OBVIOUS VERSUS SUBTLE TIMING PROCEDURES ON THE WECHSLER ADULT INTELLIGENCE SCALE-REVISED

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by

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ABSTRACT

The purpose of this study was to determine whether different timing procedures produced significant differences in the scores of two groups of subjects on the Wechsler Adult Intelligence Scale-Revised (WAIS-R). Previous studies in this area focused on the variable of anxiety and contained a number of other limitations which left no clear answer to the question of whether different timing procedures actually did affect subject performance. This study focused on the relationship between timing procedures and subjects' perceptions of the importance of speed as a factor in test performance.

A sample of 60 students enrolled in Education courses at Memorial University, Newfoundland, were chosen for the study. The subjects were randomly divided into two groups of 30. The WAIS-R was administered to all subjects by a school psychometrist. For one group the timing requirements of the WAIS-R were made patently obvious during its administration. For the other group the timing requirements were effected in a very subtle manner.

Analysis of the results of a two-way analysis of variance involving two levels of timing and sex yielded no significant interaction or main effect for the timing variable. While the magnitude of the timing effect was insufficient to be declared significant, subjects who were aware of being timed

scored higher on nine of eleven WAIS-R subtests than did subjects who were not made aware they were being timed. The sex variable yielded significant main effects on three WAIS-R subtests with males scoring significantly higher than females.

The results of this investigation suggest that additional study is required to explain fully the effects of different timing practices on Wechsler scale performance. Given the unusual trend, if the examiner's purpose is to maximize the performance of examinees, as is indicated in Wechsler manuals, then obvious timing appears to be the preferred timing practice.

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CHAPTER I

INTRODUCTION

Statement of the Problem

The intelligence scales of David Wechsler have been used and accepted widely as instruments for measuring intelligence. The Wechsler Adult Intelligence Scale (WAIS, 1955), has recently been revised and updated. The new version has been renamed the WAIS-R (1981). Wechsler's original scale for the measurement of children's intelligence, the Wechsler Intelligence Scale for Children (WISC), which was published in 1949, was also revised and updated to become the WISC-R in 1974.

The children's scales contain twelve subtests, one more than do the adult scales. Three subtests on each scale contain items whereby the examinee can gain points for quick, accurate performance. For the WISC, WISC-R and the WAIS these are the Object Assembly, Block Design and Picture Arrangement subtests. On the WAIS-R, however, Picture Arrangement is simply a timed subtest with no bonus points for quick completion, and the Arithmetic subtest takes its place as a timed subtest with bonus points.

An additional speed factor is present in the form of either a Digit Symbol or Coding subtest. Although there are no bonus points for quick performance on these subtests, performance is inherently connected to time in that the

subject's raw score is closely linked to the number of items completed at the expiration of time. Each Wechsler Scale also contains a number of timed subtests with no bonus points for quick performance, and a number of untimed subtests. Speed is obviously an important factor in Wechsler test performance.

A review of the manuals of the Wechsler Intelligence Scales showed that no set procedure for handling the stopwatch during test administration had been stated. The practice of following a set, standard procedure when administering intelligence tests has been recognized as being of utmost importance. A standard procedure attempts to keep conditions as similar as possible for all subjects to obtain a valid and reliable test result. In the manuals that accompany his tests, David Wechsler prescribed standardized procedures for examiners to follow when administering the WISC, WISC-R, WAIS and WAIS-R. Directions were provided to standardize the physical conditions of the testing room, the establishment and maintenance of rapport, the introduction and administration of each subtest, and the scoring of subtest items. Generally speaking, the administration procedures for the Wechsler Scales are clearly stated and standardized. However, one exception to this generalization is the procedure for handling the stopwatch that is prescribed for the timed sections of the Wechsler Scales. Although Wechsler's publications include brief comments on this subject, no unambiguous standard procedure for presenting

