1966

# A Study of Sex Differences in Solutions to a Multiple Choice Anagram Task

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A STUDY OF SEX DIFFERENCES IN SOLUTIONS

TO A MULTIPLE CHOICE ANAGRAM TASK


by

Loretta Y. Postillion


A Thesis Submitted to the Faculty of the Graduate School

of Loyola University in Partial Fulfillment

of the Requirements for the Degree of

Master of Arts


January

1966

# LIFE

Loretta Y. Postillion was born in Oak Park, Illinois, February 19, 1937. She graduated from the Nazareth Academy High School in June, 1955, and received a Bachelor of Arts in Philosophy from Saint Mary's College, Notre Dame, Indiana in June, 1959.

The author entered Loyola University as a graduate student in Clinical Psychology in June, 1961. From March, 1961 through December, 1962 she served as a Psychology Trainee at the Catholic Charities Guidance Center. Her Clerkship in Clinical Psychology was served in the Loyola Center for Guidance and Psychological Service from February to September, 1963. The first six months of 1964 were spent as a Research Assistant in the Psychometric Laboratory of Loyola University. In September, 1964 she began a one year Internship in Child Psychology at Presbyterian - St. Luke's Hospital in Chicago, Illinois.

At present, she is pursuing further studies in the Clinical - Counseling section of the Psychology Department.

## ACKNOWLEDGEMENTS

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# CHAPTER I

## INTRODUCTION

Anagram solving has been used as a method to test hypotheses regarding a variety of concepts. Because anagrams have been so extensively used, they have also been studied in themselves. These methodological studies have had as their purpose the definition of characteristics within the anagram task that would need control when anagrams are used to assess some variable. In this review, both types of studies will be considered. In most studies, one aspect that has been largely neglected, without providing evidence supporting this neglect, has been that of possible sex differences in either solving ability or the choice of solution in anagram problems.

The concept of "perceptual defense" was upheld in a study using anagrams (Postman and Solomon, 1950); while in a similar study (Keehn, 1959), the same phenomenon was described as a function of learning the test situation. Postman and Solomon tested subjects for recognition thresholds on ten moderately familiar words (according to Thorndike and Lorge, 1944) that they previously failed or solved as anagrams in a competitive situation. They found that failure in solving the anagram resulted in the subject's showing either significantly greater or significantly less difficulty recognizing the failure words and used this finding to argue for "perceptual defense." Keehn, in attempting to account for the above results, initially ruled out, on a

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logical basis, concern about subjects taking significantly longer to recognize the failed words since unfamiliar words would take longer to recognize and to solve as anagrams. Being primarily concerned with those subjects showing heightened sensitivity to the failed words, Keehn replicated the Postman and Solomon experiment using familiar words. He reasoned that failure in a simple situation should prove more threatening and thus, if perceptual defense was operative, the effect should be amplified. This did not occur. It was Keehn's contention that the increased sensitivity in Postman and Solomon's experiment was the result of the subjects having learned the words; however, when learning is not likely to be increased, sensitivity does not occur. Although the argument against perceptual defense posed by Keehn is a logical one, the fact that neither experimenter described specific characteristics of their groups leaves unanswered the question as to whether the two groups were intrinsically different at the onset (e.g., on the basis of sex). Another factor may have contributed to the contradictory findings.

The relationship between anagram solving ability and anxiety has been considered by Wiggins (1957), Tallarico and Reitman (1959), and by Crager (unpublished dissertation, 1960). Wiggins found that the number of correct solutions obtained on a series of multiple solution anagrams correlated significantly and negatively with both number of blockings (measured by the number of words skipped) and the scores on the Taylor Manifest Anxiety Scale.

Tallarico and Reitman (1959) attempted to validate the anagram test as an index of anxiety on a larger group (N=176), but obtained findings that did not support Wiggin's hypothesis that anagram solving ability is an index of

anxiety. The authors concluded that "if the anagram solving test is to be used as a rapid clinical diagnostic tool...," which Wiggins (1956) proposed, "...there would still seem to be the need to determine what it measures." In both these studies there was no mention of the subjects' sex, which may again have been a contributing factor in the contradictory findings.

Crager (unpublished 1960), also investigating the effect of anxiety on anagram solving ability, took the sex of his subjects into consideration in his design although he did not specifically isolate the effects of sex on anagram performance. His interest was in the interaction between anxiety level and the degree of motivation. While no significant interaction was found in this respect for the groups, certain evidence specific to the sex of the subjects did emerge that was in accord with a habit strength hypothesis. Both high and low anxious males performed as well as low anxious females with all three of these groups performing better than high anxious females. In conclusion he makes the statement that "sex of the subject seems to be an important variable which needs more investigation in its own right."

Anagrams have been rationally evaluated regarding their usefulness as a complex problem solving task. Ammons and Ammons (1959b) and Ray (1955) advocate their use for such studies while Battig (1957) criticizes anagrams for this purpose. None of these authors treated the question of sex differences in performance of anagram tasks.

The concept of set has been extensively investigated through the use of anagrams. The pioneer study in this respect was done by Rees and Israel (1935). They reinforced subjects on a particular method of solving the ana-

grams (specifically, by rearranging the letters according to a certain letter order) and found the set to be operative although subjects reported no conscious awareness of having used a pattern. Based on this use of anagrams to investigate set, Gibson (1941) defined the type of set produced by anagrams as "a mental operation or method, not intended, but aroused by the problem or learned in the course of problem solving." Davis and Hess (1962), replicated the Rees and Israel (1935) study, employing a larger, more heterogeneous group, a more systematic method of assessing awareness, and an additional measure of the effectiveness of the concept and, as a result, came to contradictory conclusions. In neither study was the sex of the subjects controlled or even specified.

Other anagram studies on the concept of set have included the influence of task instruction alone in inducing a disposition for a given class of solutions (Maltzman and Morrisett, 1953b) as well as the effect of task instruction when previous training was incongruent (Maltzman and Morrisett, 1956). Both studies upheld the importance of task instruction. Sex of the subjects was not considered in these studies.

Anagrams have been used to study set according to the principles of learning theory. Adamson (1959), basing his hypothesis on reinforcement theory, failed to find a greater resistance to extinction in a partial reinforcement (50%) group than in a group which had specific order of solution continuously reinforced (100%). He also failed to find significant differences between the groups during spontaneous recovery. However, it is to be noted that the design of the experiment was such that the task in the last

phase differed from that in the conditioning and extinction phases in that there were two solutions in phase three and only one in the first two. Of the studies on set, Adamson's is the only one to control for sex as a variable, having matched his groups on this dimension.

Maltzman and Morrisett (1952), in a study investigating the validity of defining "set" in terms of Hull's habit strength hypothesis ($_sH_r$), concluded that "all the variables determining reaction potential and the manner in which different reaction potentials interact may be determiners of thought." However, the authors take no account of sex as one of these variables.

There have been numerous studies treating anagrams methodologically. Erlebacher (1962), in a global factor analytic study, derived three major parameters: a) vowel or consonant structure of the beginning letter of the solution-word; b) frequency of occurence in the English language of the solution-word; and, c) total bigram frequency of the solution-word. The effects of anagram transition probabilities were also studied extensively by Mayzner and Tresselt (1959, 1962) and by Beilin and Horn (1962) using the bigram and digram frequency tables of Underwood and Schulz (1960) and Pratt (1942) as their reference sources. Mayzner and Tresselt (1958), Hunter (1959), and Terooka (1959) have all specifically attacked the problem of letter order effects on anagram solution. The effect of solution word familiarity, based on Thorndike and Lorge (1944) frequency tables, has been dealt with by Mayzner and Tresselt (1958) and by Keehn (1959). Wilson (1961), in an unpublished paper, attempted to produce a two solution anagram word list for which predictable frequency probabilities could be established.

None of the above studies either specifically attacked the problem of sex differences in solving ability or solution choice. Safren's (1962) findings that anagram solving is related to word association warrants some consideration be given to the studies of sex differences in word choice on association tests. Wyatt (1932), Terman and Miles (1936), Goodenough (1942), Tresselt, Leeds and Mayzner (1955), and Palermo and Jenkins (1965) all indicate that such differences between the sexes do exist. And yet, in anagram studies only Crager (1960) and Wilson (1961) actually discussed sex as a variable in itself.

Wilson (1961) noted that, when tallying frequency of solution choice, differences existed between the males and females on some of the anagrams. However, his results are strictly observational and not statistical due to the small number of his subjects. Also, this investigator found that the list used by Wilson contained anagrams for which there were more than two solutions.

It is because of the lack of any strictly relevant literature, and also because of the underlying assumption of a null hypothesis with respect to sex differences, that the present study was undertaken. Specifically, it will attempt to determine if there are any significant differences between normal male and female subjects in their choice of solution on a series of two solution anagrams. Secondarily, and only as an interest variable, it will consider differences between the sexes in their times for solutions.

