be worthwhile, since this experimental condition was basically a productive method. Condition FW results indicate that arrangements of this kind would not salvage that procedure.

As seen in Fig. 7, the method used on Condition CS was basically sound. It was found generally throughout the experimental conditions that strategy report was not as extensive as anticipated. However, Es cannot afford to deny ample time to the few exceptional Ss who are capable of extensive strategy reporting. Therefore, in most cases, a large portion of the 10 minute period allowed for reporting strategy was wasted because Ss had nothing more to list after the first few minutes. In Condition CS, the entire 25 minutes was utilized; if Ss were not reporting strategy, they were again solving the BLC. Since

Ss had the additional time to solve the problem, it might be expected that they would have achieved a greater number of solutions than Ss in the other conditions where solving was limited to 15 minutes. Since Fig. 7 shows this not to be the case suggests that the same oppressing mechanisms were perhaps operating in this condition as in Condition FW. That is, the accounting for each solution produced with a strategy for that solution inhibited spontaneity, or the "running off" of solutions. Perhaps Ss produced a strategy statement for some solutions whether they could accurately identify their strategy or not, simply because they were required to produce something explaining the origin of each solution. It was apparent to E, while scoring, that occasionally when S was required to furnish a strategy for each solution produced, he produced the solution and then thought of a strategy to fit it, whether that strategy was responsible for the solution or not. He was required by instructions to make an accounting for each solution and was not above or could not avoid inventing if the appropriate strategy did not come to mind.

It is believed that a limiting point was reached as far as the number of solutions possible was concerned, based upon E's prior experiences on this task (Corts, 1961). Inspection of the data indicated a somewhat mechanical production of solutions although not to the degree found in Condition FW data. It should be realized that this method carried to its limits in terms of trial or solving time, is one of the few methods that makes any sense at all. Increasingly longer trial times makes S more subject to forgetting and thus decreases the percentage of total number of strategies used that can be recovered by

S after the trial. As a result, this suggests that strategy reporting should be an ongoing process during solution of problems, particularly in experiments in which strategy is the focal factor under study.

E observed that strategy statements made during trials in Condition CS were somewhat more difficult to read and interpret. Possibly this was a result of haste in getting back to solving the anagram problem. Emphasis in this study was to produce the most solutions possible to the problems along with listing all strategies used. Ss' set is within E's control and can readily be altered to focus upon clear, concise strategy reporting if strategy is the variable under study. It must be remembered that strategy statements during trials in Condition CS as currently formulated, were final. There was no provision for expanding or clarifying strategy statements once the trial was completed. The method can be modified to accommodate expanded statements of strategy upon completion of the trial. It should be remembered, however, that the fact that this was not needed was one of the major advantages of this condition.

As a result of the foregoing discussion, Condition CS is believed to be perhaps the most valuable method for gaining strategy information of all methods investigated. With modification it could fit all problem solving tasks. The major advantages center around strategy report as an ongoing process, economy and conservation of time, modifications of the method to accommodate strategies used which were not productive, and strategies reported at points during the trial where they occurred and were used. Subsequent modification of this method should definitely include provisions for listing strategies which do not enable S to produce solutions.

Ss do not particularly care to work according to the requirements of this method. Pilot study Ss ranked it fourth out of six methods in terms of ease and productivity as seen in Table 2 (the rank was pure; see Table 2, Note x). The data from this condition is somewhat difficult to score and interpret. It is also sometimes difficult to judge the adequacy of the strategies reported.

Condition CL. The checklist method has been extremely widely used in past experimentation to gain strategy information. It has nearly been taken for granted to be a valid and productive method. It is essentially an RS method (as defined in this study) in that S remembers strategy during trials and rather than listing them, checks them off on a prepared checklist. Contents of previous checklists have taken the form of strategies or questions which indicate use or nonuse of certain strategies. Investigation of this method was not undertaken to provide a new or unique method so much as to evaluate the adequacy of a method in common use.

In this experiment, the checklist was compiled from strategies reported in a previously described pilot study by highly sophisticated Ss from a thought processes course. Most of these Ss were graduate students in psychology. In the main experiment, provision was made for write-in strategies not already included in the checklist. Ss were urged not to claim approximations but to write in strategies if they were in any way different from those given in the checklist.

Tables 12 and 16 show that a significant difference was found only between total number of solutions produced in the checklist condition and those produced in the FW Condition. Table 14 (G-I analysis)

shows no differences between Condition CL and any of the other conditions. Table 18 shows no significant difference at the .01 probability level between errors made on the checklist solutions and errors made in any other condition. At the .05 level, the mean number of errors was significantly less than those made in Condition CM-1. Condition CL as seen in Table 20 exceeded by statistical significance, all other expeimental conditions in the total mean number of strategies listed as used during solution of the problems. Nearly four times as many strategies were claimed in this condition as were listed, on the average, in the other four experimental conditions. Fig. 7 illustrates the previously described relationships.

Condition CL has the disadvantage, mentioned in connection with certain other conditions, of not yielding information specific enough to indicate where the strategy was used during problem solving. This method may be modified so that Ss will put the number of the strategy beside the corresponding solution when the trial is completed. A checklist has the further limitation of not providing much information which is unique to individual Ss, in the sense of expression of strategy usage in an original manner. To this extent, opinions of E regarding a certain sterility of checklist information are borne out. Very few Ss added anything of their own experiences at the end of the checklist where this information was solicited. Information that was added was usually not appreciably different from what was already in the checklist. It is believed that a checklist is a lazy way for Ss to give strategy information. It could be a useful method for obtaining the frequencies of usage of certain selected available strategies.

When Ss have reviewed the strategies listed, they apparently feel that it has all been covered quite thoroughly. They are generally not able to add anything of their own. Ss perhaps feel stifled when much strategy is listed for them and lose the set to produce.

It has been shown that checklists are very productive in terms of volume of strategies reported. Ss have only to claim them from the list. As a result, they can claim strategies that they ordinarily would not have been able to verbalize or remember, and the savings of this method is high in relation to other methods, particularly those relying on memory.

The use of a checklist makes data produced suspect in a number of ways. Excessive over-reporting is a constant danger. Strategies are indicated affirmatively by Ss when: (1) they actually use the strategy, (2) they think that they used the strategy, (3) they would have liked to have used the strategy, and (4) a poor problem solving performance is being disguised. Verbal reports by Ss in the evaluation section of the experimental booklets indicate that Ss considered themselves truthful while reporting on the checklist. The majority felt that they would gain nothing by exaggerating their strategy reports. Ss had no way of knowing how many strategies were being claimed by other Ss in the same and other conditions. However, Ss were urged in all instructions to make as good a performance as possible in accord with their abilities. This competitive overtone was also commonly mentioned by Ss in the Subject Evaluations. It is not believed that many Ss in the CL Condition allowed their strategy reports to appear sparse. The use of strategy is rarely the focus of awareness during problem

solving and is believed to be partially unconscious by many psychologists (Leeper, 1951). The use of strategy is easily rationalized in an innocent, and perhaps legitimate, way by Ss. They cannot at all times be certain; thus, they give themselves the benefit of the doubt.

There is little indication in the checklist data whether S was claiming both productive and nonproductive strategy or productive strategy alone. In spite of instructions warning against leaving out any strategy, this was a danger in all methods. When comparing methods of listing strategy as in this experiment, it can only be assumed that the various types of reporting will balance among experimental conditions.

The checklist method is valuable to the extent that it enables S and N Ss to indicate the use of strategies that are difficult to verbalize or remember. It eliminates the need for extended training of Ss in methods of identifying and verbalizing strategies. Only the checklist method, in addition to the complete sentence method, would contribute to a savings in strategy information after trials of extended duration. A combination of the two methods would gain the advantages of both; that is, strategy as an ongoing process to reduce forgetting and strategy from a checklist to decrease difficulties with verbalization. Use of the checklist in this manner, however, would provide Ss with strategies to use subsequently if there were multiple solutions or multiple trials. As a result, very few problems would remain true problem situations if workable strategies were made available during solution.

Ss enjoy working with a checklist as seen in the ratings shown in Table 2. Pilot study Ss ranked this method first almost unanimously.

It relieved them of the problem of verbalizing, and the strategy report amounted to recall and recognition rather than remembering and reconstruction. The method is rapid and can be very easily scored by E. It relieves E of subjective judgments involved in scoring statements written by Ss which are generally poorly formulated and suggest meanings that are often unclear. Checklist statements are already in a form dictated by E.

Reliability of the Measures

The reliability of the measures produced in this experiment is considered very satisfactory. The correlation between the first and second anagram problems where a specific BLC could either be first or second due to randomization procedures, was quite low (r = .363; σ_r = .054). The difference in the mean number of solutions which were produced to the two BLCs was responsible for the low correlation between the first and second problems. The BLC IBRYCETA had a mean of 35.54 solutions; BLC GUOCHNTI had a mean of 28.87 solutions (257 scores for each BLC). Nonequivalence of the two BLCs was shown by the t ratio for correlated measures reported earlier (t = 19.02; df = 256; $P < .001$). When scores of all Ss, 127 of which had worked the BLCs in the order G-I and 130 of which had worked the BLCs in the order I-G, were combined, the effect of this operation was a spreading of scores as seen in the scatterplot shown in Fig. 4. Any correlation coefficient calculated between the first and second anagram problems under these circumstances, would possess an "inherent" limiting point, even in the case of a theoretical perfectly reliable set of measures. Had the BLCs been equivalent, in the sense that a relatively equal

number of solutions could have been produced to each (usage, familiarity, and meaning) using the given letters, the above reliability coefficient would have been considerably higher.

To overcome this artifact of statistical analysis and experimental design, the data was separated into two groups according to the order in which the BLCs had been worked. The G-I and I-G groups and the number of Ss in each was described above. When the scores of these two separate groups were plotted, the spreading effect shown in Fig. 4 was substantially reduced. Scatterplots for these two groups may be seen in Figs. 5 and 6. The data, separated according to BLC order, yielded correlation coefficients judged to be quite high (r_{GI} = .723; σ_r = .04; r_{IG} = .688, σ_r = .05).

It is concluded that the two correlation coefficients, calculated with the data separated according to BLC order, show the true reliability of the measures used in the main experiment. It can be seen in Figs. 5 and 6 that an occasional S showed rather extreme variability of performance on the two problems. Although this kind of solution production was somewhat rare, factors accounting for the variability could be categorized under fatigue, "catching on," practice effects, role diffusion, interference caused from positive and negative transfer effects and, of course, the nonequivalence of the two experimental BLCs. Fatigue, as a result of the length of the experiment, was often mentioned in the Subject Evaluations, especially in the case of specific experimental conditions discussed earlier. Negative transfer (proactive interference or inhibition) was evident when solutions appeared in the second problem using letters contained in the

first BLC. (If possible, it is recommended that, in subsequent research, letters used in succeeding BLCs be completely different so that an accurate measure of negative transfer can be obtained.) Analysis of data would also be facilitated by nearly independent problems. It is recognized that, in the case of larger BLCs, overlap of vowels cannot be avoided unless the number of vowels in each BLC is reduced.

The majority of Ss showed a very stable solution production from the first BLC to the second. Positive transfer effects were not absent but were considered minimal. This was expected in Phase II where only two problems were used. Ss perform consistently on this task and within the limits of their individual problem solving abilities. As was noted previously (Ammons, et al., 1958), correlations with verbal ability, and subsequently intelligence, is expectedly high.

Pearson product moment correlation coefficients between the three strategy scorers are shown in Table 21. Correlations between scorers DBC and EMC were based upon scores of all Phase II Ss who produced strategies on both problems. Correlations between scorers DBC and CM were based upon both problems in booklets from a sample of eight Ss in each of the strategy-producing conditions.

As is seen in Table 21, correlation coefficients between scorers DBC and EMC are very satisfactory. Scorer DBC was E and had had much prior experience with the SAT and strategy in problem solving experimentation. Scorer EMC was very familiar with this experiment and the principles and variables under study. In the case of three experimental conditions (RS, PL, and CL) the reliability of strategy scoring was unexpectedly high. Reliability was adequate for two experimental

conditions (FW and CS). Discussion of Conditions FW and CS pointed out that strategy statements made as an ongoing process were more difficult to score than strategy statements in conditions where statements of strategy were not concurrent with solution production. Ss in experimental conditions requiring only the listing of strategies upon completion of the trial found their ten-minute period for listing strategies used to be much less stressful than did Ss in Conditions FW and CS. Strategy statements in Condition FW were listed (expanded) after the trial was completed but were made on the basis of notes made during the trial. (E concluded that Condition FW procedures had limited usefulness.) Strategy statements made in Condition CS were final in the form that they were produced during the trial (while solving the BLCs). These were found to be rather hurried and somewhat incomplete statements which were often more difficult to read and interpret. Ultimately, however, disagreements between scorers DBC and EMC were mostly over minor inclusions or exclusions of strategy ideas within Ss' statements. Based upon the reliability coefficients shown in Table 21, it is concluded that no problems exist concerning strategy scoring procedures or the reliability of scoring by different scorers.

As a check on the above conclusion, and also recognizing the fact that scorers DBC and EMC had a common environment, similar training and thus related strategy scoring principles (criterion), a third scorer who was unfamiliar with the experiment and had had no prior experience scoring problem solving strategy, was used to score samples of booklets from the five experimental conditions. Scoring instructions used by scorer CM can be seen in Appendix D.

Correlation coefficients for this reliability determination may be seen in Table 21. Since all coefficients are extremely high, the conclusion that no problems exist in strategy scoring procedures is substantiated. An independent scorer using complete and adequate instructions can score problem solving strategies with little difficulty. The instructions in Appendix D suggest that any independent scorer should be a psychology student and implied a familiarity with the special area of problem solving. Scorer CM qualified under these requirements. It is felt that this requirement guarantees E an intelligent scorer who can bring to bear simple principles of perception, motivation and learning which are an intregal and essential component of any statement of strategy. It is not believed that an individual with less training would be useful as a scorer of strategy statements.

Errors

Errors, as defined in this experiment, appears to be an inadequate quantitative measure. Few meaningful conclusions were possible regarding Ss' performance in this experiment on the basis of error scores.

Some general comments are possible regarding errors made while solving the BLCs. Errors were perhaps mainly a function of the manner in which individual Ss go about doing paper and pencil work. This simply involved neatness under hurried conditions and organization of thought in the somewhat stressful atmosphere of experimentation. Conclusions based upon the above are unimportant in this investigation. Quantitative differences in the number of errors between conditions were generally so slight that the only sound conclusion possible is

that, in the case of the five experimental conditions (see mean number of solutions and errors produced for each experimental condition -- Tables 12 and 18), the mean number of errors was nearly directly proportional to the mean number of solutions produced in the respective conditions. Mean number of errors in the two control conditions possibly reflect the effects of other variables. Among those possible are intereference, emotional factors, and fatigue. It was observed that fewer errors were made when all solutions were listed on the first page of the trial sheets. This was mainly because former solutions were all within S's view and he did not repeat many solutions.

It was hoped that error scores would reflect the amount of interference caused by the mechanics of S's operating under the instructions for each condition. This result was slightly evident in the case of the control conditions (see Tables 12 and 18). It was a secondary result to the extent that the mechanical performance under each condition affected the number of solutions produced in the condition. The number of errors are directly proportional to the number of solutions. If the mechanics of the condition had determined the number of errors, it was supposed that error scores from most to least would have been somewhat as follows: CS, FW, PL, CM-1, RS, CL, CM-2. According to Table 18, from most to least they were: CM-1, RS, CS, PL, CL, CM-2, FW. The above described relationship based upon mechanics of the condition is only slightly evident.

Errors, as defined, used and analyzed in this experiment, was not considered an adequate measure. Differential performance by Ss in producing solutions and strategies yielded nearly all of the

information concerning faulty S performance that was expected from analysis of error scores.

Strategy

Strategies used during problem solving take many forms and do not always occur in an isolated, elemental fashion (see Appendix C). Ss may consciously strive to reduce motivation all the while they are specifically utilizing the mechanical strategies peculiar to this task (see checklist in Appendix A). Ss used in this experiment were trained to limit themselves to the strategies specific to this task, and did actually produce strategies in the form shown in the checklist. More academic statements of strategy principles, as well as strategy principles having to do with emotional and personality characteristics, were discouraged during Phase I strategy training because of the necessity of involved descriptions when these phenomena are verbalized in lay language. In effect, essays were discouraged -- simple statements of mechanical manipulation were encouraged. Many nonmechanical strategies were reported insofar as they could be stated simply. The more complex personality, emotional and academic/technical statements of strategy were, for the most part, absent.

The fact that nonmechanical strategies were in operation during Ss' problem solving efforts was evident during E's inspection of the data. Ss manifested nearly the entire range of known techniques which facilitate problem solution. That is, such strategy as variability of behavior, reliance upon memory, transfer from prior experience, etc., readily became apparent during scoring as E traced S's progress through the trials.

Appendix C contains a "complete" listing of strategies by types, gained through literature search and E's prior research experience. These strategies describing problem solving efforts, were compiled for E's own understanding of strategy. E's prior knowledge of strategy and its use was the criterion for judgment of adequate and legitimate strategy report by Ss during scoring. It is believed that the listing and classification of strategies in Appendix C may be most practical and valuable for subsequent researchers.