and manipulating a stopwatch during a timed subtest is present in any of the Wechsler test manuals. As a result, the procedure for presenting and manipulating the stopwatch appears to be at the discretion of the individual examiner. This created ambiguity that resulted in individual differences among examiners in the handling of the stopwatch. These variations in examiners' methods of timing the Wechsler Scales constituted a lack of standardization of the testing procedures that resulted in the differential treatments of examinees. A basic question which is not answered by the test manuals is: Should the examinee be aware that the examiner is timing performance on particular subtests? An informal survey of certified Wechsler Scale administrators revealed that the procedure for presenting and manipulating a stopwatch varies along a dimension that may influence test performance. The dimension ranges from completely obvious stopwatch manipulation at one extreme to extremely subtle manipulation at the other. This variability is not consistent with the rigorous standardization of other procedures for the Wechsler Scales, and since it may serve to differentially influence the test performance of examinees it is essential that its effects be investigated. This range of timing procedures represents differences in test administration practices that may well bias test performance. Examinees who are made aware that they are being timed on a test that includes bonus points for quick performance may benefit from such knowledge by working quickly. Examinees

who are not made aware that their performance is being timed would have no such inducement to work quickly and may not gain the benefits awarded to speedy performers. If the timing procedure variability does systematically influence test performance, it will be necessary to select an appropriate timing procedure and describe it as the standard procedure for the Wechsler Scales.

The purpose of this study was to determine whether two different timing procedures produced significant differences in the scores of two groups of subjects on the WAIS-R.

Limitation of the Study

The two methods of handling the stopwatch used in the study represented the most extreme examiner interpretations of timing procedures. Other timing procedures could conceivably and probably do exist among examiners when timing the Wechsler Scales. The effects of these other timing procedures were not investigated in this study.

Rationale

Two previous studies have investigated the effects of different timing procedures on the Wechsler Scales. There were a number of limitations in the studies which made their findings unclear. Some of these limitations are listed below:

1. The samples in each study were made up of high and low anxious subjects. The rationale for this division appeared questionable for two reasons: (a) No solid link had ever been established which showed that anxiety would be more delibitating to subjects' performance on timed subtests or because of an obviously timed approach, than it would be on untimed subtests or because of a subtly timed approach. (b) The results of both studies were difficult to interpret because of the way the samples were divided. Other factors may have overshadowed any effects different timing procedures may have had. The high anxious group may have been so anxious upon entering the test or because of other anxiety arousing factors during testing that the timing procedures used made no difference. For the low anxiety group, anxiety may have been so low that different timing procedures did not produce differences in subjects' results, although the timing manipulations may have been a facilitating factor on performance (Spence and Spence, 1972).

2. The samples used in both studies were small, considering two independent variables were analyzed with a 2 x 2 analysis of variance. The probability of Type II error was therefore substantial.

3. In both studies, subjects in the obviously timed condition were told they were being timed. This practice violated standard procedure. The Wechsler manuals do not recommend telling subjects they are to be timed.

4. In one of the studies (Carrubba, 1976), elementary

school students were used as subjects. Subjects' scores are less likely to be affected by speed of performance at that age (Kaufman, 1979; Woo-Sam and Zimmerman, 1972). In another study that included young subjects, the Wechsler Scales were only partially administered. This modification made the validity of the administrations and their results difficult to interpret.

In response, the literature concerned with test timing procedures and anxiety is inconclusive. It suggests both variables are important determiners of Wechsler Scale performance, but it does not identify their separate effects.

While the effects of different timing procedures on subjects' performance on the Wechsler Scales are not clearly determined, the reviewed literature supports the following conclusions:

1. The lack of specific directions concerning the timing practices that are to be used during administrations of the Wechsler Scales has resulted in individual differences among examiners in the presentation and manipulation of the stopwatches that are used to measure the response latencies of examinees. These individual differences can be construed as occupying a dimension that ranges from obvious timing at one extreme to subtle timing at the other.

2. Timing practices at the extremes of the dimension have the effect of creating a difference in the administration of the Wechsler Scales that may significantly alter the

performance of examinees. The difference is that obvious timing would make the examinee aware that particular subtests are being timed and that speed must be an important determiner of performance. In contrast, subtle timing would frequently leave examinees unaware that they are being timed and that response speed is an important determinant of performance.

3. Previous research has shown that altering subjects' perceptions of the presence of test time limits and the importance of speed did affect subjects' performance on tests similar to those which appear on the Wechsler Scales (Rost, Theunissen and Andert, 1974).