# CHAPTER II

## PROCEDURE

### Subjects

Subjects were drawn from four introductory psychology classes at
Loyola University.  Of the 163 students enrolled in these classes, 134 were
available as subjects on the day of testing.  The group was composed of 57
males and 77 females.

### Material

The 60 anagrams employed are those which were selected and tested in a
preliminary study (see Appendix 1).  The anagrams, along with their solutions,
appear in the order of their alphabetical letter arrangement in Table 1.  The
list was established in the following manner.

The experimenter, using Webster's New Collegiate Dictionary, Second
Edition, first selected all possible four letter words.  These were recorded
on separate cards and filed according to their alphabetical letter order.
For example, the words BALM and LAMB were both recorded and filed under
ABLM.

As a next step, preliminary anagrams were selected which met all of
the following a priori requirements: a) only two common noun solutions possi-
ble; b) no repetition of a letter in anagram (e.g., AAGL was eliminated);
and c) no solutions possible which are plurals of nouns (e.g., AELS was elimi-

## TABLE 1

## THE 60 ANAGRAMS EMPLOYED IN THE STUDY

| Alphabetical Letter Order | Solutions | Alphabetical Letter Order | Solutions |
|---|---|---|---|
| ABEK | BAKE, BEAK | CDEO | CODE, COED |
| ABLM | BALM, LAMB | CDLO | CLOD, COLD |
| ABNR | BARN, BRAN | CDRU | CRUD, CURD |
| ACEN | ACNE, CANE | CHIN | CHIN, INCH |
| ACEP | CAPE, PACE | CKOR | CORK, ROCK |
| ACHR | ARCH, CHAR | CLOT | CLOT, COLT |
| ACKS | CASK, SACK | DENU | DUNE, NUDE |
| ACLM | CALM, CLAM | DGIR | GIRD, GRID |
| ADEI | AIDE, IDEA | DSTU | DUST, STUD |
| ADNW | DAWN, WAND | EFLT | FELT, LEFT |
| ADRW | DRAW, WARD | EFLU | FLUE, FUEL |
| AEFR | FARE, FEAR | EHIR | HEIR, HIRE |
| AEFT | FATE, FEAT | EILM | LIME, MILE |
| AEGP | GAPE, PAGE | EIMN | MINE, MIEN |
| AEGR | GEAR, RAGE | ELOR | LORE, ROLE |
| AEMR | MARE, REAM | ELRU | LURE, RULE |
| AERW | WARE, WEAR | EOTV | VETO, VOTE |
| AFLO | FOAL, LOAF | EOPR | PORE, ROPE |
| AGOT | GOAT, TOGA | EPRY | PREY, PYRE |
| AHLT | HALT, LATH | FGLO | FLOG, GOLF |
| AHLU | HAUL, HULA | FILT | FLIT, LIFT |
| ALMP | LAMP, PALM | GIPR | GRIP, PRIG |
| ALMS | ALMS, SLAM | GLPU | GULP, PLUG |
| AMOT | MOAT, ATOM | IKLN | KILN, LINK |
| AMPR | PRAM, RAMP | IORT | RIOT, TRIO |
| AMRT | MART, TRAM | LMPU | LUMP, PLUM |
| APRW | WARP, WRAP | LSTU | LUST, SLUT |
| BGRU | BURG, GRUB | MNOR | MORN, NORM |
| BLOT | BLOT, BOLT | NRTU | RUNT, TURN |
| BLOW | BLOW, BOWL | ORTU | ROUT, TOUR |

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nated because it could be ALES as well as SALE and SEAL.)

This list of preliminary anagrams was then subjected to further refinement on the basis of two criteria. First, at least four of six judges to whom the two solutions were presented rated both of them as familiar words. In addition to this, all the solutions had to appear in the Thorndike - Lorge (1944) frequency tables (see Table 2).

Considering each anagram, there are 24 possible permutations of the four letters, two of which are the solution words. In order to control for letter order effects in the solution of the anagrams, 22 separate forms of each anagram were determined for presentation to the subjects. Test forms were composed such that every one of the letter orders was represented at least twice. The order of presentation of the 60 anagrams was randomized for each test form. The 22 test forms appear as Appendix 2.

Administration

In order to insure that every form was distributed to approximately the same number of subjects of each sex, the class lists were used. The test was administered in regular 50 minute class periods.

All subjects were given the following instructions.

> This is an experiment involving the use of anagrams.
> Anagrams are a series of scrambled letters which need to be
> rearranged into sensible words. For example, can anyone
> tell me what word this is? (E writes AEDM on the blackboard.)
> Yes, ____ (MADE or DAME, whichever was given) is correct.
> So is ____ (other alternative). Here is another example.
> (E writes LKEA on the blackboard.) This can be solved by
> either KALE or LAKE. (Pause.) Can someone tell me what the
> solution is for this anagram? (E writes ROHE on the black-
> board.) Yes (or No), HERO is the correct solution.

TABLE 2

THORNDIKE-LORGE (1944) FREQUENCY VALUES
FOR THE 120 SOLUTION WORDS

| Solution Word | Frequency Value | Solution Word | Frequency Value | Solution Word | Frequency Value | Solution Word | Frequency Value |
|---|---|---|---|---|---|---|---|
| BAKE | A | MARE | 14 | CODE | 21 | LURE | 14 |
| BEAK | 15 | REAM | (15) | COED | (11) | RULE | AA** |
| BALM | 7 | WARE | 18 | CLOD | 4 | PORE | 8 |
| LAMB | 45 | WEAR | AA** | COLD | AA** | ROPE | A |
| BARN | 45 | FOAL | 1 | CRUD | ==== | VETO | 6 |
| BRAN | 5 | LOAF | 17 | CURD | 2 | VOTE | AA |
| ACNE | ==== | GOAT | A | CHIN | 27 | PREY | 28 |
| CANE | 19 | TOGA | 11 | INCH | AA** | PYRE | (16) |
| CAPE | 34 | HALT | 29 | CORK | 11 | FLOG | 2 |
| PACE | A | LATH | 2 | ROCK | AA** | GOLF | 26 |
| ARCH | 34 | HULA | ==== | CLOT | 2 | FLIT | 12 |
| CHAR | 3 | HAUL | 21 | COLT | 21 | LIFT | AA** |
| CASK | 5 | LAMP | A | DUNE | 3 | GRIP | 35 |
| SACK | 30 | PALM | 37 | NUDE | 1 | PRIG | (10) |
| CALM | A | ALMS | 6 | GIRD | 6 | GULP | 8 |
| CLAM | 7 | SLAM | 11 | GRID | (14) | PLUG | 9 |
| AIDE | 2 | MOAT | 7 | DUST | A | KILN | 2 |
| IDEA | AA* | ATOM | 8 | STUD | 8 | LINK | 24 |
| DAWN | A | PRAM | ==== | FELT | AA* | RIOT | 14 |
| WAND | 12 | RAMP | 1 | LEFT | AA* | TRIO | 2 |
| DRAW | AA** | MART | 5 | FLUE | 2 | LUMP | 20 |
| WARD | 18 | TRAM | 1 | FUEL | 21 | PLUM | 23 |
| FARE | A | WARP | 12 | HEIR | 23 | LUST | 8 |
| FEAR | AA* | WRAP | 45 | HIRE | A | SLUT | (9) |
| FATE | A | BURG | (8) | LIME | 27 | MORN | 15 |
| FEAT | 13 | GRUB | 11 | MILE | AA* | NORM | (9) |
| GAPE | 7 | BLOT | 14 | MINE | AA** | RUNT | (15) |
| PAGE | AA** | BOLT | 27 | MIEN | 4 | TURN | AA* |
| GEAR | 9 | BLOW | AA** | LORE | 4 | ROUT | 8 |
| RAGE | 49 | BOWL | A | ROLE | 11 | TOUR | 20 |

Legend:   1-49 = One to 49 times per million words
          A = Occurs 50 to 99 times per million words
          AA = Occurs 100 or more times per million words
          * = 500 most frequent words
          ** = Next 500 most frequent words (500-1000)
          ( ) = Number of occurences per 18 million words
          ==== = Occurs less than once per 18 million words

You will be given a list of 60 anagrams. You are to solve every one, making them into sensible words. They can all be solved by familiar dictionary words. Use no proper nouns. If more than one solution occurs to you, write down only the first. If you need to do any figuring, do it on the form itself. As soon as you are finished, raise your hand. I will collect your paper and record the time. Once the test begins, ask no questions. Does anyone have a question?

When you receive the list of anagrams, keep it face down until I tell you to begin.

The Ss were not informed of the differences in the forms nor of the number of correct solutions possible.

Although no time limit was imposed, the time taken by each subject to complete the test was recorded as accurately as possible by means of a stop watch.