Table 19 shows that a significant difference was found between the first and second problem in Phase II. The mean number of strategies reported on the first problem was 8.36, and on the second problem, 8.84. In Results, this was explained as practice effect. Certain reservations, regarding this conclusion, must be noted. On page 37 are shown the mean number of strategies reported for each problem in the five experimental conditions. Only two conditions (FW and CL) show a substantial enough increase to merit consideration. The increase in mean number of strategies reported was from 4.72 to 5.28 for Condition FW. It is possible, in view of previous discussion regarding difficulties with Condition FW, that more time is required for Ss, using this method of reporting strategies, to "catch on" to adequate techniques of noting and expanding notes into strategy statements. As a result of this kind of difficulty, Ss' initial trial would be poor and would improve over an undetermined number of trials. If one wants to include "getting the hang of it" as practice effect, then the increase shown for Condition FW qualifies.

The increase from 19.31 to 21.34 in mean number of strategies reported by Ss in Condition CL also does not represent practice effect

in the purest sense. As was stated in Results, Ss in Condition CL were able to use all the strategies during the second trial in Phase II that they read from the checklist at the end of the first trial. This made it very easy for Ss to add to the number of strategies used during the first trial when they reported use of strategies following Trial 2. Based upon the foregoing discussion, it is felt that the increases in the number of strategies reported between Trial 1 and 2 in Phase II represents practice effect in a very limited sense only. Had the above described opportunity not been possible, there would have been found no significant difference between the first and second problem, nor would there have been a significant problem by condition interaction (A x C Interaction, Table 19).

The large difference between the mean number of strategies reported by Ss in Condition CL and the mean number of strategies reported in the other four experimental conditions was alone responsible for the significant F ratio for conditions (see Tables 19 and 20). Although the method used for scoring Ss' reports of strategy in this experiment does not reveal any significant differences between the experimental methods used by Ss (other than the obvious difference shown for Condition CL), it is felt that more sophisticated strategy scoring criterion would reveal real and significant differences. Due to the complex nature of scoring strategies according to quality and relative value, such a re-evaluation must be postponed to a later time. On the basis of a more sophisticated evaluation of strategy report in the five experimental conditions, further conclusions regarding the respective value of the five methods for reporting strategy will be possible.

Summary

This experiment was conducted to determine which of five possible methods for listing strategy information while solving anagram problems would yield the most valuable data in terms of quantity and quality. Comparisons were made with two control conditions in which no strategy principles were taught nor strategies listed. Differences between Ss with (S) and without (N) prior anagram experience were analyzed. Sex differences were also determined. Normative data was compiled for two anagram problems and a relatively "complete" listing of problem solving strategies was gained.

Ss numbered 257 and were distributed approximately equally among the seven conditions. All had a one-hour training period during which they learned and practiced the Standard Anagram Task, and a one-hour testing period. During the second hour (Phase II), all worked two anagram problems and Ss using the five methods for listing strategy listed the strategies they used for solving the problems. Ss worked each problem for 15 minutes and had ten minutes after (in one case -- during) each trial to list their strategies.

Two methods were found to be more adequate in all respects than the others. One of these required Ss to remember and list their strategies after the trial was completed and the other allowed them to list their complete strategies while solving the problem. One of the five methods was found to be inferior to the other four in every respect. One control condition was judged superior to the other in terms of the accepted functions of experimental control.

Sophisticated Ss (prior experience) were found to be superior to Naive Ss (no prior experience) in the production of solutions with

the least number of errors. N Ss were judged most desirable Ss because of their uncomplicated experimental histories. No strategy differences were found based upon Ss experience. Females were found to be superior to males in the production of solutions. No sex differences were associated with errors or strategy. Sex differences were further analyzed with regard to the prior anagram experience of the sexes.

Reliability of the two experimental anagrams was determined and found to be satisfactory. No practice effect was found from first to second problem. Analysis of strategy scoring procedures were carried out between E's scoring and that of two additional scorers and were found to be satisfactory.

Recommendations were made regarding procedures to be used in subsequent anagram and strategy experimentation.

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Table 1

Pilot Study: Total Solutions Produced; Range of Total Solutions; Rank-Order of Total Solutions -- for Six BLCs in Six Tentative Experimental Conditions (N = 19)

Condition	NPI	RS	PL	FW	CS	CL
BLC	FOREST	PERIOD	DIRECT	AROUND	NEARLY	NUMBER
Mean Total Solutions per Cond.	17.00	19.84	15.42	12.68	13.95	11.26
Range per BLC and Condition	13-23	13-29	9-26	8-17	9-17	7-16
Rank-Order BLC Totals	2	1	3	5	4	6
Rank-Order BLC Totals Ammons, et al. 1958	4	2	2	5	2	6
Mean Total Solutions all Six BLCs	90.16		Range of Total Solutions all Six BLCs		66-116	

Table 2

*Ranking of Procedures (Conditions) from Easiest to Most Difficult to Perform (1 to 6 Respectively) by +17 Ss

Condition	Total Rank this Condition	Rank Based Upon Total
NPI	79 x(102)	6
RS	60 x(51)	3
PL	72 x(85)	5
FW	58 x(34)	2
CS	68 x(68)	4
CL	20 x(17)	1

* Lowest total means that condition was rated most desirable, since the easiest condition was ranked 1.

+ Originally there were 19 Ss. Data from two Ss unuseable in this part of the experiment.

x Multiples of 17 -- indicating pure total if all Ss had agreed upon ranking.

Table 3

Total Number of Independent Strategies per Condition; Range and Mean Total Strategies for 19 Ss

Condition	Mean Number of Strategies per Condition	Range of Straegies per Condition
NPI	5.42	2-10
RS	5.74	2-10
PL	7.26	3-12
FW	5.37	2-11
CS	5.42	1-10
CL	20.05	7-29

Mean Number of Strategies on all Conditions -- 49.26

Range of Total Strategies on all Conditions -- 20-66

Table 4

Sequence of Training and Time Allotments for Sections of Phase I Training -- Five Experimental and Two Control Conditions -- Time in Minutes

	Five Experimental Conditions	Two Control Conditions
General Instructions	3	3
Strategy (General)	5	*NA or N
SAT Instructions	3	3
1st BLC -- TOFRES	5	5
Score 1st BLC	1	1
Strategy (Specific)	5	NA or N
2nd BLC Instructions	1	1
2nd BLC -- DECIRT	5	5
Score 2nd BLC	1	1
Strategy Sheet 2nd BLC	5	NA or N
3rd BLC Instructions	1	1
3rd BLC -- YANERL	5	5
Score 3rd BLC	1	1
Strategy Sheet 3rd BLC	5	NA or N
	Total Time -- 46 Minutes	

* NA -- Interpolated Neutral Activity. N -- Doing Nothing. These activities for amount of time are equivalent to that of Ss in Experimental Conditions.

Table 5

Time in Minutes Alloted to Each Section in Seven Experimental Groups of Phase II

Conditions -- Phase II

Time in Minutes	RS	PL	FW	CS	CL	CM-1	CM-2
0							
2		General Instructions -- All Conditions					
4							
6	instr.	instr.	instr.	instr.	instr.	instr.	instr.
8		strat.					
10		instr.					
12	1st BLC		1st BLC		1st BLC	1st BLC	1st BLC
14				1st BLC			
16	15 min.	1st BLC	15 min.		15 min.	15 min.	15 min.
18				and			
20		15 min.					
22	strat.			strat.	strat.	neutral	do
24			strat.		10 min.	activity	nothing
26	10 min.			25 min.		10 min.	10 min.
28		strat.	10 min.				
30							
32	instr.	10 min.	instr.	instr.	instr.	instr.	instr.
34							
36		instr.					
38	2nd BLC	strat.		2nd BLC	2nd BLC	2nd BLC	2nd BLC
40		instr.	2nd BLC				
42	15 min.			and	15 min.	15 min.	15 min.
44		2nd BLC	15 min.				
46				strat.			
48		15 min.					
50	strat.			25 min.	strat.	S eval.	S eval.
52			strat.				
54	10 min.				10 min.		
56			10 min.				
58	S eval.	strat.			S eval.		
60			S eval.	S eval.			
62		10 min.					
64							
66		S eval.					
68							
70							

Table 6

Breakdown of Ss Used in All Conditions of the Main Experiment According to the Number of Ss Falling Into Each of the Categories of Male-Female, Sophisticated-Naive, and G-I vs. I-G Order of BLC Presentation.

The Number of Ss Eliminated from Each Category Due to Inadequate Data are Shown.

	Conditions							
	CM-1	CM-2	RS	PL	FW	CS	CL	Total
Total Ss Tested	39	39	38	39	38	38	37	268
Males	(24)	(22)	(25)	(21)	(27)	(16)	(21)	(156)
Females	(15)	(17)	(13)	(18)	(11)	(22)	(16)	(112)
Inadequate Data Eliminated	1	1	3	2	2	1	1	11
Males	(1)	(0)	(2)	(2)	(2)	(1)	(0)	(8)
Females	(0)	(1)	(1)	(0)	(0)	(0)	(1)	(3)
Total Eligible Ss Tested	38	38	35	37	36	37	36	257
Males	(23)	(22)	(23)	(19)	(25)	(15)	(21)	(148)
Females	(15)	(16)	(12)	(18)	(11)	(22)	(15)	(109)
Total Ss Tested	39	39	38	39	38	38	37	268
Sophisticated	(21)	(21)	(21)	(21)	(21)	(20)	(20)	(145)
Naive	(18)	(18)	(17)	(18)	(17)	(18)	(17)	(123)
Inadequate Data Eliminated	1	1	3	2	2	1	1	11
Sophisticated	(1)	(0)	(2)	(2)	(1)	(0)	(1)	(7)
Naive	(0)	(1)	(1)	(0)	(1)	(1)	(0)	(4)
Total Eligible Ss Tested	38	38	35	37	36	37	36	257
Sophisticated	(20)	(21)	(19)	(19)	(20)	(20)	(19)	(138)
Naive	(18)	(17)	(16)	(18)	(16)	(17)	(17)	(119)
Total Ss Tested	39	39	38	39	38	38	37	268
G-I	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(133)
I-G	(20)	(20)	(19)	(20)	(19)	(19)	(18)	(135)
Inadequate Data Eliminated	1	1	3	2	2	1	1	11
G-I	(0)	(1)	(1)	(2)	(1)	(1)	(0)	(6)
I-G	(1)	(0)	(2)	(0)	(1)	(0)	(1)	(5)
Total Eligible Ss Tested	38	38	35	37	36	37	36	257
G-I	(19)	(18)	(18)	(17)	(18)	(18)	(19)	(127)
I-G	(19)	(20)	(17)	(20)	(18)	(19)	(17)	(130)

Table 7

Summary of All Statistical Techniques Used, the Differences Established, and the Number of Ss or Scores (Two Scores for Each S) Used in Each Test

Statistical Test	Scores Used	Difference Established or Analyzed	No. Ss (Sc)
t test (correlated measures)	Solutions to each BLC	Between two Phase II BLCs -- GUOCHNTI and IBRYCETA	257 prs.
t test	Total Solutions	Between males and females	148 males 109 females
t test	Total errors	Between males and females	148 males 109 females
t test	Total strategy	Between males and females	103 males 78 females
Chi square	No. of Ss in categories of male, female, S and N	Whether frequency of Ss falling into the four categories could have occurred through random sampling	257 Ss
2 x 2 Factorial ANOVA	Solutions each BLC	Between two control conditions and first and second problems	76 Ss 152 Scores

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Table 7 (continued)

Statistical Test	Scores Used	Difference Established or Analyzed	No. Ss (Sc)
Mixed Factorial Type III ANOVA -- Independence on Experience and Conditions	Solutions each BLC	Between first and second problem; S and N Ss; two control and five experimental conditions	224 Ss 448 Scores
Bartlett Test for Homogeneity of Variance	Solutions each BLC	Homogeneity of Variance of 28 subgroups in ANOVA using solutions	224 Ss 448 Scores
Duncan New Multiple Range Test	Solutions each BLC	Multiple comparison of seven groups in C-dimension of ANOVA to establish groups significantly different	224 Ss 448 Scores
Mixed Factorial Type III ANOVA -- Independence on Experience and Conditions	Errors each BLC	Between first and second problem; S and N Ss; two control and five experimental conditions	224 Ss 448 Scores
Bartlett Test for Homogeneity of Variance	Errors each BLC	Homogeneity of Variance of 28 subgroups in ANOVA using errors	224 Ss 448 Scores
Duncan New Multiple Range Test	Errors each BLC	Multiple comparison of seven groups in C-dimension of ANOVA to establish groups significantly different	224 Ss 448 Scores

- continued -

Table 7 (continued)

Statistical Test	Scores Used	Difference Established or Analyzed	No. Ss (Sc)
Mixed Factorial Type III ANOVA -- Independence on Experience and Conditions	Strategy each BLC	Between first and second problem; S and N Ss; two control and five experimental conditions	160 Ss 320 Scores
Bartlett Test for Homogeneity of Variance	Strategy each BLC	Homogeneity of Variance of 20 subgroups in ANOVA using strategies	160 Ss 320 Scores
Duncan New Multiple Range Test	Strategy each BLC	Multiple comparison of five groups in C-dimension of ANOVA to establish groups significantly different	160 Ss 320 Scores
Mixed Factorial Type III ANOVA -- Independence on Experience and Conditions	Solutions each BLC in order G-I	Between first BLC (G) and second BLC (I); S and N Ss (G-I); two control and five experimental conditions (G-I)	84 Ss 168 Scores
Duncan New Multiple Range Test	Solutions each BLC in order G-I	Multiple comparison of seven groups in C-dimension of ANOVA to establish groups significantly different	84 Ss 168 Scores
Mixed Factorial Type III ANOVA -- Independence on Experience and Conditions	Solutions each BLC in order I-G	Between first BLC (I) and second BLC (G); S and N Ss (I-G); two control and five experimental conditions (I-G)	84 Ss 168 Scores

- continued -

Table 7 (continued)

Statistical Test	Scores Used	Difference Established or Analyzed	No. Ss (Sc)
Duncan New Multiple Range Test	Solutions each BLC in order I-G	Multiple comparison of seven groups in C-dimension of ANOVA to establish groups significantly different	84 Ss 168 Scores
Pearson Product Moment Coefficient of Correlation	Solutions to first vs. second problems (order disregarded)	Reliability (coefficient of equivalence) between solution scores on first problem and second problem	257 Ss (pairs of scores)
Pearson Product Moment Coefficient of Correlation	Solutions to first problem (G) vs. second problem (I)	Reliability (coefficient of equivalence) between solution scores on first problem (GUOCHNTI) and second problem (IBRYCETA)	127 Ss (pairs of scores)
Pearson Product Moment Coefficient of Correlation	Solutions to first problem (I) vs. second problem (G)	Reliability (coefficient of equivalence) between solution scores on first problem (IBRYCETA) and second problem (GUOCHNTI)	130 Ss (pairs of scores)
Pearson Product Moment Coefficient of Correlation	Strategy scores for first and second problem	Reliability of strategy scoring on two problems -- between scorer DBC (E) and scorer EMC -- Condition RS	76 Ss (pairs of scores)
Pearson Product Moment Coefficient of Correlation	Strategy scores for first and second problem	Reliability of strategy scoring on two problems -- between scorer DBC (E) and scorer EMC -- Condition PL	78 Ss (pairs of scores)
Pearson Product Moment Coefficient of Correlation	Strategy scores for first and second problem	Reliability of strategy scoring on two problems -- between scorer DBC (E) and scorer EMC -- Condition FW	76 Ss (pairs of scores)

- continued -

Table 7 (continued)

Statistical Test	Scores Used	Difference Established or Analyzed	No. Ss (Sc)
Pearson Product Moment Coefficient of Correlation	Strategy scores for first and second problem	Reliability of strategy scoring on two problems -- between scorer DBC (E) and scorer EMC -- Condition CS	76 Ss (pairs of scores)
Pearson Product Moment Coefficient of Correlation	Strategy scores for first and second problem	Reliability of strategy scoring on two problems -- between scorer DBC (E) and scorer EMC -- Condition CL	74 Ss (pairs of scores)
Pearson Product Moment Coefficient of Correlation	Strategy scores for first and second problem	Reliability of strategy scoring on two problems -- between scorer DBC (E) and scorer CM -- Condition RS (random sample of eight booklets)	16 Ss (pairs of scores)
Pearson Product Moment Coefficient of Correlation	Strategy scores for first and second problem	Reliability of strategy scoring on two problems -- between scorer DBC (E) and scorer CM -- Condition PL (random sample of eight booklets)	16 Ss (pairs of scores)
Pearson Product Moment Coefficient of Correlation	Strategy scores for first and second problem	Reliability of strategy scoring on two problems -- between scorer DBC (E) and scorer CM -- Condition FW (random sample of eight booklets)	16 Ss (pairs of scores)
Pearson Product Moment Coefficient of Correlation	Strategy scores for first and second problem	Reliability of strategy scoring on two problems -- between scorer DBC (E) and scorer CM -- Condition CS (random sample of eight booklets)	16 Ss (pairs of scores)
Pearson Product Moment Coefficient of Correlation	Strategy scores for first and second problem	Reliability of strategy scoring on two problems -- between scorer DBC (E) and scorer CM -- Condition CL (random sample of eight booklets)	16 Ss (pairs of scores)

Table 8

Summary Table of Means and t Tests Showing Sex and Experience Differences in Total Solutions, Total Errors and Total Strategies Produced on Two Anagram Problems by Sophisticated and Naive Ss

Source of Differences	Mean		t	P
	S & N Males	S & N Females		
Total Solutions (Seven Conditions)	62.37 (N=148)	67.10 (N=109)	3.03	< .01
Total Errors (Seven Conditions)	7.14 (N=148)	5.95 (N=109)	1.63	> .05
Total Strategies (Seven Conditions)	16.37 (N=103)	18.00 (N=78)	.84	> .05
	S-Males	S-Females		
Total Solutions (Seven Conditions)	63.57 (N=94)	69.73 (N=44)	2.81	< .01
	N-Males	N-Females		
Total Solutions (Seven Conditions)	60.28 (N=54)	65.32 (N=65)	2.16	< .05
	S-Males	N-Males		
Total Solutions (Seven Conditions)	63.57 (N=94)	60.28 (N=54)	1.44	> .05
	S-Females	N-Females		
Total Solutions (Seven Conditions)	69.73 (N=44)	65.32 (N=65)	1.97	< .05

Table 9

Mean Number of Solutions for Two Control Conditions on First and Second Anagram Problems*

Problems	Conditions	
	CM-1	CM-2
First Problem	31.50	34.74
Second Problem	31.71	34.08

* Each mean based upon N = 38.