4. The actual altering of time limits on tests similar to those which appear on the Wechsler Scales altered both the information processing strategies employed by examinees and the test results. If the altering of subjects' perceptions of test time limits and the importance of speed affected performance on these measures, then it is reasonable to assume that performance on at least some of the Wechsler subtests may be similarly affected by timing procedure differences.

5. The relationship between timing practices and test performance appears to be complex. Different timing procedures on the Wechsler Scales are likely to affect the subject's perception of time limits and the importance of fast performance in different ways. For this reason the consequence of these differences is difficult to predict. For example, a subtle timing procedure would seem to place

an examinee at a disadvantage because s/he would not be aware that response latency was a determinant of performance. However, this same procedure might augment performance if the examinee was either bothered by the pressure of obvious time limits or distracted by the manipulation of a stopwatch.

6. The variations of the timing procedures used on the Wechsler Scales by different examiners may produce individual differences among the results of older subjects moreso than among younger subjects because the speed of performance plays a greater role in the scores of older subjects (Kaufman, 1979; Woo-Sam and Zimmerman, 1972). Consequently, the effects of using different timing procedures may be more evident on the WAIS or WAIS-R than on the WISC-R.

7. Two previous investigations of Wechsler Scale timing practices have reported that while the scores obtained by obviously timed subjects were consistently higher than those obtained by subtly timed subjects, the differences were not significant. The first investigation, Carrubba (1976), involved young children and the WISC-R. It is possible that, in accord with the point noted above, the differences were not significant because the subjects were of an age at which speed of performance plays a limited role in the determination of performance. The second investigation, Morris and Liebert (1969), involved older subjects that were measured with the WAIS, but here the investigators reported a significant timing practice x anxiety interaction. This interaction makes it very difficult to interpret the timing practice main effect.

Hypotheses

The following were considered to be the major hypotheses for analysis:

1. There are no significant differences in the two timing procedures used in administration of the WAIS-R.

2. There are no significant differences between the scores of males and females on the WAIS-R.

3. There is no timing x sex interaction on the WAIS-R.

CHAPTER II

REVIEW OF THE LITERATURE

Part I

Previous Research

Intelligence Testing and Standard Procedures

Early research on intelligence testing generally neglected the nonintellectual aspects of testing (Glasser and Zimmerman, 1967). By the 1940's the influence of such nonintellectual factors on test scores began to be noted in the literature. Littell (1960) concluded from his review of the WISC that "the possible effects of differences in the examiners' techniques of administration is another problem area which has not received the attention it merits" (p. 146). In the Sixties, research on the Wechsler Scales flourished, particularly studies which focused on departures from standard procedures and their effects on test performance. Of particular interest were studies of situational, experimenter, and subject variables and their effects on subject performance on the Wechsler Scales (Sattler, 1967). Research with special groups of subjects also grew. Carrubba (1976) divided research completed on the Wechsler Scales into studies of examiner bias, interpersonal variables, examiner behaviour, and stressors. With the formulation of the WISC-R in the 1970's much research was devoted to comparisons

of this test to the WISC.

The area of research of most interest for this study concerned that done on departures from standard procedures and their effects on Wechsler Scale results. Wechsler (1974) emphasized the importance of following standard procedures in administering individual intelligence tests, as did Cronbach (1960), Freeman (1962) and Terman and Merrill (1960). Wechsler noted that standard procedures must be followed during the administration of his scales; instructions and questions must be read exactly as written in the test manual. Cronbach stated "any departure from standard administrative practice changes the meaning of scores" (p. 185). Terman and Merrill commented that "the discipline of the laboratory has furnished the training ground for instilling respect for standard procedures" (p. 47).

Sattler (1967), however, stated that research on the effects of departing from standard procedures is scant, and the results are only suggestive. He argued:

> In light of the limited number of studies, the rather minute procedural changes often studied, and the fact that some studies demonstrated a significant effect resulting from departures from standard procedures, the experimenter should follow standard procedures. (p. 350)

Sattler (1967) went on to conclude:

> No sanction to deviate from standard procedures is provided by the present review. However, the intelligence testing field needs to have available further data concerning how procedural departures and hard situational, experimenter,

> and subject variables may lead to significant alterations in test scores. (p. 357)