# CHAPTER III

## RESULTS

Although the 22 forms of the anagram test were originally distributed according to the class lists, yielding 163 possible subjects, data was finally available from a total of 134 subjects. This group was composed of 57 males and 77 females. The distribution of the 22 forms among the subjects according to sex is shown as Table 3. In order to determine if both sexes were equally represented, the $t$ test for difference between proportions was computed. The obtained $t$ value of 1.62 was not significant ($p<.10$). Therefore, the two subgroups may be considered numerically equivalent. The difference between the proportions of correctly solved anagrams for males and females was not significant ($t=.3050$).

The frequency values for each pair of solution words, broken down according to sex, are presented as Table 4. The table and all resulting statistics are based on answers which were correct for the particular anagram. Thus, due to incorrect and/or incomplete solutions, the N varies.

A chi square analysis was applied to the frequency values of each anagram solution for the two sexes. The resulting values appear as Table 5. Of the values in this table, it will be noted that five reached a probability level of less than .10. McNemar (1962, p.69) considers the area between $p=.10$ and $p=.01$ as a "region of indecision" with respect to acceptance or

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## TABLE 3

DISTRIBUTION OF THE 22 FORMS OF THE ANAGRAM TEST
ACCORDING TO THE SEX OF THE SUBJECTS

| Form | Sex | |
| | Male | Female |
| --- | --- | --- |
| I | 2 | 2 |
| II | 3 | 3 |
| III | 3 | 3 |
| IV | 3 | 4 |
| V | 3 | 4 |
| VI | 3 | 4 |
| VII | 3 | 4 |
| VIII | 2 | 3 |
| IX | 3 | 3 |
| X | 3 | 5 |
| XI | 3 | 4 |
| XII | 3 | 3 |
| XIII | 2 | 3 |
| XIV | 3 | 4 |
| XV | 2 | 4 |
| XVI | 2 | 3 |
| XVII | 2 | 3 |
| XVIII | 2 | 3 |
| XIX | 3 | 4 |
| XX | 2 | 4 |
| XXI | 3 | 4 |
| XXII | 2 | 3 |

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## TABLE 4

CORRECT SOLUTION FREQUENCY VALUES OF THE 60 ANAGRAMS
FOR MALE AND FEMALE SUBJECTS--THE PERCENTAGE
VALUES IN PARENTHESES ADD TO 100

| Word Choice | Groups Males | Females | Word Choice | Groups Males | Females |
|---|---|---|---|---|---|
| BAKE | 42(74) | 48(64) | GEAR | 20(38) | 31(42) |
| BEAK | 15(26) | 26(36) | RAGE | 33(62) | 42(58) |
| | | | | | |
| BALM | 17(30) | 26(35) | MARE | 35(67) | 54(78) |
| LAMB | 38(70) | 47(65) | REAM | 17(33) | 15(22) |
| | | | | | |
| BARN | 43(79) | 53(70) | WARE | 29(54) | 34(45) |
| BRAN | 11(21) | 22(30) | WEAR | 25(46) | 41(55) |
| | | | | | |
| CANE | 44(86) | 66(90) | FOAL | 10(19) | 21(28) |
| ACNE | 7(14) | 7(10) | LOAF | 42(81) | 55(72) |
| | | | | | |
| CAPE | 22(44) | 36(49) | GOAT | 35(64) | 62(83) |
| PACE | 27(56) | 37(51) | TOGA | 20(36) | 13(17) |
| | | | | | |
| ARCH | 28(64) | 30(45) | HALT | 47(82) | 68(91) |
| CHAR | 16(36) | 36(55) | LATH | 10(18) | 7( 9) |
| | | | | | |
| CASK | 15(28) | 22(31) | HAUL | 35(65) | 50(68) |
| SACK | 39(72) | 50(69) | HULA | 19(35) | 23(32) |
| | | | | | |
| CALM | 32(57) | 50(67) | LAMP | 31(55) | 50(66) |
| CLAM | 24(43) | 25(33) | PALM | 25(45) | 26(34) |
| | | | | | |
| AIDE | 18(35) | 21(31) | ALMS | 6(12) | 16(23) |
| IDEA | 33(65) | 47(69) | SLAM | 43(88) | 53(77) |
| | | | | | |
| DAWN | 33(59) | 48(65) | MOAT | 44(81) | 54(75) |
| WAND | 23(41) | 26(35) | ATOM | 10(19) | 18(25) |
| | | | | | |
| DRAW | 25(48) | 34(46) | PRAM | 6(11) | 8(11) |
| WARD | 27(52) | 40(54) | RAMP | 50(89) | 66(89) |

TABLE 4 cont'd

| Word Choice | Groups Males | Females | Word Choice | Groups Males | Females |
|---|---|---|---|---|---|
| FARE | 24(47) | 32(44) | MART | 44(81) | 56(75) |
| FEAR | 27(53) | 40(56) | TRAM | 10(19) | 19(25) |
| FATE | 26(51) | 39(54) | WARP | 32(58) | 34(46) |
| FEAT | 25(49) | 33(46) | WRAP | 23(42) | 40(54) |
| GAPE | 26(46) | 21(28) | BURG | 21(38) | 26(35) |
| PAGE | 30(54) | 53(72) | GRUB | 34(62) | 49(65) |
| BLOT | 21(76) | 32(43) | LORE | 15(28) | 18(24) |
| BOLT | 34(24) | 43(57) | ROLE | 39(72) | 56(76) |
| BLOW | 26(50) | 34(47) | LURE | 16(28) | 27(35) |
| BOWL | 26(50) | 39(53) | RULE | 41(72) | 50(65) |
| CODE | 42(79) | 57(76) | PORE | 13(23) | 17(22) |
| COED | 11(21) | 18(24) | ROPE | 43(77) | 60(78) |
| CLOD | 19(35) | 18(25) | VETO | 15(27) | 17(22) |
| COLD | 36(65) | 55(75) | VOTE | 41(73) | 59(78) |
| CURD | 30(56) | 47(67) | PREY | 36(77) | 40(69) |
| CRUD | 24(44) | 23(33) | PYRE | 11(23) | 18(31) |
| CHIN | 36(82) | 49(74) | FLOG | 21(38) | 23(30) |
| INCH | 8(18) | 17(26) | GOLF | 35(62) | 53(70) |
| CORK | 24(43) | 33(45) | FLIT | 5( 9) | 8(11) |
| ROCK | 32(57) | 41(55) | LIFT | 48(91) | 65(89) |
| CLOT | 23(43) | 25(35) | GRIP | 49(89) | 67(89) |
| COLT | 31(57) | 46(65) | PRIG | 6(11) | 8(11) |
| DUNE | 22(39) | 21(28) | GULP | 28(54) | 32(43) |
| NUDE | 34(61) | 54(72) | PLUG | 24(46) | 42(57) |
| GIRD | 8(16) | 23(32) | LINK | 47(87) | 59(80) |
| GRID | 43(84) | 48(68) | KILN | 7(13) | 15(20) |

TABLE 4 cont'd

| Word Choice | Groups Males | Females | Word Choice | Groups Males | Females |
|---|---|---|---|---|---|
| DUST | 35(61) | 47(61) | RIOT | 39(80) | 56(80) |
| STUD | 22(39) | 30(39) | TRIO | 10(20) | 14(20) |
| FELT | 25(45) | 34(44) | LUMP | 28(52) | 39(53) |
| LEFT | 31(55) | 43(56) | PLUM | 26(48) | 34(47) |
| FUEL | 43(86) | 52(81) | LUST | 32(58) | 51(68) |
| FLUE | 7(14) | 12(19) | SLUT | 23(42) | 24(32) |
| HEIR | 15(28) | 25(35) | MORN | 21(37) | 39(51) |
| HIRE | 38(72) | 46(65) | NORM | 36(63) | 37(49) |
| LIME | 24(45) | 41(55) | RUNT | 18(32) | 26(34) |
| MILE | 29(55) | 34(45) | TURN | 38(68) | 50(66) |
| MINE | 48(94) | 67(94) | ROUT | 20(38) | 26(35) |
| MIEN | 3( 6) | 4( 6) | TOUR | 33(62) | 49(65) |