Table 10

Analysis of Variance for Solutions Produced Under Two Control Conditions to First and Second Anagram Problems

Source of Variance	df	MS	F	P
Conditions (B)	1	298.48	6.01	$< .025$
Problems (A)	1	1.90	.04	$> .20$
(Cells)	(3)			
A x B Interaction	1	7.16	.14	$> .20$
Within Cells	148	49.70		

Table 11

Analysis of Variance of Correct Solutions to First and Second Anagram Problems by Sophisticated and Naive Ss in Two Control and Five Experimental Conditions

Source of Variance	df	MS	F	P
Within Ss	224			
Problems (A)	1	4.52	.12	$> .20$
A x B Interaction	1	.64	.02	$> .20$
A x C Interaction	6	19.48	.50	$> .20$
A x B x C Interaction	6	17.38	.45	$> .20$
Error (w)	210	38.82		
Between Ss	223			
Experience (B)	1	163.93	2.36	$< .20$
Conditions (C)	6	436.62	6.28	$< .001$
B x C Interaction	6	40.66	.58	$> .20$
Error (b)	210	69.55		

Table 12

Summary Table of Duncan New Multiple Range Test -- Ranges of Mean Solution Scores for Two Control and Five Experimental Conditions ($\underline{F}$ = 6.28; $\underline{df}$ = 6, 210; $\underline{P} < .001$)

		Conditions in Range Order							
		FW	CM-1	PL	CL	CS	RS	CM-2	
Mean		26.72	31.88	32.52	33.16	33.39	34.03	34.45	SSR
FW	26.72		5.16*	5.80*	6.44*	6.67*	7.31*	7.73*	R_2=3.79
CM-1	31.88			.64	1.28	1.51	2.15	2.57	R_3=3.95
PL	32.52				.64	.87	1.51	1.93	R_4=4.06
CL	33.16					.23	.87	1.29	R_5=4.14
CS	33.39						.64	1.06	R_6=4.20
RS	34.03							.42	R_7=4.26
CM-2	34.45								

Error (b) $\underline{MS}$ = 69.55; $\underline{df}$ = 210; $S_{\bar{X}}$ = 1.04; α = .01

* Significant

FW	CM-1	PL	CL	CS	RS	CM-2
Ranges Significantly Different						

Table 13

Analysis of Variance for Solutions to Two BLCs in the Order GUOCHNTI-IBRYCETA by Sophisticated and Naive Ss in Two Control and Five Experimental Conditions

Source of Variance	df	MS	F	P
Within Ss	84			
BLCs (A)	1	1735.71	121.46	< .001
A x B Interaction	1	2.38	.167	> .20
A x C Interaction	6	39.91	2.79	< .025
A x B x C Interaction	6	13.49	.944	> .20
Error (w)	70	14.29		
Between Ss	83			
Experience (B)	1	2.38	.031	> .20
Conditions (C)	6	224.23	2.93	< .025
B x C Interaction	6	94.38	1.24	> .20
Error (b)	70	76.45		

Table 14

Summary Table of Duncan New Multiple Range Test -- Ranges of Mean Solution Scores in the BLC Order GUOCHNTI-IBRYCETA for Two Control and Five Experimental Conditions ($F = 2.93$; $df = 6, 70$; $P < .025$)

		Conditions in Range Order							
		FW	CL	CM-1	PL	CS	RS	CM-2	
Mean		25.88	31.33	31.67	32.96	34.21	34.33	34.63	SSR
FW	25.88		5.45	5.79	7.08	8.33*	8.45*	8.75*	R_2=6.70
CL	31.33			.34	1.63	2.88	3.00	3.30	R_3=6.98
CM-1	31.67				1.29	2.54	2.66	2.96	R_4=7.18
PL	32.96					1.25	1.37	1.67	R_5=7.32
CS	34.21						.12	.42	R_6=7.43
RS	34.33							.30	R_7=7.52
CM-2	34.63								

Error (b) $MS = 76.45$; $df = 70$; $S_{\bar{x}} = 1.78$; $\alpha = .01$

* Significant

FW	CL	CM-1	PL	CS	RS	CM-2
Ranges Significantly Different						

Table 15

Analysis of Variance for Solutions to Two BLCs in the Order IBRYCETA-GUOCHNTI by Sophisticated and Naive Ss in Two Control and Five Experimental Conditions

Source of Variance	df	MS	F	P
Within Ss	84			
BLCs (A)	1	1672.02	29.64	< .001
A x B Interaction	1	.86	.015	> .20
A x C Interaction	6	26.00	.46	> .20
A x B x C Interaction	6	28.08	.50	> .20
Error (w)	70	56.41		
Between Ss	83			
Experience (B)	1	277.71	8.98	< .005
Conditions (C)	6	228.11	7.38	< .001
B x C Interaction	6	11.74	.38	> .20
Error (b)	70	30.91		

Table 16

Summary Table of Duncan New Multiple Range Test -- Ranges of Mean Solution Scores in the BLC Order IBRYCETA-GUOCHNTI for Two Control and Five Experimental Conditions
($F = 7.38$; $df = 6, 70$; $P < .001$)

		Conditions in Range Order							
		FW	CM-1	PL	RS	CS	CM-2	CL	
Mean		25.58	32.29	33.42	33.50	33.71	34.04	34.38	SSR
FW	25.58		6.71*	7.84*	7.92*	8.13*	8.46*	8.80*	R_2=4.25
CM-1	32.29			1.13	1.21	1.42	1.75	2.09	R_3=4.43
PL	33.42				.08	.29	.62	.96	R_4=4.56
RS	33.50					.21	.54	.88	R_5=4.65
CS	33.71						.33	.67	R_6=4.72
CM-2	34.04							.34	R_7=4.78
CL	34.38								

Error (b) $MS = 30.91$; $df = 70$; $S_{\bar{x}} = 1.13$; $\infty = .01$

* Significant

FW	CM-1	PL	RS	CS	CM-2	CL

Ranges Significantly Different

Table 17

Analysis of Variance for Error Scores on First and Second Anagram Problems by Sophisticated and Naive Ss on Two Control and Five Experimental Conditions

Source of Variance	df	MS	F	P
Within Ss	224			
Problems (A)	1	0.00	0.00	> .20
A x B Interaction	1	.38	.10	> .20
A x C Interaction	6	4.77	1.19	> .20
A x B x C Interaction	6	3.42	.86	> .20
Error (w)	210	4.00		
Between Ss	223			
Experience (B)	1	115.02	7.34	< .01
Conditions (C)	6	35.57	2.27	< .05
B x C Interaction	6	4.55	.29	> .20
Error (b)	210	15.67		

Table 18

Summary Table of Duncan New Multiple Range Test -- Ranges of Mean Error Scores for Two Control and Five Experimental Conditions ($F = 2.27$; $df = 6, 210$; $P < .05$)

		Conditions in Range Order							
		FW	CM-2	CL	PL	CS	RS	CM-1	
Mean		2.28	2.67	2.91	3.22	3.28	3.63	4.59	SSR
									∞ = .01
FW	2.28		.39	.63	.94	1.00	1.35	2.31*	R_2=1.80
CM-2	2.67			.24	.55	.61	.96	1.92**	R_3=1.88
CL	2.91				.31	.37	.72	1.68**	R_4=1.93
PL	3.22					.06	.41	1.37	R_5=1.97
CS	3.28						.35	1.31	R_6=2.00
RS	3.63							.96	R_7=2.03
CM-1	4.59								

Error (b) $MS = 15.67$; $df = 210$; $S_{\bar{x}} = .495$; ∞ = .01, .05

* Significant at the .01 level
** Significant at the .05 level

FW	CM-2	CL	PL	CS	RS	CM-1
Ranges Significantly Different						

Table 19

Analysis of Variance for Strategies Reported for First and Second Anagram Problems by Sophisticated and Naive Ss on Five Experimental Conditions

Source of Variance	df	MS	F	P
Within Ss	160			
Problems (A)	1	18.53	6.39	$<.025$
A x B Interaction	1	0.00	0.00	$>.20$
A x C Interaction	4	13.43	4.63	$<.005$
A x B x C Interaction	4	2.45	.85	$>.20$
Error (w)	150	2.90		
Between Ss	159			
Experience (B)	1	5.26	.34	$>.20$
Conditions (C)	4	2759.88	176.46	$<.001$
B x C Interaction	4	19.24	1.23	$>.20$
Error (b)	150	15.64		

Table 20

Summary Table of Duncan New Multiple Range Test -- Ranges of Mean Strategy Scores for Five Experimental Conditions ($F = 176.46$; $df = 4, 150$; $P < .001$)

		Conditions in Range Order					
		FW	RS	PL	CS	CL	
Mean		5.00	5.77	5.86	6.06	20.33	SSR
FW	5.00		.77	.86	1.06	15.33*	R_2=1.79
RS	5.77			.09	.29	14.56*	R_3=1.86
PL	5.86				.20	14.47*	R_4=1.91
CS	6.06					14.27*	R_5=1.95
CL	20.33						

Error (b) $MS = 15.64$; $df = 150$; $S_{\bar{x}} = .49$; $\infty = .01$

* Significant

FW	RS	PL	CS	CL
Ranges Significantly Different				

Table 21

Reliability of Strategy Scoring. Pearson Product Moment Coefficients of Correlation Between E's Scoring of Strategy and the Scoring of Two Other Scorers (EMC, CM) on Five Experimental Conditions

Condition	N	r	σ_r
Correlation Between Scorers DBC and EMC			
RS	76	.969	.007
PL	78	.929	.016
FW	76	.821	.038
CS	76	.762	.048
CL	74	.9996	.00023
Correlation Between Scorers DBC and CM			
RS	16	.992	.004
PL	16	.924	.038
FW	16	.990	.005
CS	16	.995	.003
CL	16	.997	.0015

FIGURE CAPTIONS

Figure 1. Relationship between the number of solutions produced and the number of strategies listed, in the pilot study. The data from all tentative conditions is included in the scatterplot.

Figure 2. Relationship between the number of solutions produced and the number of strategies listed, in the pilot study. The data from tentative conditions, minus the checklist data, is included in the scatterplot.

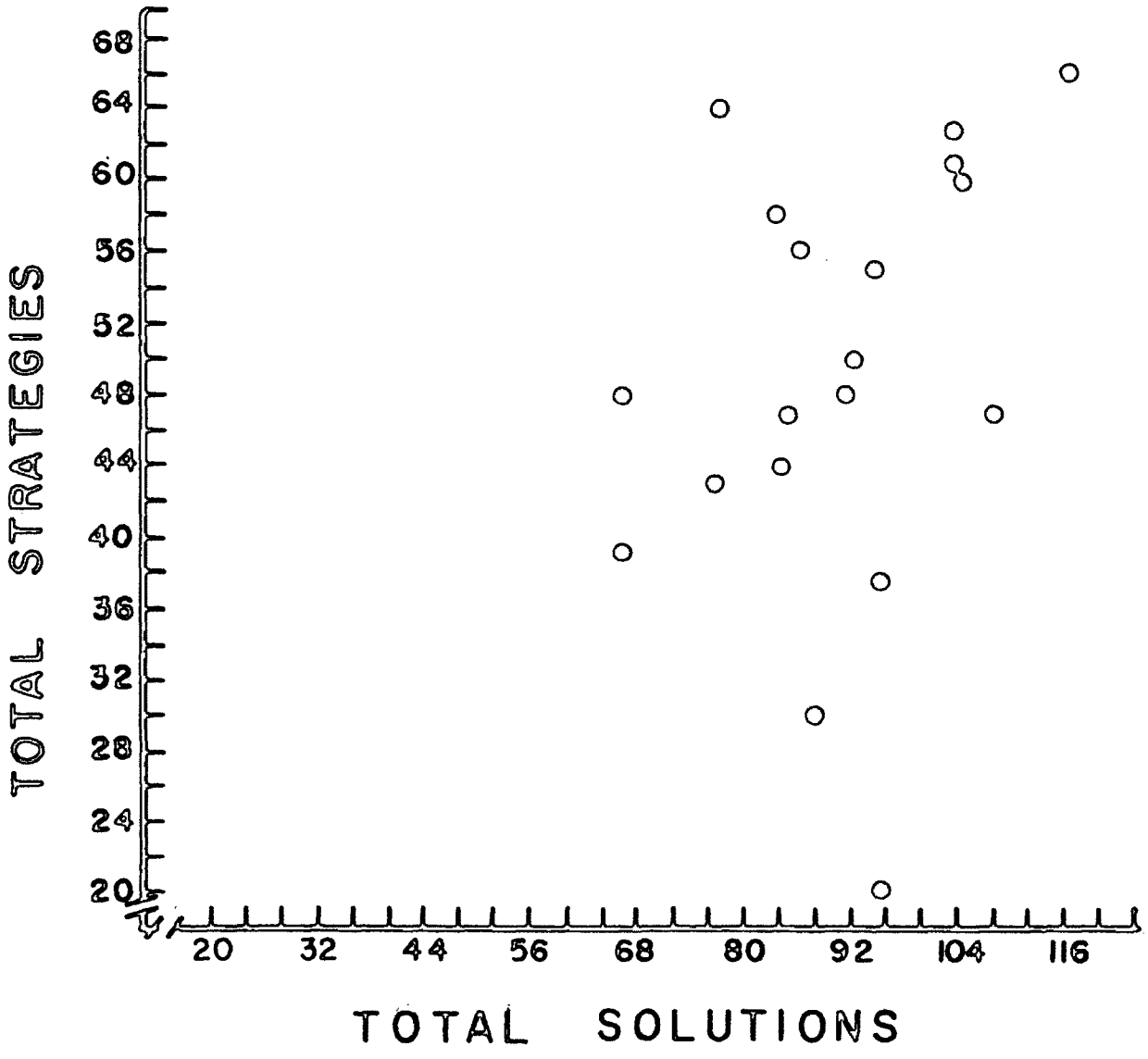
Figure 3. Design representation for 2 x 2 x 5 and 2 x 2 x 7 mixed Type III analysis of variance used to analyze solutions, errors, and strategy (combined problem scores and separated BLC order scores). A-dimension always correlated -- B and C-dimension always independent.

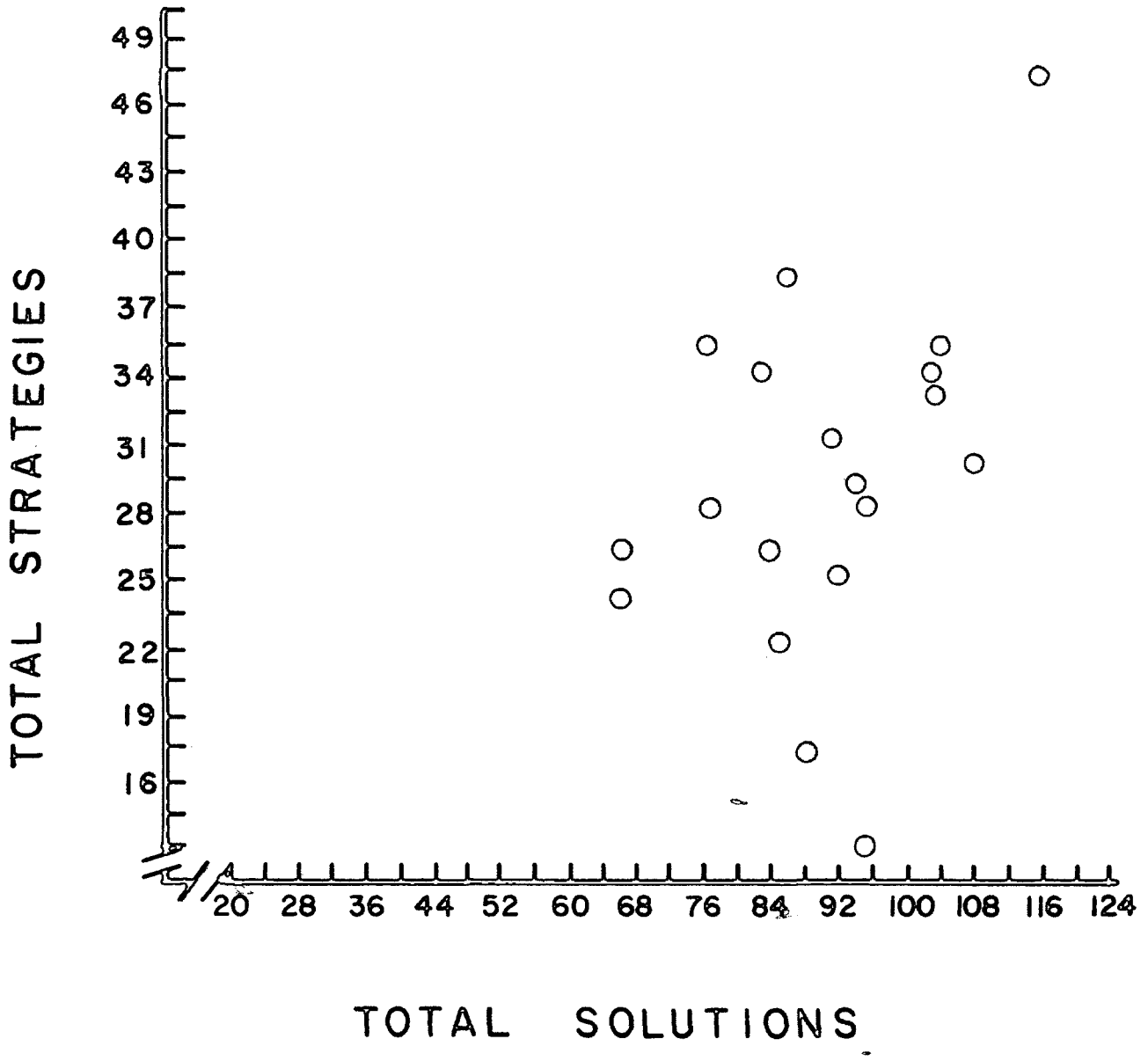
Figure 4. Scatterplot of Pearson Product Moment correlation between the first and the second anagram problems using the total number of solution scores produced by 257 Ss.