Timing Procedures on the Wechsler Scales

Wechsler (1974, p. 55) noted that the examiner should avoid being secretive in his handling of the materials, including the stopwatch, since this may arouse the child's suspicion or resistance. This note appears in a section entitled Establishing and Maintaining Rapport, and does not appear in other Wechsler manuals. In the section on timing on page 51 of the same manual, Wechsler maintained that careful attention be paid to accurate timing of subtests when timing is required. However, no specific directions about the handling of the recommended stopwatch during the administration of the test are provided in any of the manuals. In the newest Wechsler manual, the WAIS-R (Wechsler, 1981), there appears a specific section entitled, Timing. It reads:

> A stopwatch is needed for timing the subjects' responses to the arithmetic test and for all five of the Performance tests.... However, only work that is actually completed within the time limit may be reflected in the recorded score for that item. (p. 54)

Again, a specific procedure to use in handling the stopwatch was not provided. Carrubba (1976) has identified two common methods of timing used by examiners in administering the Wechsler Scales. The first method is one that might be called obvious manipulation. Examiners make no attempt to

hide the stopwatch, and manipulate it in plain view of the subject. The second method could be called subtle manipulation. The stopwatch is manipulated out of view of the subject, and subjects often are not aware that they are being timed. Other evidence regarding examiner variations in handling the stopwatch was found in the literature but they were variations of the two methods noted above; for example, Lutey (1977) seemed to favour a subtle approach to timing:

> Constant clicking on and off of the watch can be extremely distracting to some subjects. For certain subtests where the time limits are fairly generous and the responses are often rapid particularly to the easier items (e.g., Arithmetic and Picture Completion on the WISC, WISC-R or WAIS) it is recommended that the examiners not start and stop the watch for each item, but simply note and record the starting and finishing times. (p. 96)

It is of particular interest to note that the Lutey (1977) publication has been distributed for use in the instruction of intelligence testing practices. Consequently, examiners trained with this manual probably employ a subtle method of timing Wechsler Scale performance. In contrast, in a handbook concerned with the interpretation of Wechsler Scale performance, Glasser and Zimmerman (1967) recommend the obvious approach. They conclude that children may be encouraged to handle the stopwatch if they wish, and it should be left in sight to reduce their anxiety about it and increase their awareness of it.

Wechsler advocated strict adherence to the standard

procedures outlined in his test manuals. However, the lack of clarity regarding manipulation of the stopwatch has created confusion among examiners. At least two different methods of timing have resulted and their effects upon the performance of examinees is unknown.

Effects of Anxiety on the Wechsler Scales

Many studies have looked into the effects of anxiety on performance on the Wechsler Scales. Hafner, Pollie and Wapner (1960) found that anxiety as assessed by the CMAS (Children's Manifest Anxiety Scale) was significantly related to the WISC Block Design and Coding subtests in 10 to 12 year olds. Sarason and Minard (1962) discovered that low test anxious subjects were superior to high test anxious subjects on Vocabulary, Block Design, and Comprehension. Walker, Sannito and Firetto (1970) found that anxiety as indicated by subjects' reports was significantly related to low scores on four of five WAIS subtests administered to a sample of college students. Oros, Johnson and Lewis (1972) showed that induced anxiety in a testing situation can depress WISC results. Rowley and Stone (1963), however, found that anxiety as assessed by the CMAS was not significantly related to any WISC scores for a sample of children referred to a child psychiatric service.

Numerous other studies have investigated the effects of anxiety on specific subtests of the Wechsler Scales. Biggs (1971), Boor and Schill (1968), Miller and Harvey (1973),

Moon and Lair (1970) and Reger (1966) found a negative relationship between performance on Digit Symbol/Coding and the anxiety level of subjects. Johnston and Cross (1962) discovered no relationship between anxiety level and performance on this subtest. Griffiths (1958) found no significant relationship between subjects' anxiety level and performance on the Object Assembly subtest. Lanfield and Saunders (1961) noted that anxiety was negatively related to Object Assembly performance. Walker, Nielson and Nicolay (1965) found that anxiety significantly lowered scores on four of five WAIS subtests administered to a sample of college students. Increases in anxiety have been related to decreases in performance on all Wechsler subtests except Mazes, on which little research has been done (Carrubba, 1976). Despite conflicting studies the trend seemed to indicate that anxiety decreases performance on the Wechsler Scales.