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## TABLE 5

### CHI SQUARE VALUES OBTAINED FOR THE 60 ANAGRAMS

| Solutions | $x^2$ | Solutions | $x^2$ |
|-----------|-------|-----------|-------|
| BAKE, BEAK | 1.16 | CODE, COED | 0.19 |
| BALM, LAMB | 0.31 | COLD, CLOD | 1.49 |
| BARN, BRAN | 1.32 | CRUD, CURD | 1.74 |
| ACNE, CANE | 0.51 | CHIN, INCH | 0.86 |
| CAPE, PACE | 0.23 | CORK, ROCK | 0.04 |
| ARCH, CHAR | 3.50* | CLOT, COLT | 0.71 |
| CASK, SACK | 0.11 | DUNE, NUDE | 1.85 |
| CALM, CLAM | 1.24 | GIRD, GRID | 4.37** |
| AIDE, IDEA | 0.26 | DUST, STUD | 0.00 |
| DAWN, WAND | 0.48 | FELT, LEFT | 0.00 |
| DRAW, WARD | 0.06 | FLUE, FUEL | 0.46 |
| FARE, FEAR | 0.08 | HEIR, HIRE | 0.66 |
| FATE, FEAT | 0.12 | LIME, MILE | 1.09 |
| GAPE, PAGE | 4.50** | MINE, MIEN | 0.00 |
| GEAR, RAGE | 0.29 | LORE, ROLE | 0.19 |
| MARE, REAM | 1.83 | LURE, RULE | 0.74 |
| WARE, WEAR | 0.88 | PORE, ROPE | 0.02 |
| FOAL, LOAF | 1.19 | VETO, VOTE | 0.34 |
| GOAT, TOGA | 6.07*** | PREY, PYRE | 0.76 |
| HALT, LATH | 1.95 | FLOG, GOLF | 0.76 |
| HAUL, HULA | 0.19 | FLIT, LIFT | 0.08 |
| LAMP, PALM | 1.48 | GRIP, PRIG | 0.00 |
| AIMS, SLAM | 2.26 | GULP, PLUG | 1.38 |
| MOAT, ATOM | 0.75 | KILN, LINK | 1.17 |
| PRAM, RAMP | 0.00 | RIOT, TRIO | 0.00 |
| MART, TRAM | 0.84 | LUMP, PLUM | 0.03 |
| WARP, WRAP | 1.89 | LUST, SLUT | 1.33 |
| BURG, GRUB | 0.17 | MORN, NORM | 2.76* |
| BLOT, BOLT | 0.26 | RUNT, TURN | 0.06 |
| BLOW, BOWL | 0.14 | ROUT, TOUR | 0.13 |

  * = p<.10
 ** = p<.05
*** = p<.02

rejection of the null hypothesis. In accordance with this, the five anagrams will be treated separately as at least indicative of trends. The percentage values (see Table 4) will be used in this presentation since they represent a comparable base for varying N's.

The anagram reaching the highest level of significance was AGOT with $p < .02$. In this instance, females solved the anagram by the word GOAT 83% of the time and by the word TOGA 17% of the time while males solved it by the word GOAT only 64% of the time and the word TOGA 36% of the time.

Two values of chi square reached the .05 level of confidence. In the first of these, AEGP, the solution PAGE was chosen by the females 72% of the time and by the males 54% of the time. The solution GAPE was given by 28% of the females and by 46% of the males. In the second, DGIR, the solution GRID was given by 84% of the males and by 68% of the females. GIRD was solved by 16% of the males and by 32% of the females.

At the .10 level of probability, the solution to the anagram ACHR was ARCH in 64% of the males and 45% of the females. Males gave CHAR 46% of the time while females gave it 55% of the time. The solution to the anagram MNOR was NORM in 63% of the males and 49% of the females. Females solved this anagram by the word MORN 51% of the time. Males gave this solution 37% of the time.

Inspecting these five anagram choices with respect to the Thorndike - Lorge frequencies (see Table 2), it may be noted that in two cases (AEGP and AGOT), both males and females chose the solution word having the higher frequency value. In the case of DGIR, both sexes chose the word having the

lower frequency value. Males chose the higher value solution to ACHR, while females did so in the case of MNOR. Considering all 60 of the solution word pairs, both sexes chose the more familiar word in 46 cases and the less familiar word in seven cases. In two cases, the males chose the more familiar word while this was true for the females in five cases.

A comparison was made of the solution times for males and females. The difference between the groups was not significant. The results of this comparison are presented as Table 6.

## TABLE 6

### COMPARISON OF MEAN SOLUTION TIMES FOR
### 57 MALE AND 77 FEMALE SUBJECTS ON
### 60 ANAGRAM TASKS

|  | Solution time in minutes | | |
| Group | Mean | SD | $\underline{t}$ |
|-------|------|-----|---|
| Males | 20.97 | 9.1112 | |
|  |  |  | 1.552 |
| Females | 18.72 | 7.0908 | |

CHAPTER IV

DISCUSSION

The purpose of this investigation was to determine if any significant differences would appear between normal males and females in their choice of solution on a two solution anagram task. The results obtained definitely supported the null hypothesis in 57 of the 60 cases. In two cases, ACHR and MNOR, the probability was between .05 and .10 and, hence, they were considered as at least indicative of a difference. In two cases the .05 level of confidence was reached. Thus, for the anagrams, AEGP and DGIR, it may be said that a significant difference between the sexes existed in solution choice. A more definite difference was found for the anagram, AGOT, which reached the .02 level of probability. It may be inferred from these results that in the majority of cases sex does not make a difference in the answer given when a two choice task is involved. Using .05 level of significance, one would expect on the basis of chance alone to find three out of 60 significant differences. Hence, cross validation of the three obtained differences is being conducted in order to determine if these are true population differences and not just sampling errors.

An interesting finding which resulted from the comparison with the Thorndike - Lorge frequency values was that in seven cases both sexes chose the less frequent solution. In another seven cases one sex or another chose

the less frequent word most often. This occurred twice with the females and five times with the males. These factors of differences in frequency choice offer possibilities for future investigation.

The subsidiary determination of response time comparison showed that, within gross limits, there are no significant differences between the sexes. It also indicates that a 50 minute period for the 60 anagram task makes it a power rather than a speed test, since even three standard deviations from the mean came within this period.

Perhaps the most important aspect of the present study has been the development and testing of a complete list of two solution noun anagrams and the establishment of frequency values for all 22 letter order permutations on a sizable sample. This list may serve as a prototype for future research employing anagrams.

# CHAPTER V

## SUMMARY

The primary purpose of this investigation was to determine if there are differences between the sexes in the choice of solution on a series of anagram tasks.

One hundred and thirty-four students in Introductory Psychology were tested on 60 two-solution anagram problems. The group was composed of 57 males and 77 females. Applying a chi square analysis to the frequencies of solution choice for males and females, it was found that in 57 out of 60 cases no difference existed between the sexes. Three anagrams reached a significant level of probability, however, cross validation of these is needed to determine if this occurred on the basis of chance alone. Thus, the implicit assumption of a null hypothesis in the literature appears generally warranted.

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APPENDIX 1


PILOT STUDY ON THE COMPILATION AND PRELIMINARY TESTING OF AN
ANAGRAM LIST


INTRODUCTION

Since a review of the literature has revealed no satisfactory sample
of anagram problems, the following study was undertaken as a first step in
the testing of sex differences. It involved, first, the compilation of a
complete set of anagrams which met rigid specifications. Secondly, a pre-
liminary testing of this list, on a small sample representative of the popu-
lation to be used in the major test, was done to determine the following:
a) the possibility of solution of all the anagrams; b) the existence of any
systematic error (in the form of a repeated wrong solution); c) the minimal
and maximal time requirements for completion of the list.

The last problem to be considered was that of possible time differences
between the male and female subgroups.


PROCEDURE

A.    Compilation of the Anagram List.  The anagram list used in this study
was established in the following manner.
        Step 1.    The experimenter, using a Webster New Collegiate Dictionary,
(2nd Ed., 1959), selected all possible four letter words which were recorded
according to the alphabetical order of the letters in the words (e.g., BALM
and LAMB would both be recorded under ABLM).
        Step 2.    From this list preliminary anagrams were selected which met
all of the following a priori requirements:
                    a.) only two common noun solutions possible
                    b.) no repetition of a letter in anagram (e.g., AAGL was
                         eliminated)
                    c.) no solutions which are plurals of a noun (e.g., AELS was
                         eliminated because it could also be ALES as well as SALE
                         and SEAL)
        Step 3.    The list was subjected to further refinement on the basis of
two criteria.

                    a.) At least four of six judges to whom the two solutions
                         were presented rated them as familiar words.

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            b.) Both solutions must appear in the Thorndike - Lorge list
               of frequencies.

Step 4.    The final list of 60 anagrams was prepared for presentation.

            a.) Since four letter combinations yield 24 permutations,
               two of which are the solutions, 22 forms of each anagram
               stimulus were possible. A representative sample of each
               of these letter combinations was included in the final
               list.

            b.) The order of presentation for the 60 anagrams was random-
               ized.

B.   Preliminary Testing of the Anagram List.

     Subjects: The subjects for this experiment were 32 undergraduate stu-
dents enrolled in introductory psychology at Loyola University of Chicago.
The group was composed of 19 male and 13 female students.

     Apparatus: The list employed is presented as Table A.