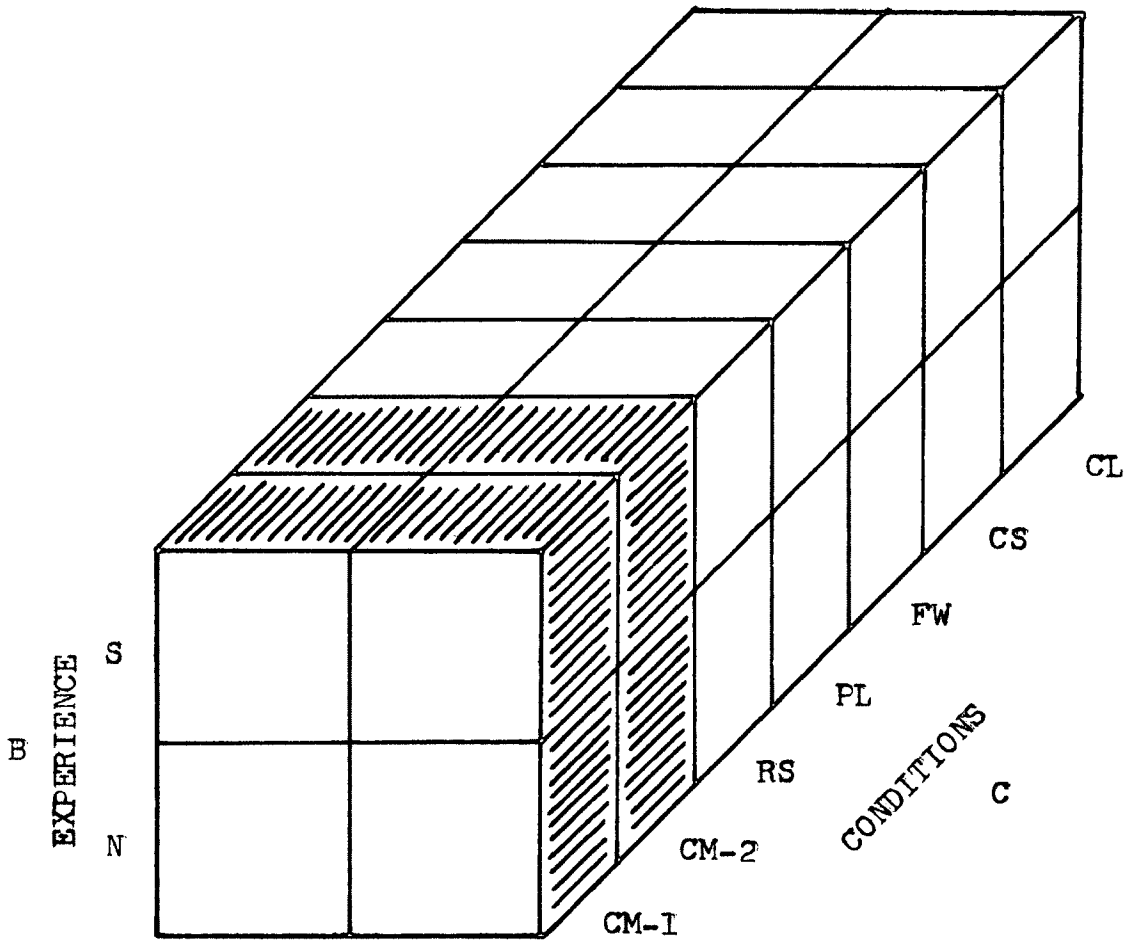
Figure 5. Scatterplot of Pearson Product Moment correlation between the first and the second anagram problems (BLCs) using the total number of solution scores of 127 Ss who worked BLCs in the order GUOCHNTI-IBRYCETA.

Figure 6. Scatterplot of Pearson Product Moment correlation between the first and the second anagram problems (BLCs) using the total number of solution scores of 130 Ss who worked BLCs in the order IBRYCETA-GUOCHNTI.

Figure 7. Summary graph of mean number of solutions, errors, and strategies produced by 224 Ss (64 combined scores in each condition) to two anagram problems.