The Relationship between Timing and Anxiety

It is somewhat more difficult to relate anxiety to time in intelligence testing. Matarazzo, Ulett, Guze and Saslow (1954) divided three groups of students according to scores on the TMAS (Taylor Manifest Anxiety Scale). Each group was evaluated according to three criteria for measuring intelligence. The relationship between scores on the anxiety scale and on the second criterion, the ACE Scale (American Council on Education Psychological Examination for College Freshman)

was found to be negative and statistically significant. The ACE Scale was the only timed measure of intelligence of the three. Siegman (1956) noted a similar result. He administered both timed and untimed subtests of the WAIS to a group of psychiatric patients. Anxiety was found to have a disruptive influence on timed tests, but time limits seemed to motivate and facilitate the performance of low anxious subjects. In addition to these studies, many of the studies which related anxiety to performance on the Wechsler Scales and to which reference was made in the preceding section showed that scores on timed subtests were affected negatively by anxiety (Glasser and Zimmerman, 1967; Hafner, Pollie and Wapner, 1960; Oros, Johnson and Lewis, 1972).

Some research, then, has tended to support the claim that a negative relationship exists between anxiety and scores on timed intelligence scales. Other research on the Wechsler Scales has pointed out a negative relationship between anxiety and scores on untimed, verbal subtests (Egeland, 1967; Moon and Lair, 1970; Sarson and Minard, 1962; Walker, Sannito and Firetto, 1970; Wechsler, 1958). A supplementary score for measuring anxiety level has been developed for the Wechsler Scales. This score is derived by averaging scores from three subtests: Arithmetic, Digit Span and Digit Symbol. The "Freedom from Anxiety" score was derived from factor analysis studies by Cohen (1957) for the WAIS and WISC, and from Kaufman's (1975) research on the WISC-R. On the WISC, WAIS and WISC-R, Digit Span

is an untimed subtest, the Arithmetic is timed only in the sense that subjects have a limited time--30 seconds to two minutes--in which to answer. No bonus points are gained or lost for quick answering within the limit. Only on the Digit Symbol subtest does time play a major factor in the results. Thus, according to the Anxiety Triad, as these three subtests have come to be known, untimed as well as timed subtests seem to monitor anxiety. In fact, Freedom from Anxiety is considered to be composed mainly of Digit Span and Arithmetic, with Digit Symbol--the subtest in which timing is most important--serving as a check (Lutey, 1977).

At times when a subject scores low on the Anxiety Triad, it might be difficult to ascertain whether this is due to the effects of anxiety or some sort of numerical impairment. Lutey (1977) suggested that a subject's score be checked for the effects of anxiety by comparing scores on timed subtests with those on untimed subtests. It is Lutey's contention that subjects whose performance is adversely affected by anxiety will score lower on the timed tests. The research cited here did not seem to support this contention. Although many studies have shown a negative relationship between subjects' performances on timed tests and their anxiety levels, research which showed a negative relationship between anxiety and performance on untimed subtests of the Wechsler Scales is extensive and it supports two conclusions. First, anxiety seems to impair performance on the Wechsler Scales. Second, its effect seems to be just as

great on untimed subtests as on timed subtests.

Previous Research on Wechsler Timing Procedures

At least two timing procedures exist among examiners administering the Wechsler Scales. This is because it has not been made clear in the Wechsler manuals just what constitutes standard procedure. Two studies have investigated the effects of varying timing procedures on scores on the Wechsler Scales. Carrubba (1976) divided a sample of students in elementary school into high and low anxious groups according to responses on the CMAS (Children's Manifest Anxiety Scale). The 30 high anxious and 30 low anxious youngsters were administered the WISC-R by the same certified school psychometrist over a three week period. Two timing procedures were used. Procedure A represented a casual, straightforward approach to timing. The students were informed the test was being timed, and the stopwatch was manipulated in full view. Procedure B was designed to keep examinees essentially unaware of timing. They were not told they were being timed, and the stopwatch was handled out of view. The timing variations yielded no significant difference in subjects' scores, and there was no significant timing x anxiety interaction. High anxious subjects consistently performed at a lower level than the low anxious group on all subtests.