TABLE A

FORM AND ORDER OF PRESENTATION OF ANAGRAM STIMULI
AS PRESENTED IN PILOT STUDY

| 1. | oelr | 21. | aetf | 41. | tmao |
|----|------|-----|------|-----|------|
| 2. | eyrp | 22. | adnw | 42. | lbto |
| 3. | pwra | 23. | egra | 43. | ehri |
| 4. | erwa | 24. | rbgu | 44. | iknl |
| 5. | rduc | 25. | tlco | 45. | abnr |
| 6. | lpgu | 26. | erlu | 46. | uort |
| 7. | ielm | 27. | otir | 47. | naec |
| 8. | tsul | 28. | rmno | 48. | emra |
| 9. | daei | 29. | lmas | 49. | atmr |
| 10. | otag | 30. | dceo | 50. | uden |
| 11. | mrpa | 31. | lmpu | 51. | radw |
| 12. | tdsu | 32. | rgpi | 52. | olbw |
| 13. | lmca | 33. | rahc | 53. | idgr |
| 14. | imne | 34. | ahtl | 54. | odlc |
| 15. | mlba | 35. | etfl | 55. | eapg |
| 16. | lgfo | 36. | utnr | 56. | akcs |
| 17. | efra | 37. | krco | 57. | ufle |
| 18. | itlf | 38. | erpo | 58. | ecpa |
| 19. | uahl | 39. | ofla | 59. | malp |
| 20. | hnci | 40. | tveo | 60. | ebka |

Method: The list was presented to the subjects during a regular class period. The experimenter first explained the nature of an anagram and gave three practice problems. The subjects were then told to solve every anagram, to use no proper nouns, and to write down only the first solution should more than one occur to them. They were instructed to do all their figuring on the test paper itself and to raise their hands immediately upon completion in order that the experimenter might record the time. The tests were then distributed face down and all subjects began at the same time.

The completed tests were then analyzed with respect to those aspects cited in the Introduction (supra).

## RESULTS AND DISCUSSION

Tallying the frequencies of each solution to each anagram, it was found that every anagram was solvable by the group although every solution was not equally presented. Secondly, no systematic error was found in the form of a repeated wrong answer.

The time taken to complete the test ranged from a minimum of eight minutes to a maximum of 57.5 minutes. This latter was the only one to exceed 50 minutes, and the median time was 19 minutes.

In order to test for differences between the subgroups mean times were determined for each group. The males took an average of 20.3 minutes for completion while the females took an average of 24 minutes. The standard error of the mean for males was 3.47 while for females it was 3.44. The t test was applied to the difference between means. The value obtained was .504 which was not significant.

The results obtained indicate that the list of anagrams is a satisfactory list in that it not only meets logical requirements but is also empirically feasible for use as a power test. They also give preliminary information concerning the lack of significant sex difference with respect to time for completion.

## SUMMARY

An anagram list was compiled according to a priori requirements and tested on a small group of subjects in order to determine characteristics of the test. This was done as a prerequisite to a proposed study on sex differences in the solving of anagrams. The list was found to be adequate for this purpose, both logically and empirically, and the anagrams contained therein will be used in the major study.

APPENDIX 2


        This section contains the 22 forms of the 60 anagrams as they
were presented to the subjects.  Each form has a different randomized
order of presentation of the 60 anagrams.

F-I
NAME                                    AGE        SEX        MAJOR

| 1.  | EMNI | 21. | PRAW | 41. | WERA |
| 2.  | OBLW | 22. | RDUC | 42. | PRYE |
| 3.  | UROT | 23. | UEDN | 43. | RADW |
| 4.  | AENC | 24. | OERP | 44. | LTOB |
| 5.  | ANBR | 25. | FERA | 45. | PGIR |
| 6.  | TUSL | 26. | APEC | 46. | CAHR |
| 7.  | DIAE | 27. | INHC | 47. | MATR |
| 8.  | AGOT | 28. | RCKO | 48. | UNTR |
| 9.  | TGOL | 29. | OETV | 49. | PULM |
| 10. | ROTI | 30. | ABEK | 50. | ECOD |
| 11. | RMNO | 31. | EROL | 51. | ALHU |
| 12. | ASML | 32. | ABML | 52. | ATMO |
| 13. | GOFL | 33. | ITLF | 53. | PGUL |
| 14. | RAEG | 34. | AHTL | 54. | ELIM |
| 15. | GUBR | 35. | TLFE | 55. | EULR |
| 16. | OLAF | 36. | RGID | 56. | AMPL |
| 17. | DWNA | 37. | LKIN | 57. | UTDS |
| 18. | LDCO | 38. | CKAS | 58. | CLMA |
| 19. | GPEA | 39. | FTAE | 59. | RAME |
| 20. | EHRI | 40. | MAPR | 60. | EFLU |

F-II

| NAME | AGE | SEX | MAJOR |
|------|-----|-----|-------|

1.  MRAT

2.  APCE

3.  NCHI

4.  MAOT

5.  LFGO

6.  MARP

7.  APML

8.  ULST

9.  PUML

10. UTSD

11. CMAL

12. ALUH

13. ERLO

14. UEND

15. RAWD

16. WRAE

17. OEVT

18. RMON

19. ASLM

20. PYER

21. ANEC

22. RTIO

23. ANRB

24. ABKE

25. PGRI

26. REMA

27. EDCO

28. PRWA

29. LERU

30. GURB

31. ALBM

32. URTO

33. CARH

34. EFLT

35. RIDG

36. LFIT

37. OBLT

38. ENMI

39. URNT

40. REAG

41. DIEA

42. AGTO

43. PLGU

44. OLFA

45. OPER

46. OBWL

47. ALHT

48. TLCO

49. LKNI

50. CKSA

51. ELMI

52. NADW

53. LDOC

54. PAEG

55. EIHR

56. EFUL

57. FTEA

58. RUCD

59. RCOK

60. FRAE

F-III

| NAME | AGE | SEX | MAJOR |
|------|-----|-----|-------|

| | | |
|------|------|------|
| 1. ARNB | 21. URTN | 41. ALMB |
| 2. OTEV | 22. EIRH | 42. RUDC |
| 3. RBGU | 23. LEUR | 43. OPRE |
| 4. LNIK | 24. APLM | 44. NCIH |
| 5. CSAK | 25. RIGD | 45. PUGL |
| 6. MPAR | 26. PWAR | 46. UNDE |
| 7. PEAG | 27. REGA | 47. RDAW |
| 8. RTOI | 28. RMAE | 48. REPY |
| 9. UTOR | 29. ENMI | 49. NAWD |
| 10. ANCE | 30. OLBW | 50. LOCD |
| 11. ELFU | 31. AEBK | 51. FREA |
| 12. EADI | 32. PIGR | 52. MRTA |
| 13. TAEF | 33. LFOG | 53. ALTH |
| 14. AULH | 34. EFTL | 54. ULMP |
| 15. LEOR | 35. RNMO | 55. CMLA |
| 16. CHRA | 36. RKCO | 56. WREA |
| 17. TLOC | 37. AFLO | 57. EMLI |
| 18. LFTI | 38. DSTU | 58. CAEP |
| 19. AOGT | 39. LAMS | 59. MATO |
| 20. ULTS | 40. OBTL | 60. EDOC |
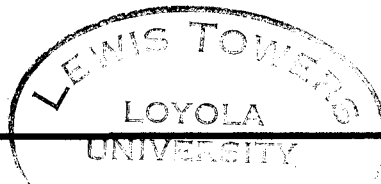
F-IV

| NAME | | AGE | SEX | MAJOR |
|------|------|------|------|------|
| 1. RGAE | 21. LACM | | | 41. CEAP |
| 2. TAFE | 22. OTVE | | | 42. OREP |
| 3. AMLB | 23. RBUG | | | 43. PWRA |
| 4. ERIH | 24. USLT | | | 44. UNED |
| 5. NDAW | 25. UTNR | | | 45. RDWA |
| 6. LODC | 26. ELFT | | | 46. MTAR |
| 7. LGFO | 27. MPRA | | | 47. RNOM |
| 8. OLBT | 28. TIOR | | | 48. PULG |
| 9. LITF | 29. NHCI | | | 49. UTRO |
| 10. LREU | 30. AFOL | | | 50. LAPM |
| 11. ARBN | 31. EOCD | | | 51. DGIR |
| 12. RKOC | 32. AOTG | | | 52. MOTA |
| 13. TOCL | 33. IEMN | | | 53. REYP |
| 14. AERW | 34. UCDR | | | 54. CAEN |
| 15. ATLH | 35. DSUT | | | 55. AEKB |
| 16. AUHL | 36. LASM | | | 56. ELUF |
| 17. PEGA | 37. OLWB | | | 57. EAID |
| 18. LERO | 38. LNKI | | | 58. RAEF |
| 19. CRAH | 39. CSKA | | | 59. PIRG |
| 20. ULPM | 40. EMIL | | | 60. RMEA |