TOTAL STRATEGIES
68
64
60
56
52
48
44
40
36
32
28
24
20
20
32
44
56
68
80
92
104
116
TOTAL SOLUTIONS


TOTAL STRATEGIES
49
46
43
40
37
34
31
28
25
22
19
16
20 28 36 44 52 60 68 76 84 92 100 108 116 124
TOTAL SOLUTIONS



PROBLEMS

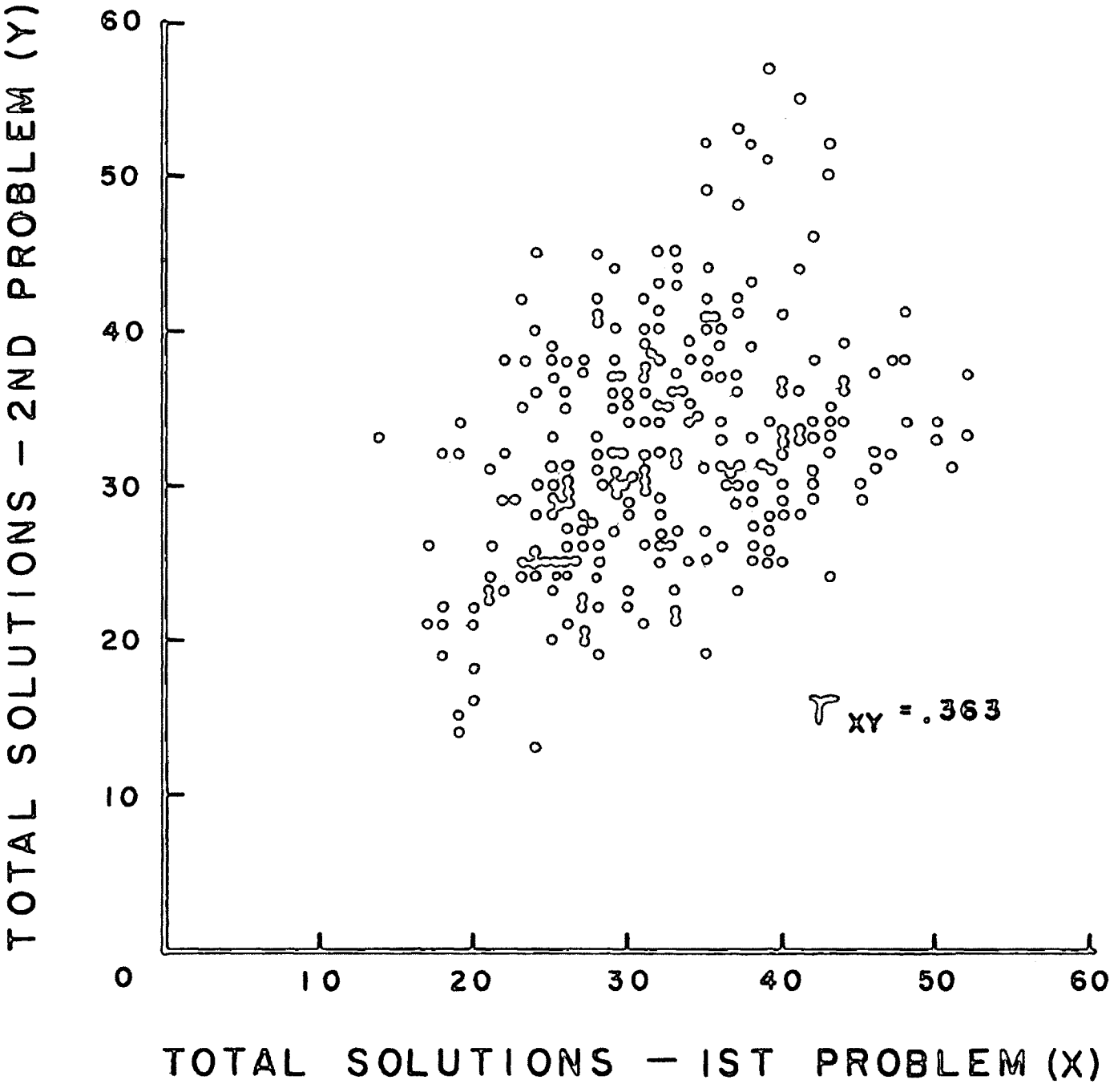
1ST BLC 2ND BLC

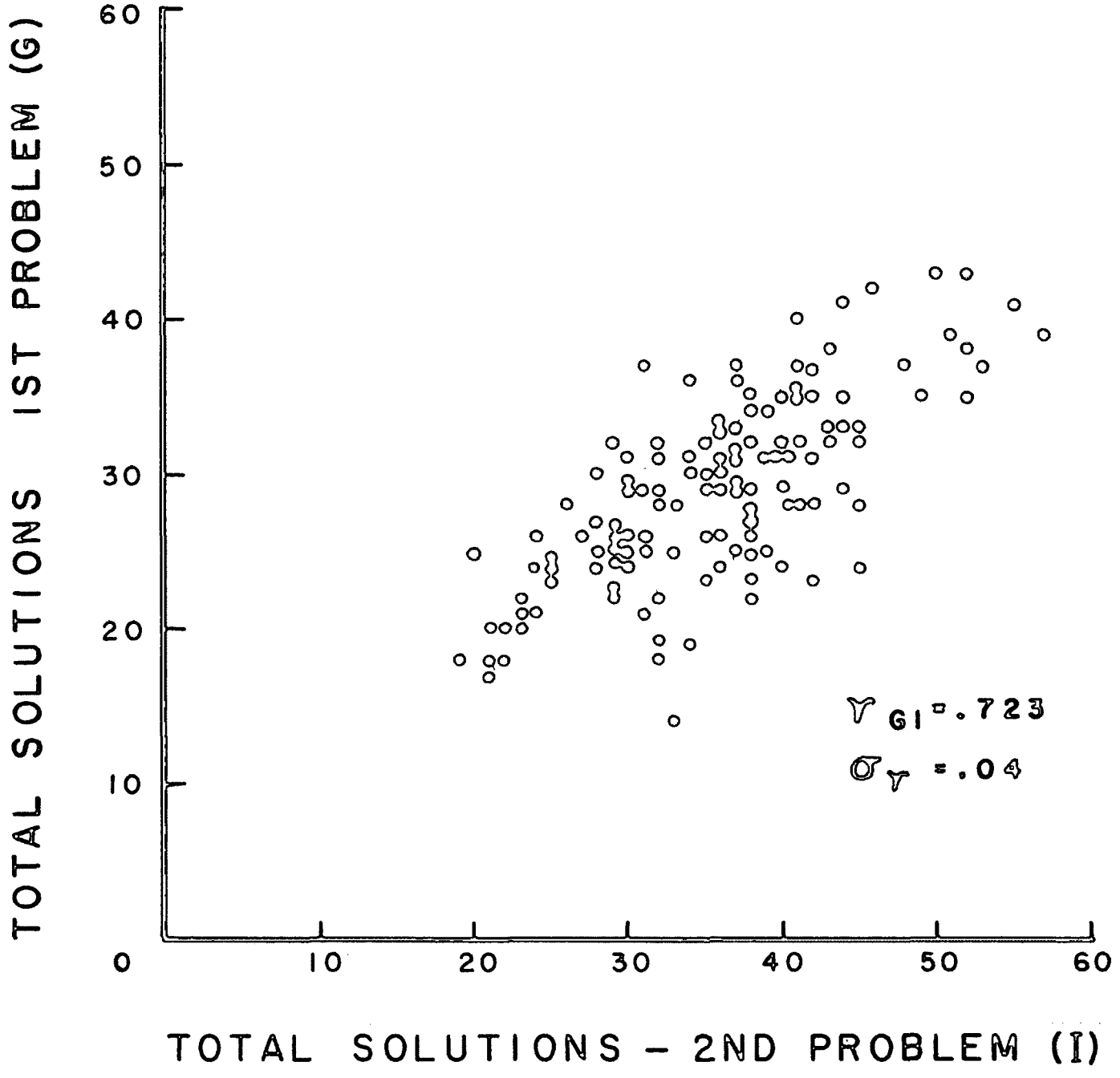
or

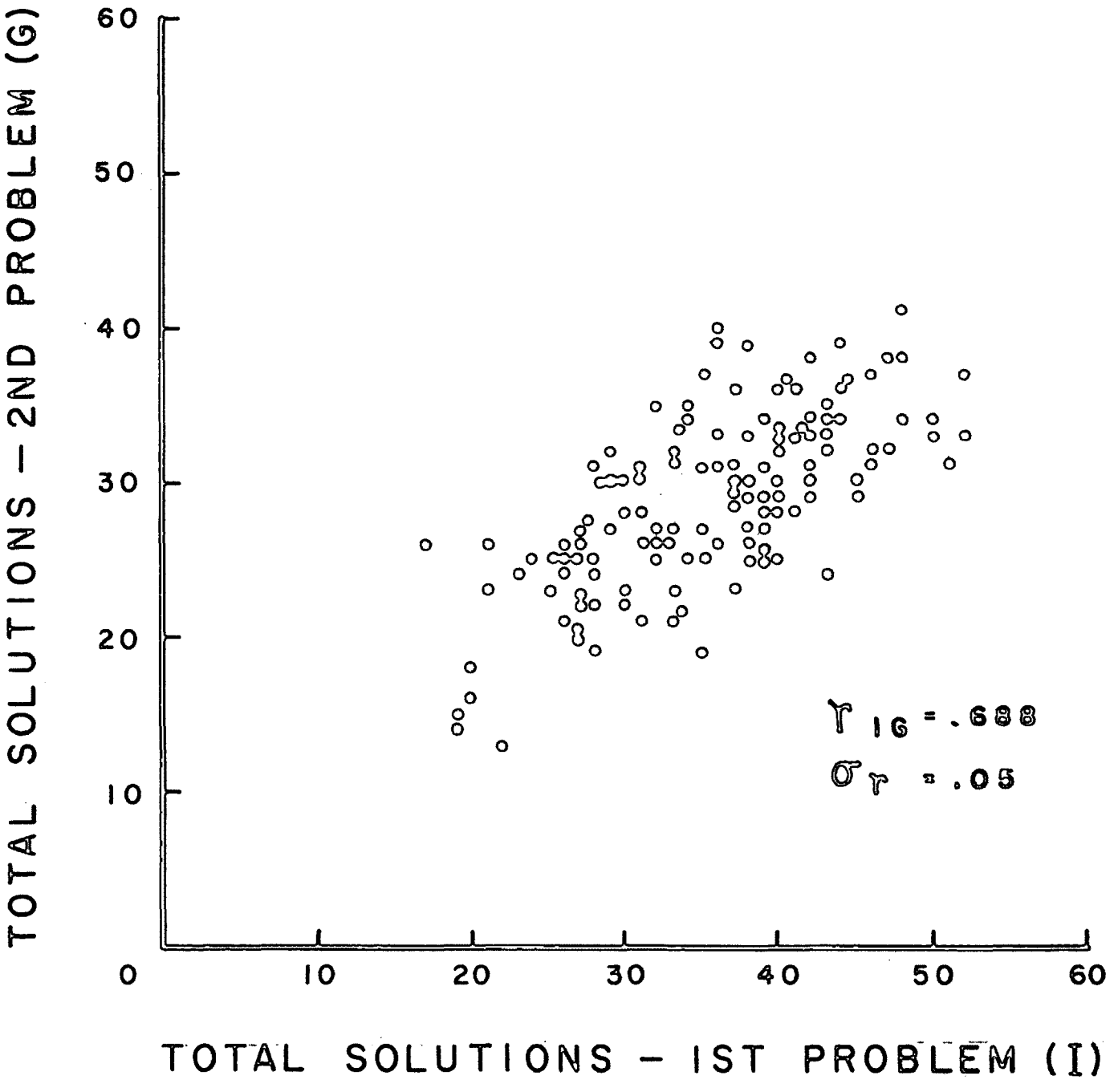
BLC ORDER

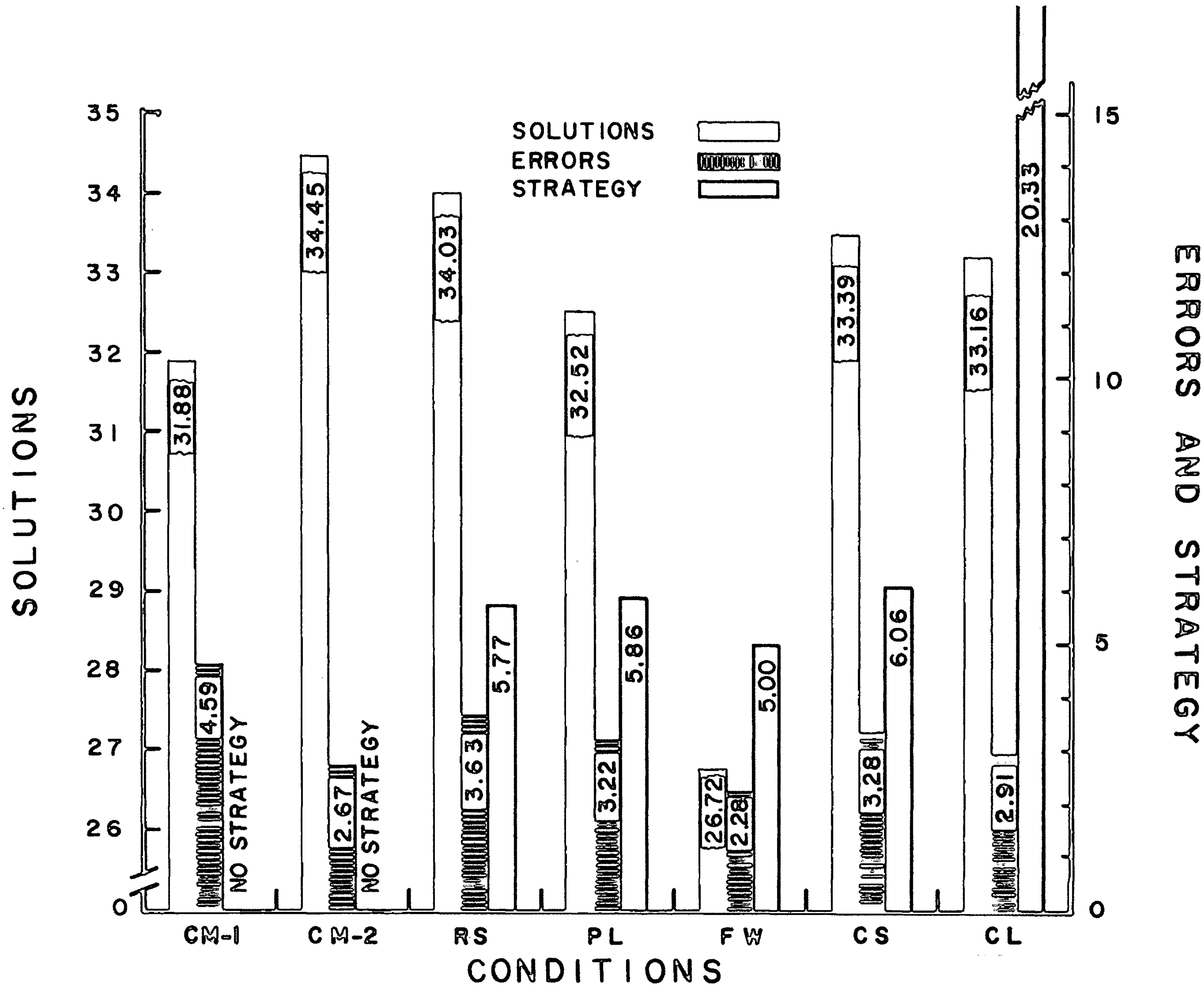
G (I) I (G)

A


TOTAL SOLUTIONS – 2ND PROBLEM (Y)
60
50
40
30
20
10
0
10
20
30
40
50
60
TOTAL SOLUTIONS – IST PROBLEM (X)
r_{XY} = .363


TOTAL SOLUTIONS IST PROBLEM (G)
60
50
40
30
20
10
0
10
20
30
40
50
60
TOTAL SOLUTIONS - 2ND PROBLEM (I)
$\gamma_{GI} = .723$
$\sigma_{\gamma} = .04$


TOTAL SOLUTIONS – 2ND PROBLEM (G)
60
50
40
30
20
10
0
10
20
30
40
50
60
TOTAL SOLUTIONS – IST PROBLEM (I)
$r_{IG} = .688$
$\sigma_r = .05$



SOLUTIONS
ERRORS
STRATEGY
SOLUTIONS
ERRORS AND STRATEGY
CONDITIONS
CM-I
C M-2
RS
PL
F W
CS
CL
31.88
4.59
NO STRATEGY
34.45
2.67
NO STRATEGY
34.03
3.63
5.77
32.52
3.22
5.86
26.72
2.28
5.00
33.39
3.28
6.06
33.16
2.91
20.33

APPENDIXES

Contents

Contents (continued)

APPENDIX A

APPENDIX A

Arrangement of pages shown in Appendix A within each booklet, in each of two control and five experimental conditions.

Condition CM-1 Booklet Arrangement

General Instructions -- Phase I
Preference Selection (1) -- Condition CM-1
Word Construction Game
BLC -- TOFRES
Preference Selection (2) -- Condition CM-1
Instructions to Work Anagram Problem
BLC -- DECIRT
Preference Selection (3) -- Condition CM-1
Instructions to Work Anagram Problem
BLC -- YANERL
Preference Selection (4) -- Condition CM-1
General Instructions -- Phase II
Instructions -- Condition CM-1, CM-2
Solution Sheet -- Conditions RS, PL, CL, CM-1, CM-2 (IBRYCETA)
Preference Selection (5) -- Condition CM-1
Instructions -- Condition CM-1, CM-2
Solution Sheet -- Conditions RS, PL, CL, CM-1, CM-2 (GUOCHNTI)
Subject Evaluation

Condition CM-2 Booklet Arrangement

General Instructions -- Phase I
Instructions -- Five Minute Rest
Word Construction Game
BLC -- TOFRES
Instructions -- Five Minute Rest
Instructions to Work Anagram Problem
BLC -- DECIRT
Instructions -- Five Minute Rest
Instructions to Work Anagram Problem
BLC -- YANERL
Instructions -- Five Minute Rest
General Instructions -- Phase II
Instructions -- Conditions CM-1, CM-2
Solution Sheet -- Conditions RS, PL, CL, CM-1, CM-2 (IBRYCETA)
Interpolated Neutral Activity -- Condition CM-2
Instructions -- Condition CM-1, CM-2
Solution Sheet -- Conditions RS, PL, CL, CM-1, CM-2 (GUOCHNTI)
Subject Evaluation

Condition RS Booklet Arrangement

General Instructions -- Phase I
Strategy Training (General)

Word Construction Game
BLC -- TOFRES
Strategy Training (Specific)
Instructions to Work Anagram Problem
BLC -- DECIRT
Instructions to List Strategy
Instructions to Work Anagram Problem
BLC -- YANERL
Instructions to List Strategy
General Instructions -- Phase II
Instructions -- Condition RS
Solution Sheet -- Conditions RS, PL, CL, CM-1, CM-2 (IBRYCETA)
Strategy Sheet -- Condition RS
Instructions -- Condition RS
Solution Sheet -- Conditions RS, PL, CL, CM-1, CM-2 (GUOCHNTI)
Strategy Sheet -- Condition RS
Subject Evaluation

Condition PL Booklet Arrangement

General Instructions -- Phase I
Strategy Training (General)
Word Construction Game
BLC -- TOFRES
Strategy Training (Specific)
Instructions to Work Anagram Problem
BLC -- DECIRT
Instructions to List Strategy
Instructions to Work Anagram Problem
BLC -- YANERL
Instructions to List Strategy
General Instructions -- Phase II
Instructions (1) -- Condition PL
Strategy Sheet (First) -- Condition PL
Instructions (2) -- Condition PL
Solution Sheet -- Conditions RS, PL, CL, CM-1, CM-2 (IBRYCETA)
Strategy Sheet (Second) -- Condition PL
Instructions (1) -- Condition PL
Strategy Sheet (First) -- Condition PL
Instructions (2) -- Condition PL
Solution Sheet -- Conditions RS, PL, CL, CM-1, CM-2 (GUOCHNTI)
Strategy Sheet (Second) -- Condition PL
Subject Evaluation

Condition FW Booklet Arrangement

General Instructions -- Phase I
Strategy Training (General)
Word Construction Game
BLC -- TOFRES
Strategy Training (Specific)
Instructions to Work Anagram Problem
BLC -- DECIRT

Instructions to List Strategy
Instructions to Work Anagram Problem
BLC -- YANERL
Instructions to List Strategy
General Instructions -- Phase II
Instructions -- Condition FW
Solution Sheet -- Condition FW (IBRYCETA)
Strategy Sheet -- Condition FW
Instructions -- Condition FW
Solution Sheet -- Condition FW (GUOCHNTI)
Strategy Sheet -- Condition FW
Subject Evaluation

Condition CS Booklet Arrangement

General Instructions -- Phase I
Strategy Training (General)
Word Construction Game
BLC -- TOFRES
Strategy Training (Specific)
Instructions to Work Anagram Problem
BLC -- DECIRT
Instructions to List Strategy
Instructions to Work Anagram Problem
BLC -- YANERL
Instructions to List Strategy
General Instructions -- Phase II
Instructions -- Condition CS
Solution Sheet -- Condition CS (IBRYCETA)
Instructions -- Condition CS
Solution Sheet -- Condition CS (GUOCHNTI)
Subject Evaluation

Condition CL Booklet Arrangement

General Instructions -- Phase I
Strategy Training (General)
Word Construction Game
BLC -- TOFRES
Strategy Training (Specific)
Instructions to Work Anagram Problem
BLC -- DECIRT
Instructions to List Strategy
Instructions to Work Anagram Problem
BLC -- YANERL
Instructions to List Strategy
General Instructions -- Phase II
Instructions -- Condition CL
Solution Sheet -- Conditions RS, PL, CL, CM-1, CM-2 (IBRYCETA)
Strategy Sheet -- Condition CL
Instructions -- Condition CL
Solution Sheet -- Conditions RS, PL, CL, CM-1, CM-2 (GUOCHNTI)
Strategy Sheet -- Condition CL
Subject Evaluation

GENERAL INSTRUCTIONS - PHASE I

Before we begin this experiment, there are some general instructions that should be borne clearly in mind throughout the experimental session. Please bear with the redundancy that you will encounter in the many instructions throughout the experiment. This is done to enable you to achieve and maintain maximum understanding of what you are expected to do.

Since a good many students will be run as subjects this quarter, under conditions similiar to the ones you will be experiencing, please do not pass on any information about the Standard Anagram Task or any of the major concepts utilized in this experiment. Subjects with prior knowledge of these things will produce data that is worthless. Every available subject will be needed badly, and uncontaminated!

Each phase of the experiment has a time limit. In this phase, you will be given the signal when to begin and when to stop. Look up when you finish reading instructions and understand them - the experimenter will then know that you are ready to proceed with the experiment. Please do not turn the pages until you are told to do so. When you do, turn them all the way over so that you have only one page before you at a time. Do this unless you are specifically instructed to do otherwise.

The instructions and explanations contained within the various phases of this experiment are complex and, at times, rather extensive. It is very important that you understand these thoroughly for each phase or you will not be able to function correctly in the experiment, and the data you produce will be useless. There will be ample time for reading and understnading the instructions and explanations. Read them very carefully, and, if you have time, scan through them again and fix the major points firmly in mind. If you have read them carefully, you will not have difficulty understanding what you are to do.

Pay absolutely no attention to what your neighbor is doing. There are many variations of the conditions of this experiment being run now, at one time, so at times your neighbor will not be performing on the same type of task that you are. Follow the instructions in your own booklet and do not become confused by what others are doing.

Please use a soft lead pencil for writing in these booklets. If you do not have one, it can be obtained from the experimenter. Hard pencil or ballpoint marks show through on following pages. This will definitely disrupt and interfere with your thinking, ultimately hampering your performance, Write firmly enough to be readable but try not to impress the paper.

You will be earning experimental points for your performance in this experiment. Your data will be analysed and compared with those participating in the experiment with you. Your performance

will also be evaluated for valuable scientific information - this will be revealed in a number of different ways. Be alert - be concise, complete and clear in your work. You will want to do the best job that you possibly can in all phases and sections of the experiment.

STOP - Do not turn the page until you are given the signal to do so.

STRATEGY TRAINING (GENERAL)

You are beginning an experiment today in which the concept of strategy occupies a dominant position and role. This concept, as referred to in problem solving experiments, has not always been referred to in the same way each time. Other names, which may be more meaningful to you, are program, modes of attack, variability, patterns of search, hypothesis, tactics, set approach, and so on. The reference here is to the manner in which people go about solving problems. It is our purpose, in these first minutes, to learn all that we can about strategy; how to identify strategies, how to name them, how to recognize when they are in operation and such, so that we can put this new or revived knowledge to work for us in the later parts of the experiment.

'Strategy', as used in this experiment, will not mean anything essentially different from what we ordinarily think of as strategy. We think of strategy in connection with military tactics; we think of strategy in a chess game or a football game. Various strategies are used in nearly all card games. All of these examples of the use of strategy imply the variability of behavior, the plan, the direction of our attempts to solve a problem; to reach some goal or some criterion of success. This may be the winning of a battle or the ultimate winning of a war. Each person adopts rules to determine which parts of the problem situation to react to. In all cases, the individual is confronted with a problem, or a series of problems, and it is up to him to figure out how he is going to approach, and ultimately, to solve them.

Ordinarily, within any problem there are a series of subproblems or smaller problems to be solved in a step-by-step way. Any situation can be called a problem situation. We are constantly confronted with problems which require us to come up with the correct response. Sometimes the response is readily available and we come up with it immediately; other times we must struggle a little or alot in order to respond correctly. We are more inclined to consider the latter situation as problematic. One can see, therefore, that what are and what are not called problems is certainly a matter of degree. Some psychologists have agreed that when the first response to a situation is not the correct one, the individual is confronted with a problem. For our purposes, this definition is suitable.

As was mentioned, strategy, as used in this experiment, means the same thing as it did during the solution of any problem that you can remember having tackled. One attempts the most obvious and reasonable methods first. You may use the methods many times before you realize some other means of solution is required. Your behavior changes - you have a new approach to the problem. Imagine, in a general way, a chess or checker game. Strategies are the plans you utilize in winning these games. You attempt deception; you attempt plays that are too obvious; you might make rapid moves in an effort to hurry your opponent. You try to plan plays that are complex enough not to be easily noticed by your opponent.

Suddenly you discover that one of many techniques is more successful against your opponent than others. You exploit the technique, the strategy, and go on toward winning the game. By the time your opponent 'catches on' to your method, perhaps you are already in the process of refining a new strategy.

A person attempting to solve a crossword puzzle may try to think of the solution outright first. He may then look at the few letters of the word that he has and try to imagine a word around them. This being unseccessful, he may either consult the dictionary, ask a friend, or get more letters into the word by attempting another part of the puzzle which ties in with the unsolved portion which was tried first. He uses many approaches in his efforts to to produce a solution.

Perhaps these examples will be sufficient to give you an idea of what is generally meant by strategy in the solution of verbal and game type problems. Remember, your strategies are the various approaches which you use to try to produce solutions to problems. One strategy may yield many solutions or few. You may utilize many strategies during the course of solving a problem; you may use one strategy over and over again in producing different kinds of solutions. You may come back to a strategy at different times during problem solving. Your strategies are the different ways that you respond to the stimulus (problem) situation.

Now, if you will try to keep this information in mind, for a time. we will direct our attention to adifferent aspect of this experiment. We will return to this topic in a few minutes. If you have time, try to review the major points of what you have just read.

STOP - Do not turn page until you are given the signal to do so.

WORD CONSTRUCTION GAME

This is a game in which you will construct words out of a Basic Letter Combination (BLC) which you will have in front of you while you work. After some time with each letter combination, you will work on a different letter combination. As you work, you will turn over the pages so that the previous letter combination you have worked on will not be visible.

The rules you should follow are these:

1. Use any number of letters you wish out of the basic letter combination - from one to as many letters as there are in the letter combination.

2. Use each letter only once in a given word. Of course you can construct many words using the same letter once each time as a part of each single word.

3. Construct only English words. Foreign words do not count. Neither do prefixes or suffixes (e.g., "pre-" or "-ing"). An improperly spelled word is not counted, and neither are abbreviations and contractions.

4. Construct no proper nouns, that is, no name whose first letter would be capitalized.

Try the following letter combination: MDEA

Some of the words you could make would be: A, MAD, MA, DAM, DAME and ME. DE would not be usable under the rules because it is a foreign word meaning "of" in several languages, and not an English word. MAE also would not count, since it is a proper noun - the name of a specific girl, which name would always have the first letter capitalized. You could not use MADAM because that would mean that you were using the letters "m" and "a" twice in the same word. Remember, use each letter only once in each word you construct, use no proper nouns, use no foreign words, and use either singular or plural, but not both. These words would not count, and would just slow you down.

<u>PRINT</u> the words you construct, starting under the Basic Letter Combination at the upper left of the page. Your score for each letter combination will be the number of acceptable words constructed from it in a given period.

STOP - Do not turn page until you are given the signal to do so.

STRATEGY TRAINING (SPECIFIC)

Look briefly back at the sheet of solutions that you just produced. You should have no solutions that are usually capitalized (proper names), no foreign words that could not be found in a standard American dictionary, and no prefixes or suffixes (parts of words). Only the letters in the Basic Letter Combination can be used and each of these can be used only once in a given solution. Did you produce some unacceptable solutions? This first trial was for practice. If you had some questionable solutions, try not to make these mistakes on subsequent trials.

Now that we have had an opportunity to practice on this word construction game (hereafter it will be referred to as the Standard Anagram Task), we will recall some of the general things that were said about strategy in the beginning of this hour and discuss strategy in connection with the Standard Anagram Task. The general statements made about strategy in problem solving all apply here, as you work on tasks such as the one that you just finished. In the Standard Anagram Task you find yourself confronted with a problem and it is up to you to find ways to solve this problem. Your job is to perform the task as your abilities and ingenuity will allow.

You may have been thinking of problem solving strategies previously, while we were examining some, and you likely remember the examples that were given in connection with the chess game, and so on. When you think of problem solving strategies in connection with the Standard Anagram Task, you will often be obliged to think of explaining them in a slightly different way. One of your biggest jobs will be to get your strategies into words. You are going to be asked to explain the strategies that you are using in producing solutions to the Basic Letter Combinations.

Let us examine some examples of what would <u>not</u> be considered strategies. Mere descriptions of what you are doing ("Now I am looking at the Basic Letter Combination." or "I went back to a strategy used previously.") will not be acceptable statements of strategy - no credit will be given for them. Also unacceptable will be very general statements that are not linked with anything in this specific task and hence, meaningless ("I went from the general to the particular." or "These solutions came by association."). Everything in this world is either from the general to the particular or vice versa; also, everything is associated or related to everything else do not tell us very much. Just list strategies that are specific to this task and try to word them well. You should attempt to notice exactly what you are doing while you are solving these problems. The purpose of the experiment is to gain a clear understanding of what processes and methods you are using.

Try to state your strategies in the most molecular, that is, the simplest terms possible. Boil them down to their simplest elements. Do not make a statement about strategy that contains

two or three strategies subtly concealed within it. This can nearly always be avoided. Try to separate them out- then list them one after another. However, if you are using a multiple strategy and cannot reduce it to its elements, by all means list it so that the experimenter will have the advantage of the information contained within it.

You will be working more than one anagram problem in the course of this experiment. State the strategies over and over for each Basic Letter Combination that you use the strategy on. Do not merely list the strategy once and let that cover everything following. List the strategy each time you use it.

Once again, remember that no foreign words (ja, el) will count; nor will proper nouns (Idaho, Suzan, etc.); nor will prefixes and suffixes (pre-, ex-). Questionable solutions will be checked against the dictionary. Improper solutions will waste your time and hurt your overall performance and score.

STOP - Do not turn page until you are given the signal to do so.

When you are given the signal to begin, turn the page and begin working on the anagram problem. Write down as many solutions as you possibly can, following the Standard Anagram Task rules. Remember, the rules state that only the letters in the particular combination shown in the upper left hand corner of the page can be used, that each letter can only be used once in constructing a particular word, and that no foreign words, prefixes, suffixes, or proper names will count. Remember to PRINT all solutions legibly.

STOP - Do not turn page until you are given the signal to do so.

Basic Letter Combination SCORE _____

TOFRES

1.	26.
2.	27.
3.	28.
4.	29.
5.	30.
6.	31.
7.	32.
8.	33.
9.	34.
10.	35.
11.	36.
12.	37.
13.	38.
14.	39.
15.	40.
16.	41.
17.	42.
18.	43.
19.	44.
20.	45.
21.	46.
22.	47.
23.	48.
24.	49.
25.	50.

Corts

Basic Letter Combination SCORE _____

DECIRT

1.	26.
2.	27.
3.	28.
4.	29.
5.	30.
6.	31.
7.	32.
8.	33.
9.	34.
10.	35.
11.	36.
12.	37.
13.	38.
14.	39.
15.	40.
16.	41.
17.	42.
18.	43.
19.	44.
20.	45.
21.	46.
22.	47.
23.	48.
24.	49.
25.	50.

Basic Letter Combination

YANERL

SCORE _____

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
17.
18.
19.
20.
21.
22.
23.
24.
25.
26.
27.
28.
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32.
33.
34.
35.
36.
37.
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41.
42.
43.
44.
45.
46.
47.
48.
49.
50.

On this page please describe in one sentence each, the different strategies used in solving the preceding anagram problem. Use a complete sentence to identify each strategy; that is, each method used to find solutions. Remember, strategies are to be broken down into the simplest form possible and listed one after another in a one, two, three fashion. You may turn back and examine the trial sheet, if you wish. Be concise, complete and clear. WRITE legibly. When you understand these instructions - BEGIN

1.

2.

3.

4.

5.

6.

7.

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12.

13.

14.

15.

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19.

20.

Use other side if needed

GENERAL INSTRUCTIONS - PHASE II

We are beginning the second and most important phase of this experiment. For the next hour you will perform under actual, varied conditions using the Standard Anagram Task as an experimental basis. As you will remember, the First Phase of this experiment was primarily a training phase to familiarize you with all aspects of the task. Although the first (training) phase will furnish valuable scientific information, it is primarily this second phase that will furnish the data of this experiment. PIease do the best job that you possibly can. Remember, you will be showing your ability to perform on this experiment in a number of different ways.

You are now familiar with the Standard Anagram Task and have had experience with it. Remember, the rules state that only the letters in the particular combination shown in the upper left hand corner of the page can be used; that each letter can only be used once in constructing a particular word; and that no foreign words, prefixes, suffixes, or proper names count.

PIease do not turn to following sections until it is time to do so. When you do, turn the pages all the way over so that you only have one page before you, unless you specifically are instructed to do otherwise.

Do not score your work in this phase as you did in the first. All scoring from here on will be done by the experimenter after the experiment is completed. You can find out your scores later from the experimenter.

You probably remember that in the first, or training, part of this experiment, the timing of each part that you worked on was done by the experimenter. Due to the varied conditions of the experiment from this point on, and the complexity of coordinating the timing of these conditions, it will be necessary for each person to act as his or her own time-keeper. It is extremely important to the outcome of this experiment that the time limits that you find marked in each section of your booklet be observed exactly. If this is not done, understand that it will be impossible for us to compare your performance with that of the other subjects working on the same condition as you are. From this point on, the experimenter will do nothing other than call your attention to the time each minute by announcing the exact time. He will also stop you at the end of the hour since the conditions of the experiment are set up so that most will finish at the same time. Some will finish 10 or 15 minutes earlier than the rest. At the end of the hour, time will be provided for you to make a brief evaluation of the experiment and your opinion of your performance in it. However, please try to avoid mistakes in timing since they only slow up the analysis of the data, and if gross enough, may make your data unusable.

At the front of the room you will see a large clock. The experimenter will give you the signal to begin and each one (1)

minute interval will be announced throughout the hour. At the top of each section of your experimental booklet you will find the time allotted for that section. When you turn to each section, look at the clock and immediately jot down at the top of the page the time that you are to turn to the next section. That is, if you turn to a section at 15 minutes after the hour and the time limit for that section is ten minutes, write __:25 at the top of your page, in the space provided. Then when the experimenter announces this time, having written it down once, your attention will be arrested more readily and you will recall that it is time for you to turn to the next section. Promptly turn to the next section of the experiment when the time is up for the section that you are working on, or you will not finish by the end of the hour. The time limits for each section are to the full minute. You will find it most convenient timing this if you begin your time intervals on the new minute, i. e. when the second hand is at twelve. This is when the minutes will be announced. If you finish reading instructions or some other section before the minute is up, wait until the new minute before turning to the next section and beginning the timing of the new section. Your timing will be most accurate if you do this.

At times you will think that the time allowed for a section is too great. However, do not turn on to the next section before the time limit is up. Continue to work on the section you are on. Just when you think that you cannot produce any more solutions to the problem you are working on, you will come up with an idea that will yield more information for the experiment. You have likely experienced this already. Continue working earnestly until the time limit is reached.

STOP - Do not turn page until you are given the signal to do so.

INSTRUCTIONS - Condition RS

TIME LIMIT - 1 MINUTE Check clock at front of room. Note here the time at which you are going to turn to next page:_____

When the minute is up for reading these instructions, turn the page and begin solving the anagram problem. Find as many solutions as you can consistent with the rules for the Standard Anagram Task. Try not to let anything interfere with your production of the most solutions possible.

Remember that you are going to be asked to recall and record the strategies that you use. You will be asked to write complete sentence explanations describing these strategies when the trial is completed. Notice as you go along the methods you are using for producing solutions.

Remember to PRINT all solutions legibly.

After one (1) minute - turn page and BEGIN

SOLUTION SHEET - Conditions RS, PL, CL, CM-1, CM-2

TIME LIMIT - 15 MINUTES Check clock at front of room. Note here the time at which you are going to turn to next section:____

Basic Letter Combination

IBRYCETA

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

13.

14.

15.

16.

17.

18.

19.

20.

Use next page if necessary

Basic Letter Combination

IBRYCETA

You may look back at the solutions on the preceding page whenever you wish.

21.

22.

23.

24.

25.

26.

27.

28.

29.

30.

31.

32.

33.

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35.

36.

37.

38.

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44.

45.

STOP - End of section

STRATEGY SHEET - Condition RS

TIME LIMIT - 10 MINUTES Check clock at front of room. Note here the time at which you are going to turn to next section:____

Record on this page in complete sentences the strategies that you used in solving the anagram problem. Record in the most molecular form possible - break your strategies into their simplest elements. Record them one after another; one-two-three fashion. You may turn back at any time and examine the Solution Sheet in order to refresh your memory. Be as concise, complete, and as clear as you can.

WRITE your strategies legibly. As soon as you understand these instructions - BEGIN

1.

2.

3.

4.

5.

6.

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15.

Use next page if necessary

STRATEGY SHEET - Condition RS

16.

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36.

37.

38.

39.

40.

STOP - End of section

Corts

SOLUTION SHEET - Condition RS, PL, CL, CM-1, CM-2

TIME LIMIT - 15 MINUTES Check clock at front of room. Note here the time at which you are going to turn to next section:____

Basic Letter Combination

GUOCHNTI

1.

2.

3.

4.

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10.

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12.

13.

14.

15.

16.

17.

18.

19.

20.

Use next page if necessary

Basic Letter Combination

GUOCHNTI

21.

22.

23.

24.

25.

26.

27.

28.

29.

30.

31.

32.

33.

34.

35.

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43.

44.

45.

STOP - End of section

You may look back at the solutions on the preceding page whenever you wish.

INSTRUCTIONS (1) - Condition PL

TIME LIMIT - 1 MINUTE Check clock at front of room. Note here the time at which you are going to turn to next page:_____

When the minute is up for reading these instructions, turn the page and begin listing all of the strategies, in complete sentence form, that you intend to use on the next anagram problem. You know by now what strategies are. Record them in the most molecular form possible - break your strategies into their simplest elements. Record them one after another in a one-two-three fashion. Be as concise, complete and clear as you can be.

When the anagram problem is completed, you will again be asked to record all of the strategies you use. Notice as you go along the methods you are using for producing solutions.

Remember to WRITE all strategies legibly.

After one (1) minute - turn page and BEGIN

STRATEGY SHEET (FIRST) - Condition PL

TIME LIMIT - 3 MINUTES Check clock at front of room. Note here the time at which you are going to turn to next page:_____

Begin recording the strategies you intend to use on the next anagram problem. WRITE legibly. BEGIN

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21.

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24.

25.

INSTRUCTIONS (2) - Condition PL

TIME LIMIT - 1 MINUTE Check clock at front of room. Note here the time at which you are going to turn to next page:_____

When the minute is up for reading these instructions, turn the page and begin solving the anagram problem. Find as many solutions as you can consistent with the rules for the Standard Anagram Task. Try not to let anything interfere with your production of the most solutions possible.

Remember that you are going to be asked to recall and record the strategies that you use. You will be asked to write complete sentence explanations describing these strategies when the trial is completed. Notice as you go along the methods you are using for producing solutions.

Remember to PRINT all solutions legibly.

After one (1) minute - turn page and BEGIN

STRATEGY SHEET (SECOND) - Condition PL

TIME LIMIT - 10 MINUTES Check clock at front of room. Note here the time at which you are going to turn to next section:____

Record on this page, in complete sentence form, the strategies that you used in solving the anagram problem. Record them in the most molecular form possible - break your strategies into simplest elements. Record them one after another in one-two- three fashion. You may turn back at any time and examine the Solution Sheet in order to refresh your memory. Do not look back at the first Strategy Sheet. Be as concise, complete and clear as you can. WRITE your strategies legibly.

As soon as you understand these instructions - BEGIN

1.

2.

3.

4.

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Use next page if necessary

STRATEGY SHEET (SECOND) - Condition PL

21.

22.

23.

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STOP - End of section

INSTRUCTIONS - Condition FW

TIME LIMIT - 2 MINUTES Check clock at front of room. Note here the time at which you are going to turn to next page:_____

When the time is up for reading these instructions, turn the page and begin solving the anagram problem. Find as many solutions as you can consistent with the rules for the Standard Anagram Task. Try not to let anything interfere with your production of the most solutions possible.

Notice, when you turn the page, that the Solution Sheet is divided down the center. You are to list the solutions down the left side of the Solution Sheet and record strategy information down the right side, opposite the solution that the strategy produced. List the strategy for each solution. Strategies are to be written in the form of a few words - no more than three or four. Make these few-word descriptions as clear as you can. After the trial is completed, you will be given time to expand these short, few-word indications of strategy into full, complete sentence form. Once a strategy is jotted down in the form of a few words, it does not have to be written down again. Each time the strategy occurs subsequently, write the number of the solution where the strategy was first used and recorded. When the trial time is up, every solution will have opposite it either a one to four word strategy description or a number showing the solution number where the description was written down earlier.

PRINT all solutions legibly - WRITE all one to four word descriptions legibly.

After two (2) minutes - turn page and BEGIN

SOLUTIDN SHEET - Condition FW

TIME LIMIT - 15 MINUTES Check clock at front of room. Note here the time at which you are going to turn to next section:___.

Basic Letter Combination	
IBRYCETA	
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	

Use next page if necessary

Basic Letter Combination
IBRYCETA
21.
22.
23.
24.
25.
26.
27.
28.
29.
30.
31.
32.
33.
34.
35.
36.
37.
38.
39.
40.
41.
42.
43.
44.
45.

You may look back at the solutions on the preceding page whenever you wish.

STOP - End of section

STRATEGY SHEET - Condition FW

TIME LIMIT - 10 MINUTES Check clock at front of room. Note here the time at which you are going to turn to next section:____

On this page list the few-word strategy indications, referring back to the previous page, where you originally wrote them down. Next to each write a full-sentence statement of the strategy. Put the phrase and the sentence explaining it side by side, dictionary-like. Do this for each different strategy that you noted while solving the anagram problem. List each different strategy only once. Record in the most molecular form possible - break your strategies into simplest elements. You are merely expanding your few-word indications of strategy into full-blown sentences explaining them. Be as concise, complete and clear as you can. WRITE your strategies legibly.

As soon as you understand these instructions - BEGIN

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

13.

14.

15.

16.

17.

Use next page if necessary

STRATEGY SHEET - Condition FW

18.

19.

20.

21.

22.

23.

24.

25.

26.

27.

28.

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30.

31.

32.

33.

34.

35.

36.

37.

38.

39.

40.

STOP - End of section

SOLUTION SHEET - Condition FW

TIME LIMIT - 15 MINUTES Check clock at front of room. Note here the time at which you are going to turn to next section:____

Basic Letter Combination	
GUOCHNTI	
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	

Use next page if necessary

Basic Letter Combination
GUOCHNTI
21.
22.
23.
24.
25.
26.
27.
28.
29.
30.
31.
32.
33.
34.
35.
36.
37.
38.
39.
40.
41.
42.
43.
44.
45.

You may look back at the solutions on the preceding page whenever you wish.

STOP - End of section

INSTRUCTIONS - Condition CS

TIME LIMIT - 2 MINUTES Check clock at front of room. Note here the time at which you are going to turn to next page:_____

When the time is up for reading these instructions, turn the page and begin solving the anagram problem. Find as many solutions as you can consistent with the rules for the Standard Anagram Task. Try not to let anything interfere with your production of the most solutions possible.

Notice, when you turn the page, that the Solution Sheet is divided down the center. You are to list the solutions down the left side of the Solution Sheet and record strategy information down the right side, opposite the solution that the strategy produced. List the strategy for each solution. Strategies are to be written in complete sentence form on the Solution Sheets. Once a strategy is written out in full, complete sentence form, it does not have to be written out again. Each time the strategy occurs subsequently, simply write the number of the earlier solution where the strategy was first stated. You will not have an opportunity to add to or change these statements of the strategies after the completion of the trial. Record your strategies in the most molecular form possible - break your strategies into simplest elements. Make them as concise, complete and clear as you can the first time. When the time is up, every solution will have opposite it, either a full, complete sentence explanation of the strategy used, or a number showing where the complete sentence explanation was written earlier on the page.

PRINT all solutions legibly - WRITE all complete sentence strategy explanations legibly.

After two (2) minutes - turn page and BEGIN

SOLUTION SHEET - Condition CS

TIME LIMIT - 25 MINUTES Check clock at front of room. Note here the time at which you are going to turn to next section:____

Basic Letter Combination	
GUOCHNTI	
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	

Use next page if necessary

Basic Letter Combination
GUOCHNTI
21.
22.
23.
24.
25.
26.
27.
28.
29.
30.
31.
32.
33.
34.
35.
36.
37.
38.
39.
40.
41.
42.
43.
44.
45.

STOP - End of section

You may look back at the solutions on the preceding page whenever you wish.