F-V

| NAME | AGE | SEX | MAJOR |
|------|-----|-----|-------|

| | | |
|---|---|---|
| 1. ALFO | 21. LAMC | 41. ORPE |
| 2. LGOF | 22. ELTF | 42. ORTU |
| 3. RGBU | 23. CEAN | 43. DENU |
| 4. MRAP | 24. AMBL | 44. LOER |
| 5. RGEA | 25. NIKL | 45. CRHA |
| 6. ATHL | 26. KACS | 46. PGAE |
| 7. OWBL | 27. RAFE | 47. LTFI |
| 8. MTRA | 28. PRGI | 48. RPEY |
| 9. UTRN | 29. ATOG | 49. DGRI |
| 10. ROMN | 30. MTAO | 50. BANR |
| 11. OLTB | 31. LRUE | 51. OVET |
| 12. TIRO | 32. UGLP | 52. RAPW |
| 13. NHIC | 33. LMAP | 53. TEAF |
| 14. AKEB | 34. IENM | 54. EODC |
| 15. EULF | 35. USTL | 55. UCRD |
| 16. EDAI | 36. IELM | 56. LMAS |
| 17. DTSU | 37. CEPA | 57. ROKC |
| 18. HALU | 38. TOLC | 58. ERHI |
| 19. RWAD | 39. NDWA | 59. AEWR |
| 20. UMLP | 40. OCDL | 60. AEMR |

**F-VI**

| NAME | AGE | SEX | MAJOR |
|------|-----|-----|-------|

| | | |
|---|---|---|
| 1. RPYE | 21. RWDA | 41. LCAM |
| 2. UDCR | 22. LUER | 42. KASC |
| 3. RAMT | 23. OVTE | 43. REAF |
| 4. CLTO | 24. ATGO | 44. RGUB |
| 5. RAWP | 25. HACR | 45. ETLF |
| 6. LREO | 26. DEUN | 46. AKBE |
| 7. TOIR | 27. NILK | 47. PGEA |
| 8. IMEN | 28. HLAU | 48. LTIF |
| 9. CENA | 29. OCLD | 49. LOFG |
| 10. OWLB | 30. OCDE | 50. AREW |
| 11. RGIP | 31. PEOR | 51. ORUT |
| 12. BAML | 32. DIGR | 52. UTLS |
| 13. AERM | 33. NRTU | 53. NWAD |
| 14. IMSA | 34. UGPL | 54. RONM |
| 15. CKOR | 35. TEFA | 55. IEML |
| 16. HERI | 36. OTBL | 56. UMPL |
| 17. MRPA | 37. MTOA | 57. AEGR |
| 18. EDIA | 38. BNAR | 58. HATL |
| 19. DTUS | 39. NICH | 59. CPAE |
| 20. EUFL | 40. LMPA | 60. ALOF |

F-VII

| NAME | | AGE | SEX | MAJOR | | |
|------|------|-----|-----|-------|------|------|
| 1. | HIER | 21. | ODCL | | 41. | REAF |
| 2. | EIAD | 22. | OCED | | 42. | TORI |
| 3. | DUTS | 23. | ULGP | | 43. | LSAM |
| 4. | LROE | 24. | OAMT | | 44. | CKRO |
| 5. | IMNE | 25. | PAMR | | 45. | AEGP |
| 6. | CNAE | 26. | TEOV | | 46. | TFIL |
| 7. | ORTU | 27. | PERO | | 47. | HLAT |
| 8. | RUBG | 28. | UTSL | | 48. | ARWE |
| 9. | DIRG | 29. | AERG | | 49. | ETFL |
| 10. | NRUT | 30. | AOLF | | 50. | BAEK |
| 11. | WBLO | 31. | OTLB | | 51. | UPLM |
| 12. | FELU | 32. | MNOR | | 52. | AMER |
| 13. | RGPI | 33. | LCMA | | 53. | NIHC |
| 14. | BLAM | 34. | KCAS | | 54. | LPAM |
| 15. | HLUA | 35. | UDRC | | 55. | RYEP |
| 16. | COTL | 36. | RATM | | 56. | BNRA |
| 17. | WADR | 37. | GAOT | | 57. | TFAE |
| 18. | RELU | 38. | HARC | | 58. | RPAW |
| 19. | IELM | 39. | DNEU | | 59. | NWDA |
| 20. | LOGF | 40. | NKIL | | 60. | CPEA |

F-VIII

| NAME | | AGE | SEX | MAJOR | | |
|------|------|------|------|------|------|------|

| 1. | TFLI | 21. | FEUL | 41. | AWRE |
| 2. | GATO | 22. | TBLO | 42. | LSTU |
| 3. | HCAR | 23. | LSMA | 43. | LMAC |
| 4. | DNUE | 24. | COKR | 44. | AMRE |
| 5. | BEKA | 25. | BRNA | 45. | OFGL |
| 6. | WADN | 26. | OELR | 46. | RFAE |
| 7. | RIGP | 27. | WDAR | 47. | INEM |
| 8. | BIMA | 28. | RMAT | 48. | ODLC |
| 9. | AGER | 29. | EIDA | 49. | ODCE |
| 10. | PARM | 30. | NKLI | 50. | ULPG |
| 11. | HLTA | 31. | ILME | 51. | OATM |
| 12. | HUAL | 32. | RUGB | 52. | TFEA |
| 13. | KCSA | 33. | DRIG | 53. | RPWA |
| 14. | URCD | 34. | REUL | 54. | FETL |
| 15. | CTOL | 35. | NTRU | 55. | RYPE |
| 16. | EACP | 36. | AEPG | 56. | CHNI |
| 17. | MNRO | 37. | SDTU | 57. | LPMA |
| 18. | TEVO | 38. | POER | 58. | CNEA |
| 19. | HREI | 39. | TROI | 59. | OTUR |
| 20. | AOFL | 40. | UPML | 60. | WBOL |

| F-IX NAME | AGE | SEX | MAJOR |
|---|---|---|---|

| | | |
|---|---|---|
| 1. TOEV | 21. HRIE | 41. AEFT |
| 2. LMCA | 22. OMAT | 42. RWAP |
| 3. ARME | 23. RLEU | 43. AGRE |
| 4. INME | 24. KSAC | 44. PMAR |
| 5. EACN | 25. URDC | 45. IORT |
| 6. OUTR | 26. CTLO | 46. WLBO |
| 7. UBGR | 27. GOTA | 47. EAPC |
| 8. DRGI | 28. HCRA | 48. MONR |
| 9. FLET | 29. DUEN | 49. CIHN |
| 10. OLCD | 30. AGEP | 50. MALP |
| 11. OFLG | 31. SDUT | 51. HTAL |
| 12. RFEA | 32. NTUR | 52. WDAN |
| 13. FALO | 33. YEPR | 53. RIPG |
| 14. LMPU | 34. AWER | 54. BMAL |
| 15. ODEC | 35. IADE | 55. LAHU |
| 16. WDRA | 36. NLIK | 56. TIFL |
| 17. RMTA | 37. LSUT | 57. IMEL |
| 18. FLEU | 38. BKAE | 58. MALS |
| 19. TBOL | 39. NABR | 59. CROK |
| 20. UPGL | 40. OERL | 60. PREO |

F-X
NAME_____AGE_____SEX_____MAJOR_____

| | | | |
|---|---|---|---|
| 1. ECAP | 21. LAUH | 41. GDIR |
| 2. MRON | 22. RLUE | 42. OECD |
| 3. AEFR | 23. WRAD | 43. OMTA |
| 4. FLTE | 24. RTAM | 44. AETF |
| 5. FULE | 25. AGPE | 45. IOTR |
| 6. ARGE | 26. STDU | 46. HTLA |
| 7. PMRA | 27. MEIN | 47. YERP |
| 8. CINH | 28. EANC | 48. NARB |
| 9. IEHR | 29. OURT | 49. EARW |
| 10. OLDC | 30. IMLE | 50. WLOV |
| 11. OGFL | 31. TILF | 51. WDNA |
| 12. MAPL | 32. LMUP | 52. KSCA |
| 13. MACL | 33. TOVE | 53. CDRU |
| 14. MASL | 34. LTSU | 54. RPGI |
| 15. CRKO | 35. GTAO | 55. BMLA |
| 16. PROE | 36. HRAC | 56. AREM |
| 17. UPLG | 37. EDNU | 57. RWPA |
| 18. NUTR | 38. IAED | 58. OLER |
| 19. BKEA | 39. NLKI | 59. TLBO |
| 20. FAOL | 40. UBRG | 60. LCOT |

F-XI

| NAME | AGE | SEX | MAJOR |
|------|-----|-----|-------|

| | | |
|------|------|------|
| 1.  MLAS | 21.  ROTU | 41.  IROT |
| 2.  KCOR | 22.  EABK | 42.  FLAO |
| 3.  LEFU | 23.  IKLN | 43.  LHAU |
| 4.  APGE | 24.  HRCA | 44.  TVEO |
| 5.  SUDT | 25.  EDUN | 45.  OTAM |
| 6.  WOPL | 26.  EAMR | 46.  NBAR |
| 7.  WRDA | 27.  YPER | 47.  LAHT |
| 8.  RTMA | 28.  CDLO | 48.  AREG |
| 9.  GDRI | 29.  OGLF | 49.  PRMA |
| 10.  OEDC | 30.  REOP | 50.  EAWR |
| 11.  MRNO | 31.  UGBR | 51.  MALC |
| 12.  LPMU | 32.  NURT | 52.  CNIH |
| 13.  AFET | 33.  MENI | 53.  IERH |
| 14.  GLPU | 34.  TLOB | 54.  ECAN |
| 15.  WAPR | 35.  LCTO | 55.  LEIM |
| 16.  GTOA | 36.  SAKC | 56.  TLFI |
| 17.  RPIG | 37.  CDUR | 57.  OLRE |
| 18.  LABM | 38.  RUEL | 58.  FTEL |
| 19.  WNAD | 39.  AERF | 59.  ECPA |
| 20.  IDAE | 40.  MLAP | 60.  LTUS |

F-XII

| NAME | AGE | SEX | MAJOR |
|------|-----|-----|-------|
| 1. EAKB | 21. LHUA | 41. MNEI | |
| 2. LBAM | 22. MLPA | 42. LEUF | |
| 3. NBRA | 23. MLSA | 43. GIPR | |
| 4. ECNA | 24. OTMA | 44. OLFG | |
| 5. EPAC | 25. RAPM | 45. RNTU | |
| 6. RACH | 26. TAMR | 46. LUTS | |
| 7. SCAK | 27. WPAR | 47. FTLE | |
| 8. MCAL | 28. UGRB | 48. LEMI | |
| 9. IEAD | 29. TOBL | 49. UELR | |
| 10. WNDA | 30. WOLB | 50. IRTO | |
| 11. ADRW | 31. CDEO | 51. TLIF | |
| 12. AFER | 32. CDOL | 52. YPRE | |
| 13. AFTE | 33. CRDU | 53. OREL | |
| 14. APEG | 34. CNHI | 54. IHER | |
| 15. EAGR | 35. KCRO | 55. TVOE | |
| 16. EARM | 36. LOCT | 56. REPO | |
| 17. ERAW | 37. ENDU | 57. RTOU | |
| 18. FLOA | 38. GIDR | 58. NMOR | |
| 19. OAGT | 39. LPUM | 59. IKNL | |
| 20. LHAT | 40. SUTD | 60. GLUP | |

F-XIII

| NAME | | AGE | SEX | MAJOR | |
|------|------|-----|-----|-------|------|
| 1. | IEDA | 21. | WPRA | 41. | GPLU |
| 2. | RTUO | 22. | TOLB | 42. | YREP |
| 3. | LUAH | 23. | LOTC | 43. | LHTA |
| 4. | VEOT | 24. | MCLA | 44. | ITRO |
| 5. | MNIE | 25. | LFEU | 45. | GIRP |
| 6. | ENAC | 26. | HCIN | 46. | GRDI |
| 7. | LIEM | 27. | IHRE | 47. | MPAL |
| 8. | ROEP | 28. | LUPM | 48. | MSAL |
| 9. | ORLE | 29. | EMAR | 49. | EAGP |
| 10. | URBG | 30. | OATG | 50. | TDSU |
| 11. | RNUT | 31. | SCKA | 51. | EARG |
| 12. | EBAK | 32. | CUDR | 52. | RMAP |
| 13. | NRAB | 33. | UERL | 53. | KOCR |
| 14. | LETF | 34. | AFRE | 54. | CDOE |
| 15. | EPCA | 35. | RAHC | 55. | ILKN |
| 16. | ADWR | 36. | ENUD | 56. | ERWA |
| 17. | SLTU | 37. | FILT | 57. | CLDO |
| 18. | TARM | 38. | LBMA | 58. | OLGF |
| 19. | TAMO | 39. | BLWO | 59. | FOLA |
| 20. | NMRO | 40. | ATFE | 60. | ADNW |

F-XIV

| NAME | | AGE | SEX | MAJOR |
|------|------|-----|-----|-------|
| 1. | LMEI | 21. TAOM | | 41. EBKA |
| 2. | TDUS | 22. NOMR | | 42. EAPG |
| 3. | LAFO | 23. MLPU | | 43. ENCA |
| 4. | EMRA | 24. YRPE | | 44. ULER |
| 5. | RCAH | 25. LTAH | | 45. VOET |
| 6. | EUDN | 26. WRPA | | 46. RELO |
| 7. | EWAR | 27. FGLO | | 47. LFET |
| 8. | GPIR | 28. ITOR | | 48. BOLW |
| 9. | ADEI | 29. SKAC | | 49. CEDO |
| 10. | RUOT | 30. EGAR | | 50. FITL |
| 11. | IDGR | 31. RMPA | | 51. ATEF |
| 12. | MPLA | 32. ADWN | | 52. GPUL |
| 13. | BLTO | 33. OGAT | | 53. LMAB |
| 14. | LTCO | 34. CODL | | 54. ILNK |
| 15. | LUHA | 35. HCNI | | 55. NEIM |
| 16. | KORC | 36. IREH | | 56. PAEC |
| 17. | RPEO | 37. URGB | | 57. ARDW |
| 18. | TMAR | 38. RTNU | | 58. STLU |
| 19. | NRBA | 39. DCRU | | 59. MLAC |
| 20. | ARFE | 40. MSLA | | 60. LFUE |

F-XV
NAME                                    AGE        SEX        MAJOR

| | | | | | |
|---|---|---|---|---|---|
| 1. EKAB | 21. AREF | 41. VTEO |
| 2. ADIE | 22. BWOL | 42. RCHA |
| 3. GPRI | 23. ERAM | 43. LFTE |
| 4. ANDW | 24. MLUP | 44. STUL |
| 5. SALM | 25. ULRE | 45. NRMO |
| 6. TMAO | 26. OGTA | 46. DCUR |
| 7. EUND | 27. BOTL | 47. TMRA |
| 8. LAOF | 28. INLK | 48. RPOE |
| 9. LTOC | 29. LTHA | 49. NACE |
| 10. EPRY | 30. RABN | 50. EGAP |
| 11. LMBA | 31. TSDU | 51. RUTO |
| 12. PCAE | 32. RPAM | 52. ARWD |
| 13. PAML | 33. EGRA | 53. LMIE |
| 14. REOL | 34. GUPL | 54. OIRT |
| 15. RTUN | 35. SKCA | 55. FGOL |
| 16. BGRU | 36. LUEF | 56. APRW |
| 17. EAFT | 37. NEMI | 57. MLCA |
| 18. IDRG | 38. IRHE | 58. KRCO |
| 19. FLTI | 39. HICN | 59. UAHL |
| 20. CEOD | 40. DCLO | 60. EWRA |

| F-XVI<br>NAME | AGE | SEX | MAJOR |
|---|---|---|---|

| | | |
|---|---|---|
| 1. ERAG | 21. NIEM | 41. PCEA |
| 2. APWR | 22. NROM | 42. VTOE |
| 3. LGPU | 23. LTEF | 43. HINC |
| 4. ACLM | 24. RANB | 44. FTLI |
| 5. KROC | 25. ACKS | 45. ERMA |
| 6. RHAC | 26. AWRO | 46. TAHL |
| 7. BGUR | 27. ETOL | 47. HPLU |
| 8. IGDR | 28. UALH | 48. OTAG |
| 9. EGPA | 29. TORU | 49. SAML |
| 10. NAEC | 30. RUTN | 50. SULT |
| 11. DCOL | 31. REHI | 51. TSUD |
| 12. EKBA | 32. TMOA | 52. LFAO |
| 13. NABL | 33. NDEU | 53. EATF |
| 14. BWLO | 34. EAFR | 54. DCEO |
| 15. ANWD | 35. INKL | 55. DRCU |
| 16. AEDI | 36. EPYR | 56. GRPI |
| 17. MEIL | 37. RPMA | 57. LUFE |
| 18. OITR | 38. PLAM | 58. RLEO |
| 19. OCLT | 39. TRMA | 59. RAEW |
| 20. FLGO | 40. UREL | 60. EOPR |