SOLUTION SHEET - Condition CS

TIME LIMIT - 25 MINUTES Check clock at front of room. Note here the time at which you are going to turn to next section:____

Basic Letter Combination	
IBRYCETA	
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	

Use next page if necessary

Basic Letter Combination
IBRYCETA
21.
22.
23.
24.
25.
26.
27.
28.
29.
30.
31.
32.
33.
34.
35.
36.
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44.
45.

You may look back at the soltions on the preceding page whenever you wish.

STOP - End of section

INSTRUCTIONS - Condition CL

TIME LIMIT - 1 MINUTE Check clock at front of room. Note here the time at which you are going to turn to next page:____

When the minute is up for reading these instructions, turn the page and begin solving the anagram problem. Find as many solutions as you can consistent with the rules for the Standard Anagram Task. Try not to let anything interfere with your production of the most solutions possible.

At the conclusion of the trial you will be asked to indicate, by checking a checklist of strategies, the ones that you used to produce solutions to the anagram problem. Notice as you go along the methods that you are using for producing solutions. Remember, you will be asked to <u>recall</u> and <u>record</u> your use of them.

Remember to <u>PRINT</u> all solutions legibly.

After one (1) minute - turn page and BEGIN

STRATEGY SHEET - Condition CL

TIME LIMIT - 10 MINUTES Check clock at front of room. Note here the time at which you are going to turn to next section:____

Begin reading down through the strategies on this checklist. When you come to one that you are quite sure you used to produce solutions to the anagram problem, put a check-mark in front of it. You may turn back at any time and examine the Solution Sheet in order to refresh your memory. Be careful - check only those that you are reasonably certain that you have used. Check the strategies that you used whether they were sucessful or unsuccessful in producing solutions. The strategies listed here by no means represent all possible strategies to be used in the solution of anagram problems. If you do not see a particular strategy on the checklist, which you used, write it in at the end. Use your left-over time for thinking of any additional strategies that you used.

The abbreviation BLC refers to Basic Letter Combination

As soon as you understand these instructions - BEGIN

Pick out small solutions intact from the BLC

Add to common beginning consonant groupings; i.e. ST, CH

Add different vowels into basic consonant groupings

Picking solutions from the BLC in the same order but skipping letters

Reversing solutions

Change one or two letters of solutions previously produced

Find solutions rhyming with solutions previously produced

Concentrate on BLC until solutions come spontaneously

Deliberate random re-ordering of the letters of the BLC

Check out consonant and vowel patterns frequently occurring in English

Conscious efforts not to relax

Conscious efforts to relax

Produce one and two letter solutions first

Add to small solutions

Pronounce solutions different ways for sound cues to new solutions

Turn page

Pronounce letters and groups of letters in different ways for sound cues to new solutions

Use various building combinations: Consonant-Vowel-Consonant; CVVC; CCV; and so on.

Break BLC into sections - small solutions more obvious

Go through BLC forwards and backwards

Take one letter of BLC and try to fit it into various combinations

Substituting different vowels and different consonants into solutions already produced

Use the BLC as a solution if it is a meaningful word

Check for opposites of solutions in meaning, which were previously produced.

Add new groups of letters to solutions; in front, in back, in the middle, etc.

Consciously attempt to avoid fixation

Randomly combine letters

Begin by putting letters where they frequently or usually occur in words

Re-arrange the BLC for new perceptions

Change the tense of verb solutions

Use E (or some other letter) often because of its frequency of usage in words

Re-write the BLC vertically for new perceptions

Look and think of objects, events, anything; then test for fit into the BLC (visual imagery).

Patterns of some groups of solutions with same number of letters

Patterns of some groups of solutions suggest patterns to be used with other groups of letters

Search specifically for solutions with many letters - large words

Produce solutions with common meanings

Recall odd, short words from cross-word puzzles and trying them in BLC

Turn page

Concentrate upon and saturate yourself with letters of the BLC to the exclusion of all else for a time

Actively suppress previous strategies for a fresh approach

Use the BLC letters in alphabetical order

Anagram previous solutions produced

Write any other strategies you used below:

STOP - End of Section

PREFERENCE SELECTION (I) - Condition CM-1

Below you will find listed groups of three activities. Indicate your preference for these activities in terms of the one in each group of three that you would like most to do and the one you would least prefer doing. This is <u>not</u> a test - there are no right or wrong answers. Your selections are merely what you prefer doing; as an individual.

In each group of three, mark an 'M' for Most behind the activity you most prefer, and an 'L' for Least behind the activity you least prefer. One activity in each group of three will not be marked.

Some of the activities presume preparation or training. Assume that you have the necessary training: that you are equally familiar with all of the activities.

Make a choice of most and least no matter how appealing or un-appealing the three activities are.

Take as much time as you wish. It is not necessary that you finish all of these within the allotted time. Make certain your choices are correct for you. If you finish early, you may recheck your choices to be sure they are what you want them to be.

You will be doing more of these as the experiment progresses. They will be done in the same way. These instructions will not be repeated in their entirety.

<u>BEGIN</u> when you understand the above instructions.

1. While traveling, take special notice of people
2. While traveling, take special notice of scenery
3. While traveling, take special notice of crops

1. Help a blind student read lessons
2. Count traffic passing a certain point
3. Survey public opinion by interviewing people

1. Frequent amusements at a carnival
2. At a county fair, survey the canned goods
3. Look at livestock at a country fair

1. Work out in a gymnasium
2. Play softball
3. Go fishing

1. Brouse a library
2. Listen to a large orchestra rehearse
3. Go to an aquarium

PREFERENCE SELECTION (1) - Condition CM-1

1. Collect famous people's signatures
2. Be a butterfly collector
3. Collect pieces of various types of wood

1. Look at famous paintings
2. Look at an exhibition of transportation means
3. Look at new types of laboratory equipment

1. Be a vegetable salesman
2. Play the organ
3. Be a vegetable grower

1. Be the social committee chairman for a club dance
2. Decorate the dance hall
3. Be in charge of announcements for a dance

1. Go to a museum of science
2. Go to an advertising agency
3. Go to a typewriter factory

1. Read stories to people who are ill
2. Teach a dog new tricks
3. Dismantle and repair a toy.

1. Study sketching
2. Study biology
3. Study metal work

1. Build bird houses
2. Draw pictures of birds
3. Write about birds

1. Tinker with broken machines
2. Be a piano player
3. Sketch scenes

1. Learn how to grow good fruit
2. Learn how to make things of plastic
3. Learn how to photograph wild animals

1. Advise people in a newspaper column
2. Raise champion dogs
3. Study the effectiveness of various types of advertising

1. Be a contract bridge authority
2. Be a soil erosion authority
3. Be a billboard advertising authority

1. Browse a motion picture studio
2. Visit a mountainous national park
3. Walk through an old battlefield

PREFERENCE SELECTION (1) - Condition CM-1

1. Learn about famous public figures
2. Study conceptions of the ideal world
3. Read about early pioneer's lives

1. Counsel people about their personalities
2. Trap rare animals
3. Be a bank worker

1. Discuss problems of modern life
2. Discuss literary works
3. Discuss amateur astronomy

1. Be around average people
2. Be around people with unorthodox ideas
3. Be around carefree and outgoing people

1. Help citizenship applicants to learn English
2. Be a stockbroker
3. Be a fine chef

1. Grow new types of flowers
2. Advertise for a florist
3. Fill orders in a floral shop

1. Direct propaganda research
2. Be a university dean
3. Be a color photographer

1. Draw historical pictures
2. Develope new fruits
3. Coach a winning team

1. Help in a scientific laboratory
2. Score examination papers
3. Play an instrument in an orchestra

1. Write histories of organizations
2. Search for historical information
3. Write musical plays

STOP - Do not turn page until you are given the signal to do so.

PREFERENCE SELECTION (2) - Condition CM-1

Below you will find listed groups of three activities. Indicate your preference for these activities in terms of the one in each group of three that you would like most to do and the one you would least prefer doing. Remember, in each group of three, mark an 'M' for Most behind the activity you most prefer, and an 'L' for Least behind the activity you least prefer. One activity in each group of three will not be marked. Assume that you have the necessary training for all of the activities. Make a choice whether all or none of the activities in the group are appealing to you. Take as much time as you wish - it is not necessary that you finish all of these in the allotted time. Make certain your choices are correct for you. If you finish early, re-check your choices to be sure they are what you want them to be.

BEGIN when you understand the above instructions.

1. Be an English teacher
2. Take telephone orders for merchandise
3. Survey public opinion over the telephone

1. Be a department store buyer
2. Hold job interviews
3. Be a cowboy

1. Be in charge of employment practices
2. Write wildlife articles
3. Give personal advice in a newspaper column

1. Study modern business methods
2. Study foreign customs
3. Study modern farming

1. Work in an arctic weather station
2. Work in a city weather station
3. Work at a mountain weather station

1. Be an eminent scientific research director
2. Be an eminent social worker
3. Be an eminent literary critic

1. Design stage scenery
2. Chemically analyse new tooth paste
3. Direct home repair of household articles

1. Interview applicants for relief
2. Research the effectiveness of types of sales letters
3. Develop efficient office work methods

1. Go to a fine art museum
2. Go to a slum recreation center
3. Go to a famous medical center

PREFERENCE SELECTION (2) - Condition CM-1

1. Hire and fire company workers
2. Interviewing and counseling unsatisfactory workers
3. Counsel and promote exceptional workers

1. Compile a slang dictionary
2. Develope a hay fever cure
3. Develope good office procedures

1. Study dramatic history
2. Study forms of early music
3. Study the effects of language on behavior

1. Chemically analyse new commercial products
2. Develope artificial lung which user can wear while moving
3. Chart business conditions.

1. Pass out advertising on a street corner
2. Count traffic on certain streets
3. Direct traffic

1. Exercise crippled children
2. Grow vegetables for market
3. Teach weaving and basket-making

1. Collect money for community projects
2. Report progress of community drives
3. Record pledges of support for community projects

1. Arrange a big wedding
2. Address invitations for a big wedding
3. Write newspaper report of a big wedding

1. Be a novelist
2. Conduct psychological research on music
3. Be a pottery maker

1. Research selling methods
2. Be a postal worker
3. Be a chicken farmer

1. Report current events in a newspaper
2. Lecture on chemistry
3. Be a vocational counselor

1. Allow a trusted person to deceide for you all of the time
2. Allow a trusted person deceide for you some of the time
3. Make all of your own decisions

1. Be a department store supervisor
2. Be a television researcher
3. Direct recreation for welfare organizations

PREFERENCE SELECTION (2) - Condition CM-I

1. Supervise clerical work
2. Interview job applicants
3. Work as a private secretary

1. Draw comic strips
2. Write advertising
3. Work on a truck farm

1. Experiment with candy recipes
2. Tell stories to children
3. Paint water colors

1. Be a chemical researcher
2. Interview job applicants
3. Be a newspaper feature writer

1. Sketch interesting scenes
2. Test various types of sails on boats
3. Write essays in different styles

1. Sell tickets to plays
2. Prepare copy for programs and tickets
3. Handle finances for a play

1. Analyse costs of producing appliances
2. Procure finances for appliance production
3. Train people in the use of appliances

STOP - Do not turn page until given signal to do so.

PREFERENCE SELECTION (3) - Condition CM-1

Below you will find listed groups of three activities. Indicate your preference for these activities in terms of the one in each group of three that you would like most to do and the one you would least prefer doing. Remember, in each group of three, mark an 'M' for Most behind the activity you most prefer, and an 'L' for Least behind the activity you least prefer. One activity in each group of three will not be marked. Assume that you have the necessary training for all of the activities. Make a choice whether all or none of the activities in the group are appealing to you. Take as much time as you wish - it is not necessary that you finish all of these in the allotted time. Make certain your choices are correct for you. If you finish early, re-check your choices to be sure they are what you want them to be.

BEGIN when you understand the above instructions.

1. Study the cause of various diseases
2. Read success stories
3. Learn how to raise livestock

1. Be around strangers
2. Be around people you know well
3. Be around strangers and people you know well

1. Sell artist materials
2. Grow flower seeds
3. Raise white mice for experimentation

1. Do laboratory experimentation
2. Build furniture
3. Be an insurance salesman

1. Be a postal worker
2. Read manuscripts to be published
3. Road-test automobiles

1. Be a jewel cutting expert
2. Conduct chemical research
3. Comment about music on the radio

1. Help sick people
2. Be a musical instrument salesman
3. Repair appliances

1. Make flower pots
2. Supervise the making of flower pots
3. Work on methods of making flower pots

PREFERENCE SELECTION (3) - Condition CM-1

1. Add up food bills in a cafeteria
2. Instruct the building of model planes
3. Keep records of scientific research

1. Be a playground director
2. Cook in a restaurant
3. Be a chemical salesman

1. Assemble a collection of tools
2. Make a scrapbook of paintings
3. Assemble an emergency first aid kit

1. Be an amateur play director
2. Print the tickets for a play
3. Be a playwrite

1. Compete with someone who usually wins
2. Compete with someone who rarely wins
3. Compete with someone of your own ability

1. Prepare advertising for appliances
2. Cost analyse the production of appliances
3. Sell appliances

1. Write a newspaper gossip column
2. Write a newspaper column of personal advice
3. Write a gardening column for a newspaper

1. Explore
2. Design
3. Invent

1. Be a cherry picker
2. Drive a farm tractor
3. Work on laboratory chemistry

1. Study public specking
2. Study sociology
3. Study story writing

1. Operate a calculator
2. Assemble a calculator
3. Sell a calculator

1. Be a shipbuilder
2. Be a labor arbitrator
3. Write music

PREFERENCE SELECTION (3) - Condition CM-1

1. Successfully sell tractors
2. Be a certified public accountant
3. Work as a tax authority

1. Develop efficient office methods
2. Do practical nursing
3. Develop cooking recipes

1. Repair appliances
2. Build a fireplace fire
3. Type a friend's letter

1. Manage a music business
2. Design buildings
3. Research community social conditions

1. Tinker with mechanical devices
2. Play checkers
3. Play chess

1. Keep business records
2. Experiment in flower growth
3. Be a personal problem counselor

1. Be a professional fisherman
2. Select trees for cutting
3. Paint automobiles in a factory

1. Be a social service visitor
2. Be a famous person's social secretary
3. Prepare advertising

1. Write true magazine stories
2. Write on poultry raising
3. Write on first aid

1. Be a head waiter
2. Compile lists of addresses
3. Care for sick people

STOP - Do not turn page until given the signal to do so.

PREFERENCE SELECTION (4) - Condition CM-1

Below you will find listed groups of three activities. Indicate your preference for these activities in terms of the one in each group of three that you would like most to do and the one you would least prefer doing. Remember, in each group of three, mark an 'M' for Most behind the activity you most prefer, and an 'L' for Least behind the activity you least prefer. One activity in each group of three will not be marked. Assume that you have the necessary training for all of the activities. Make a choice whether all or none of the activities in the group are appealing to you. Take as much time as you wish - it is not necessary that you finish all of these in the allotted time. Make certain your choices are correct for you. If you finish early, re-check your choices to be sure they are what you want them to be.

BEGIN when you understand the above instructions.

1. Study the psychology of convincing people
2. Build clay models
3. Work as a prompter in a dramatic production

1. Work as a physician
2. Work as a sculptor
3. Work as a journalist

1. Answer letters of enquiry for a business
2. Compile sales data
3. Order materials for business

1. Research propaganda methods
2. Study office-efficiency systems
3. Study United States immigration

1. Check for errors in reports
2. Be a dishwasher
3. Be a cook

1. Teach architecture
2. Procure advertisements for newspapers
3. Be a watch repairman

1. Cook meals
2. Repair toys
3. Shampoo hair in a barbershop

1. Hunt rare animals
2. Fight native epidemics
3. Work at social welfare

PREFERENCE SELECTION (4) - Condition CM-1

1. Paint portraits
2. Research the causes of earthquakes
3. Work as a mechanical engineer

1. Plan budgets for people on relief
2. Label books in a library
3. Be an expert surgeon

1. Be a store salesman
2. Be a rancher
3. Be a publisher

1. Be a mathematics professor
2. Be a university publicity director
3. Be a foreign language professor

1. Learn business letter writing
2. Learn printing
3. Learn spelling

1. Design plans for houses
2. Advertise new real estate
3. Write articles about home building

1. Buy on the installment plan
2. Borrow money to buy
3. Save enough to buy

1. Be a furniture decorator
2. Supervise work in farming
3. Be a turkey farmer

1. Be a vocational councelor
2. Be a fabric designer
3. Make cost estimates

1. Build a hand loom
2. Derive mathematical procedures
3. Research youth attitudes on church attendance

1. Make a life mask of a famous person
2. Write an article on prices
3. Write theme songs for radio

1. Determine the best of various products
2. Care for the bulletin boards in a large business
3. Repair business machines

PREFERENCE SELECTION (4) - Condition CM-1

1. Have people treat you as an equal
2. Have people treat you as their superior
3. Have people pay no attention to you

1. Teach music
2. Be an advertising artist
3. Conduct research on humor

1. Give first aid at a hospital
2. Sell floral arrangements
3. Be a private secretary

1. Edit newspaper financial news
2. Be a large scale farmer
3. Sell real estate

1. Take care of handicapped people
2. Draw statistical graphs
3. Be a store clerk

1. Be an author
2. Be an advertising authority
3. Lead a religious group

1. Have work you like with high pay
2. Have work you like with low pay
3. Have work you don't like with high pay

1. Advise people on relief concerning health
2. Write newspaper feature articles
3. Deal in art products

1. Be a congressman's secretary
2. Teach art to children
3. Write art magazine articles

STOP - Do not turn page until given signal to do so.