F-XVII

| NAME | AGE | SEX | MAJOR |
|------|-----|-----|-------|

| | | | |
|------|------|------|
| 1. ERGA | 21. TROU | 41. ACML |
| 2. TALH | 22. TNRU | 42. LGUP |
| 3. EPAG | 23. DRUC | 43. OMNR |
| 4. PEAL | 24. AMRT | 44. AEID |
| 5. URLE | 25. NDUE | 45. AWND |
| 6. BTLO | 26. LBOW | 46. AMPR |
| 7. LFOA | 27. REIH | 47. KABE |
| 8. MPUS | 28. ARPW | 48. ERPY |
| 9. IGRD | 29. LTFE | 49. KINL |
| 10. MAER | 30. RAWE | 50. EARF |
| 11. NCAE | 31. EORP | 51. PLMA |
| 12. AWOR | 32. DCOE | 52. HNCI |
| 13. ACSK | 33. EOTV | 53. MELI |
| 14. RBAN | 34. BRGU | 54. TOAM |
| 15. NIME | 35. RHCA | 55. FTIL |
| 16. IGPR | 36. OCKR | 56. OTGA |
| 17. RLOE | 37. TUDS | 57. SLMA |
| 18. DLCO | 38. FOLG | 58. SUTL |
| 19. EFAT | 39. OCTL | 59. MALB |
| 20. UEFL | 40. ORIT | 60. UHAL |

F-XVIII

| NAME | | AGE | SEX | MAJOR | | |
|------|------|-----|-----|-------|------|------|
| 1. | EPGA | 21. | AMRP | | 41. | GAER |
| 2. | PECA | 22. | BRUG | | 42. | THAL |
| 3. | DUCR | 23. | ACHR | | 43. | DEOC |
| 4. | UELF | 24. | OCRK | | 44. | TRUO |
| 5. | LBWO | 25. | FLRU | | 45. | ORTI |
| 6. | RHEI | 26. | LOFA | | 46. | EFAR |
| 7. | HNIC | 27. | REAW | | 47. | NMEI |
| 8. | MIEL | 28. | EOVT | | 48. | IGRP |
| 9. | MULP | 29. | NCEA | | 49. | AMTR |
| 10. | TEFL | 30. | DARW | | 50. | PMAL |
| 11. | ROEL | 31. | IBOT | | 51. | OMRN |
| 12. | ARWP | 32. | TNUR | | 52. | UHLA |
| 13. | TOMA | 33. | EPOR | | 53. | AWDN |
| 14. | AKCS | 34. | TUSD | | 54. | TAGO |
| 15. | RBNA | 35. | MBAL | | 55. | IFLT |
| 16. | DLOC | 36. | KAEB | | 56. | IRDG |
| 17. | EFTA | 37. | ALCM | | 57. | MEAR |
| 18. | FOGL | 38. | LPGU | | 58. | NEDU |
| 19. | OLCT | 39. | ERYP | | 59. | SMAL |
| 20. | AIED | 40. | KLIN | | 60. | TLSU |

**F-XIX**

| NAME | AGE | SEX | MAJOR |
|------|-----|-----|-------|

| | | | |
|---|---|---|
| 1. PMLA | 21. OLTC | 41. ONMR |
| 2. DOCL | 22. TELF | 42. OAFL |
| 3. ETAF | 23. DEOC | 43. UFEL |
| 4. ELUR | 24. ELOR | 44. BUGR |
| 5. REWA | 25. TUOR | 45. NMIE |
| 6. IRGD | 26. ICHN | 46. IPGR |
| 7. MERA | 27. LOBW | 47. ARMT |
| 8. IFTL | 28. RHIE | 48. DAEI |
| 9. UDST | 29. MLEI | 49. APMR |
| 10. TRNU | 30. LPUG | 50. ACEP |
| 11. EPRO | 31. NEAC | 51. DURC |
| 12. KLNI | 32. ACRH | 52. ULAH |
| 13. DANW | 33. OKCR | 53. AKEC |
| 14. SMLA | 34. GARE | 54. GAEP |
| 15. TLUS | 35. THLA | 55. ALMC |
| 16. TAOG | 36. DAWR | 56. EYRP |
| 17. NEUD | 37. LBTO | 57. OTIR |
| 18. GFLO | 38. MUPL | 58. RNAB |
| 19. AMOT | 39. AWRP | 59. MBLA |
| 20. ETOV | 40. EFRA | 60. KBAE |

```
F-XX
NAME_____AGE_____SEX_____MAJOR_____
```

| | | | | | |
|---|---|---|---|---|---|
| 1. | ARTM | 21. | LUGP | 41. | TSLU |
| 2. | MLAB | 22. | RDGI | 42. | GEAP |
| 3. | ONRM | 23. | MRAE | 43. | PLMU |
| 4. | ACPE | 24. | DAIE | 44. | ILFT |
| 5. | MLIE | 25. | TRUN | 45. | GERA |
| 6. | KNIL | 26. | DNAW | 46. | TLAH |
| 7. | ULHA | 27. | ERLU | 47. | GBRU |
| 8. | LOWB | 28. | ETVO | 48. | EIMN |
| 9. | OALF | 29. | AMLC | 49. | KBEA |
| 10. | DRWA | 30. | EYPR | 50. | TURO |
| 11. | ICNH | 31. | APRM | 51. | OTCL |
| 12. | UFLE | 32. | NECA | 52. | OKRC |
| 13. | TFEL | 33. | AHCR | 53. | LOBT |
| 14. | ASKC | 34. | RCDU | 54. | ALMP |
| 15. | ERPO | 35. | AMTO | 55. | RIEH |
| 16. | GFOL | 36. | OTRI | 56. | ERAF |
| 17. | UDTS | 37. | RNBA | 57. | RWAE |
| 18. | ETFA | 38. | DOCE | 58. | IPRG |
| 19. | TGAO | 39. | ELRO | 59. | DOLC |
| 20. | NUED | 40. | ALSM | 60. | AWPR |

F-XXI

| NAME | AGE | SEX | MAJOR |
|------|-----|-----|-------|

| | | |
|------|------|------|
| 1.  MLBA | 21.  PERY | 41.  DWAR |
| 2.  IRGP | 22.  AOMT | 42.  OFAL |
| 3.  RWEA | 23.  AMCL | 43.  LWBO |
| 4.  ASCK | 24.  EVTO | 44.  TFLE |
| 5.  ATRM | 25.  GEPA | 45.  ULEF |
| 6.  GBUR | 26.  TSUL | 46.  ERUL |
| 7.  TLHA | 27.  AHRC | 47.  EILM |
| 8.  GRAE | 28.  ACEN | 48.  RDIG |
| 9.  EROP | 29.  ARPM | 49.  LUPG |
| 10.  RCUD | 30.  TGOA | 50.  DEAI |
| 11.  ORCK | 31.  RAET | 51.  MREA |
| 12.  OTLC | 32.  USDT | 52.  KNLI |
| 13.  PARW | 33.  AMLS | 53.  AECP |
| 14.  ALPM | 34.  EOLR | 54.  LCDO |
| 15.  ILTF | 35.  DNWA | 55.  ORMN |
| 16.  RITO | 36.  TUNR | 56.  DOEC |
| 17.  ERFA | 37.  UORT | 57.  ABNR |
| 18.  PMLU | 38.  UDEN | 58.  EINM |
| 19.  LOTB | 39.  AHLU | 59.  GLFO |
| 20.  KEAB | 40.  IHCN | 60.  RIHE |

F-XXII

| NAME | | AGE | SEX | MAJOR | | |
|------|------|-----|-----|-------|------|------|
| 1. | ORKC | 21. | KEBA | | 41. | ORNM |
| 2. | UOTR | 22. | CAML | | 42. | IRPG |
| 3. | TLEF | 23. | AOTM | | 43. | ABRN |
| 4. | EMIN | 24. | GPAE | | 44. | PAWR |
| 5. | IHNC | 25. | LTBO | | 45. | OEPR |
| 6. | LCOD | 26. | PEYR | | 46. | AHUL |
| 7. | AEPC | 27. | ABLM | | 47. | UNRT |
| 8. | LIKN | 28. | UDNE | | 48. | LWOB |
| 9. | OFLA | 29. | GLOF | | 49. | TCLO |
| 10. | EHIR | 30. | AMSL | | 50. | FAER |
| 11. | RGDI | 31. | USTD | | 51. | GREA |
| 12. | EORL | 32. | TOAG | | 52. | AHLT |
| 13. | AMLP | 33. | WAER | | 53. | ECDO |
| 14. | DEIA | 34. | ULFE | | 54. | CAKS |
| 15. | PGLU | 35. | GRBU | | 55. | EIML |
| 16. | EVOT | 36. | ATMR | | 56. | AECN |
| 17. | ARMP | 37. | ITFL | | 57. | ARHC |
| 18. | PMUL | 38. | RAEM | | 58. | TULS |
| 19. | FETA | 39. | RDCU | | 59. | ROIT |
| 20. | DWAN | 40. | EURL | | 60. | DWRA |

## APPROVAL SHEET

The thesis submitted by Loretta Y. Postillion has been read and approved by three members of the Department of Psychology.

The final copies have been examined by the director of the thesis and the signature which appears below verifies the fact that any necessary changes have been incorporated, and that the thesis is now given final approval with reference to content, form, and mechanical accuracy.

The thesis is therefore accepted in partial fulfillment of the requirements for the Degree of Master of Arts.

_Jan 18 1964_
**Date**

_Ronald C Walker_
**Signature of Adviser**