INSTRUCTIONS - Condition CM-1, CM-2

TIME LIMIT - 1 MINUTE Check clock at front of room. Note here the time at which you are going to turn to next page:_____

When the minute is up for reading these instructions, turn the page and begin solving the anagram problem. Find as many solutions as you can consistent with the rules for the Standard Anagram Task. Try not to let any thing interfere with your production of the most solutions possible.

Remember to PRINT all solutions legibly.

After one (1) minute - turn page and BEGIN

PREFERENCE SELECTION (5) - Condition CM-1

TIME LIMIT - 10 MINUTES Check clock at front of room. Note here the time at which you are going to turn to next section:____

Below you will find listed groups of three activities. Indicate your preference for these activities in terms of the one in each group of three that you would like most to do and the one you would least prefer doing. Remember, in each group of three, mark an 'M' for Most behind the activity you most prefer, and an 'L' for Least behind the activity you least prefer. One activity in each group of three will not be marked. Assume that you have the necessary training for all of the activities. Make a choice whether all or none of the activities in the group are appealing to you. Take as much time as you wish - it is not necessary that you finish all of these in the allotted time. Make certain your choices are correct for you. If you finish early, re-check your choices to be sure they are what you want them to be.

BEGIN when you understand the above instructions.

1. Make your own clothing selections
2. Get advice on clothing selection
3. Have someone else make your clothing selections

1. Design bridges
2. Do work that requires much mental arithmetic
3. Work in clerical service

1. Supervise the manufacture of articles
2. Analyse costs of manufacturing
3. Design something to be manufactured

1. Trouble shoot mechanical articles
2. Check for errors in reports
3. Add columns of figures

1. Be made to look foolish
2. Make someone else appear foolish
3. Not have anyone made to look foolish

1. Work as a psychologist
2. Supervise the construction of bridges
3. Work as a landscape architect

1. Research the cause of mental illness
2. Learn music arrangement
3. Learn shorthand

PREFERENCE SELECTION (5) - Condition CM-1

1. Go to a museum of natural history
2. Go to an airplane factory
3. Go to the slums of a city

1. Draw magazine pictures
2. Raise cattle
3. Grow fruit

1. Be a hotel bell hop
2. Wash dishes in a restaurant
3. Live on a lonely island

1. Be a life insurance salesman
2. Be a magazine story writer
3. Work as a landscape gardener

1. Be considered modest
2. Be considered reliable
3. Be considered happy-go-lucky

1. Teach mathematics
2. Train seeing-eye dogs
3. Be a famous scientist's secretary

1. Study modern music
2. Study the modern novel
3. Study modern painting

1. Be known as hard-boiled
2. Be known as fair-minded
3. Be known as intelligent

1. Conduct an orchestra
2. Be an office manager
3. Plan a slum clearance project

1. Be a flower grower
2. Be a mimeograph operator
3. Compute customer's bills

1. Be a national park guide
2. Be a maker of fine jewelery
3. Arrange orchestral music

1. Be a switchboard operator
2. Make linoleum
3. Teach children games

1. Be a camping guide
2. Design camping equipment
3. Sell camping equipment

PREFERENCE SELECTION (5) - Condition CM-1

1. Repair broken appliances
2. Wash dishes
3. Clean a house

1. Instruct in cabinet making
2. Work as a book-keeper
3. Work as a salesman

1. Figure skate
2. Be a polo player
3. Be a mountain climber

1. Work at a desk
2. Be a rancher
3. Sell house-to-house

1. Work at making candy
2. Be a bee keeper
3. Examine eyes

1. Be a farmer
2. Work as a railway conductor
3. Work in an office

1. Be a clerical worker
2. Be an English literature teacher
3. Supply artists

1. Learn accounting
2. Learn irrigation methods
3. Learn stenography

1. Be a mailman
2. Be a garbage collector
3. Sort mail

1. Be a poet
2. Be an artist
3. Be a social service worker

1. Play checkers
2. Work mathematics puzzles
3. Work mechanical puzzles

1. Run a newspaper
2. Run an art school
3. Run an orchestra

1. Possess many friends
2. Possess much power
3. Enjoy great fame

PREFERENCE SELECTION (5) - Condition CM-1

1. Work as a machinist
2. Work as an architect
3. Work as a chemist

1. Work in a book bindery
2. Take care of sick children
3. Work as a typist

1. Introduce a stranger at a large party
2. Introduce a stranger at a small party
3. Let another person make the introduction

1. Collect famous people's signatures
2. Have a butterfly collection
3. Assemble various kinds of wood

1. Hunt rare animals
2. Excavate old ruins
3. Do social work

1. Work unobserved
2. Work where a few people can see you
3. Work where many people can see you

1. Enjoy good health
2. Enjoy many friends
3. Enjoy social prestige

1. Play softball
2. Play chess
3. Work mechanical puzzles

1. Visit some famous night clubs
2. Go to an amusement park
3. Attend a famous person's party

1. Work harvesting crops
2. Work in a factory
3. Be a circus performer

1. Tinker with broken mechanical devices
2. Check typewriter copy for errors
3. Add columns of figures

1. Discuss work or studies
2. Discuss the meaning of life
3. Discuss interesting people

1. Read about a famous person's life
2. Read a novel of a romantic nature
3. Read an adventure story

STOP - End of Section

During the next five minutes, you are to sit quietly and rest. No nothing that would disturb or distract those who are yet working or reading at this time. Do not look at any other pages in your experimental booklet. Do nothing at all. Try not to think about the experiment - either the part you have worked on, or the remaining part of the experiment. This is your time to rest.

The experimenter will tell you when to turn the page and begin working on the next section of the experiment.

Now - REST

STOP - Do not turn the page until you are given the signal to do so.

INTERPOLATED NEUTRAL ACTIVITY - Condition CM-2

TIME LIMIT - 10 MINUTES Check clock at front of room. Note here the time at which you are going to turn to next page:_____

During the next ten minutes, you are to sit quietly and rest. Do nothing that would disturb or distract those who are yet working or reading at this time. Do nothing at all. Try not to think about the experiment - either the part you have worked on, or the remaining part of the experiment. This is your time to rest.

Time yourself for the ten minutes. When the time is up for resting, turn to the next section and begin working.

Now - REST

After ten (10) minutes - turn page and BEGIN

SUBJECT EVALUATION

Indicate in this evaluation whether or not you were able to carry out the instructions in this experiment exactly. For example, mention any mistakes you made in timing yourself, and the nature of the mistake (two minutes over on BLC-IBRYCETA: 30 seconds over on the Strategy Sheet for GUOCHNTI: etc.). This report of error will not hurt your score, and will enable the experimenter to make decisions about how your data will be used. Specific questions are given that are applicable to this and other points concerning the experiment. Answer briefly - short answer, but try to give all the information that you can. When you finish this, the experiment is over for you - you may leave. Thank you.

Individual Performance

Were you able to observe the time limits exactly? If not, cite the specific instances in which you erred; and the nature of the mistake.

How would you rate or describe your motivation level in this experiment?

How would you rate or describe your performance on this experiment? Do you think that your performance would "stack up" with most of the other subjects on this task - surpass or fall below?

Did any significant events occur during the experiment that would have an effect on the way the experimenter will judge your performance (characteristics of the experimenter; noises; your own physical and mental condition, or characteristic; etc.)?

Do you think that your data is accurate to the extent that you understood and were able to follow and carry out the instructions in the experiment?

Task Evaluation

What do you think was being studied in this experiment?

What aspects of this task helped you to perform better (or caused you to perform more poorly) as you progressed through the experiment?

List some advantages and disadvantages of this task and experiment as a means of studying problem solving.

General Information

Mention anything else about the experimental procedure as a process for studying problem solving or your performance on the task that you think is important information.

Special Information

Answer this only if you were in the Checklist Condition. It has been suggested by other researchers that subjects claiming strategies from a checklist tend to report more strategies than they actually use. To what extent would you say this is true, if at all? Your comments will be helpful and will not invalidate your score.

APPENDIX B

APPENDIX B

Valid Solutions Produced to BLC GUOCHNTI -- Criterion, Websters New Collegiate Dictionary, 1958

C	G	H	I	N	O	T	U
chin	gin	hin	in	nigh	oh	thig	ugh
chit	gnu	hint	inch	night	on	thin	unit
chug	go	hit	into	nit	ouch	thing	unto
coin	got	ho	ion	no	ought	tho	
con	gout	hog	it	nog	out	thong	
cot	gun	hot	itch	not		thou	
cough	gut	hug		notch		thug	
count		hunt		nought		ti	
cut		hut		nut		tic	
						tie	
						tin	
						ting	
						to	
						tog	
						ton	
						tong	
						tonic	
						touch	
						touching	
						tough	
						tug	
						tun	
						tunic	

APPENDIX B

Valid Solutions Produced to BLC IBRYCETA; Criterion, Websters New Collegiate Dictionary, 1958

A	B	C	E	I	R	T	Y
a	ba	cab	ear	ice	race	tab	ye
abet	bait	car	eat	icy	racy	taber	yea
ace	bar	care	era	irate	rat	tace	year
acerb	bare	caret	eta	ire	rate	tar	yet
acre	bat	cart		it	ray	tare	
act	bate	cat			re	tea	
air	bay	cate			react	tear	
airy	bice	cater			ret	teary	
ait	bier	cay			rib	ti	
arc	bit	cite			rice	tic	
are	bite	city			rite	tie	
art	biter	cog			rye	tier	
at	be	crab				tire	
ate	bear	crate				tho	
ay	beat	crib				to	
aye	bet	cry				trace	
	beta					tray	
	bey					trey	
	bra					tribe	
	brace					trice	
	bract					try	
	brae					tyre	
	brat						
	bray						
	brit						
	by						
	bye						
	byer						
	byre						

APPENDIX B

Invalid Solutions Produced to BLC GUOCHNTI; Criterion, Websters New Collegiate Dictionary, 1958

C	G	H	I	N	O	T	U
chig	ginch	hi	ich	ni	och	thog	ug
ching	git	hic	intouch	nic	oint	tich	uh
chino	gnot	hing	ito	nich	ough	tig	un
chint	goin	hoc		nicht		tigh	uto
chog	goit	hoit		nig		tinc	
chong	gon	hon		nitch		tinch	
chou	gont	hont		nito		toc	
chout	gotch	houg		noc		toch	
chun	gote	hout		noch		toge	
chung	goth	hun		noit		toh	
chut	gothic			nouch		toung	
cig	gou			nuch		tung	
cin	gouch			nug			
cit	gount			nugh			
coit	guoit			nugit			
cong	gunch			nugot			
cug	gunt						
cun	guto						
cunt							

APPENDIX B

Invalid Solutions Produced to BLC IBRYCETA; Criterion, Websters New Collegiate Dictionary, 1958

A	B	C	E	I	R	T	Y
acert	bace	caby	erb	iber	ra	ta	ya
acetic	baen	cait	ert	ir	rab	tabe	yac
acey	baer	caite	et		rabe	tac	yae
aire	bair	cary			rabi	taib	yant
artic	baite	ceat			rabit	tair	yat
ary	bary	cerb			rac	tary	yate
atire	bater	cert			racey	tay	yeic
	bea	cet			rae	te	yeta
	beir	ceta			rait	teir	yeti
	bi	cetra			reat	tib	yi
	bicer	ciare			reb	tiba	yib
	bie	cire			recit	tibe	yie
	bir	cit			reit	tiber	
	bire	craby			rey	tice	
	brail	crait			ribe	tir	
	brate	cray			ric	trae	
	bret	crea			rie	tri	
	brey	creat			riet	ty	
	breyta	cret			rit	tye	
	bric	creta			rybe		
	brie	cribe					
	brite	crit					
	briy	cy					
	bry	cyre					
	byer	cyte					

APPENDIX C

APPENDIX C

STRATEGY

Statements Concerning Attitude and Personality Variables During Problem Solving

Concentrate on problem -- forget about self.

Tolerate efforts that are nonlogical.

Periods of rest after intensive application.

Take advantage of set -- attack problems when in a problem solving mood.

Encourage favorable attitude toward problem.

Careful deliberation -- attentiveness to task.

Maintain orientation.

Persistence -- long continued effort -- perseverance.

Moderate motivation.

Avoid fixation -- maintain flexibility of thought.

Delay decision -- think of other good solutions also (applicable to best final solution -- may apply here to solutions of borderline validity).

Suspend judgment until all evidence is in.

Critical attitude toward sources of information (problem, self, etc.)

Suppress other strategies for fresh approach (actively).

Physical environment conducive to thought process.

APPENDIX C

STRATEGY

Nontechnical General and Common Problem Solving Principles

Memorization.

Trial and Error.

Association -- one solution leading to another.

Thorough search for key to solution.

Entertain key ideas on words, or closely associated ones.

Pure stimulus acts.

Active manipulation.

Shift functional properties (meanings) of elements.

Restructure.

Consciously utilize prior related experience.

Conscious transfer from other problem situations.

Clear formulation of the problem -- or reformulation.

Re-refer to problem.

Saturate yourself with problem.

Preliminary survey of material -- preparatory work.

Rearrangement of elements into new combinations.

Talking solutions out -- sounding out.

Verbalizing solutions for clarity, cohesiveness and consistency.

Abandoning apparent solutions that appear obviously unfruitful.

(Avoid fixation.)

Appropriate questions to self during spectator behavior.

APPENDIX C

STRATEGY

Technical and Academic Statements About Strategy

Vary 'position' in the field.

Recentering.

Shift point of view.

Analysis into major variables of problem.

Location of crucial features or aspects of problem.

Varied trials (trial and error).

Control (maintain focus and orientation).

Elimination of sources of error.

Eliminate impossible methods and solutions.

Visualization

Wholist approach -- solve by immediate reorganization.

Spontaneous mental image of solution (visualization).

Partist approach -- piecemeal solution.

Whole, then part approach.

Participant behavior; manipulate.

Spectator behavior -- wait for leads for lack of hypothesis.

Assembly of behavior segments.

Overcome or avoid functional fixedness.

APPENDIX D

APPENDIX D

METHOD OF SCORING STRATEGIES

The scorer should be an advanced psychology major, preferably a graduate student in experimental psychology. This presumes prior knowledge of learning principles as well as familiarity with the problem solving field.

Study and master the strategies and strategy principles in the Checklist in Appendix A (Strategy Sheet -- Condition CL) and the principles in Appendix C. The three lists of principles in Appendix C is a consolidation of problem solving principles and strategies from the bulk of problem solving literature. Principles not understood by the scorer should be looked up in a text on problem solving (psychology of thinking) or, at least, in a good psychological dictionary (English and English, 1958). Scoring should be in the light of the principles contained in Appendix C. The more knowledge the scorer has of known principles of problem solving, the more effective he will be.

Steps for Effective Scoring

I. Preliminary preparation.

A. Read all instructions given to Ss in the five experimental conditions (strategy listed only in these conditions) so that he will know what Ss were required to do. Read instructions for each specific condition prior to scoring that condition to avoid confusion of instructions specific to other, different conditions.

B. Become thoroughly familiar with Appendix A Checklist and Appendix C principles, and have these on hand during scoring for ready reference.

C. Have a knowledge of the purpose and design of the study. One scorer (EMC) read the prospectus of the experiment prior to scoring the booklets.

II. Evaluating statements of strategy reported.

A. Count only the strategy statements reported for the two experimental BLCs in Phase II of the experimental booklets. In each of the five types of experimental booklets, score the strategies for each of the two BLCs as follows:

1. Condition RS -- count strategies on Strategy Sheet -- Condition RS

2. Condition PL -- count strategies on Strategy Sheet (Second) -- Condition PL

3. Condition FW -- count strategies on Strategy Sheet -- Condition FW

4. Condition CS -- count strategies on Solution Sheet -- Condition CS (strategies in complete form are listed there)

5. Condition CL -- count strategies on Strategy Sheet -- Condition CL plus any that are written in at the end, if they are valid and not repeats of those already listed.

B. Read each strategy statement written by S and evaluate it in the light of the lists for stated or implied strategies. If a statement suggests multiple strategy, give credit for each independent strategy and principle contained therein. Ss were directed to report strategies in the form of those shown in the Checklist, and will be found predominantly in that form. Count each different strategy once per BLC. If they are written essentially verbatim, as in the Checklist, count them as one. The statements contained in the Checklist are about as elementistic as statements of strategy are reported.

The important point to remember is that each independent strategy statement is counted once for each BLC. The statements should be different enough to be described as a separate idea or approach to the solution of the problem. There will often be overlap in the operation carried out; however, the thought behind the operation should be mutually exclusive of any other thought or strategy performed to a single problem. The purpose of the scoring is to determine the number of independent, different strategies reported by each S to each of the two BLCs in Phase II of the experiment.

C. The following are statements of strategy as found in the experimental booklets, with the strategy count shown for each statement:

Example of Reported Strategy	Strategy Count
"I changed the letters of the BLC around."	1
"I alternated consonants and vowels -- CVCs."	1
"I tried to think of words starting with the more commonly used letters."	1
"I concentrated on the BLC."	1
"I tried to think of a new way to start."	1

C. (continued)

Example of Reported Strategy	Strategy Count
"I remembered this solution from crossword puzzles."	1
"This solution rhymed with the solution before."	1
"I tried not to think about the problem too much."	1
"I added this to a former solution and made a new one."	1

III. Obtain two scores from each S's booklet; one strategy score for each of the two BLCs in Phase II. Write this score lightly on the first of each two booklet sheets and record it on the data sheets provided.