Morris and Liebert (1969) divided 48 psychology students into four anxiety groups on the basis of their responses to

an anxiety questionnaire. Students were administered the five timed subtests of the WAIS under two conditions. In the 'timed' condition students were timed with a stopwatch held in full view, while in the untimed condition, students were timed without their knowledge with the use of a sweep hand on a silent clock. Results indicated that timing and anxiety, as well as the difficulty level of items, interacted to produce significant differences in scores. Variations in timing procedures alone did not account for significant differences in scores, although they approached significance.

Both of the above-noted studies divided groups of subjects according to high and low anxiety before they evaluated the effects of the obvious and subtle methods of timing. The rationale for this seemed to be that the authors of both studies believed there was an interaction between timing and anxiety. They argued that high anxious subjects would be most affected by an obvious approach to timing, probably in a negative manner. This interaction is not supported by existing research this author has reviewed on either anxiety and its effect on Wechsler test performance, or the timing x anxiety relationship. Furthermore, it has not been made clear in these studies that anxiety is actually either increased by the presence of time limits, or the subjects' perceptions of time limits. The inclusion of anxiety as a variable and the division of subjects according to high and low anxiety may have confounded the effects of variations in timing procedures on the Wechsler Scale scores.

Other factors prior to or during testing may have raised the anxiety level of the high anxious group and affected their performance while nullifying any effect the variation of the timing procedures may have had. Support for this interpretation appeared in a study by Rost, Theunissen and Andert (1974). These investigators found that high anxious subjects tended to perform less well than low anxious subjects even without the pressure of perceived time limits. Carrubba (1976) also found that low anxious subjects outperformed high anxious subjects, regardless of the timing procedure used. Siegman (1956) and Morris and Liebert (1969) suggested from their results that awareness of timing might have been a facilitating factor on the performance of low anxious students and might have improved their results. One limitation of previous studies appears to have been their failure to focus on timing procedures, as opposed to anxiety, and their effects on performance. Generally speaking, the inclusion of the anxiety variable in these studies made the results of the different timing procedures difficult to interpret.

To this point, the literature review has been concerned with the importance of adhering to standard procedure in intelligence testing and how this principle appears to have been violated with the handling of the stopwatch on the Wechsler Scales. Previous research has been conducted on the effects of varying timing procedures on Wechsler Scale results; however, the rationale for these studies has tended to focus on the variable of anxiety.

Part II

Subject's Perceptions of the Timing Procedures and Effects on Wechsler Scale Performance

A number of studies have shown that subjects who are unaware of test time limits could be at a severe disadvantage, and that subjects' perceptions of the time limits on tests may affect results.

Woo-Sam and Zimmerman (1972) studied the role of speed as a factor in the obtained scores for 7 to 13½ year old children of normal intellect on the Block Design, Object Assembly and Picture Arrangement subtests of the WISC. The results indicated that the Block Design and Object Assembly subtests essentially measured a power function through age 10½, whereas speed was the major determinant by age 13½. On the Picture Arrangement subtest, the power function holds only at age 7½. However, a score within normal limits was possible without speed bonuses through age 9½. Accuracy of performance rather than speed determined the obtained score on the Block Design and Object Assembly subtests for younger subjects. Older subjects were more likely to earn extra time bonus points.

Kaufman (1979) did further research in this area. He concluded that adolescents of 14 years and above who solve every Picture Arrangement, Block Design and Object Assembly item correctly but earn no bonus points for quick performance will earn a scale score of 10 (50th percentile) or below on

each subtest. Indeed, their scores on Object Assembly will rank them at or below the 25th percentile. The findings of Kaufman (1979) complement those of Woo-Sam and Zimmerman (1972). Kaufman concluded that it is obvious that older children will earn a far greater number of bonus points for quick, perfect performance than will younger children.

These studies indicate that awareness of time limits takes on an added dimension of importance with older subjects. The lack of awareness of time limits among older subjects could mean that they would not realize the importance of speed as a factor in the results of their scores. They may be less likely to work quickly, which would reduce their chances of obtaining bonus points. A subtle approach to timing on the Wechsler Scales would likely increase the chances of this happening. Perceptions of the importance of speed could play an important role in adult subjects' scores on the Wechsler Scales, and these perceptions might well be affected by the method of timing used.

Rost, Theunissen and Andert (1974) provided further evidence which indicated that subjects who are aware of the importance of speed have an advantage on timed tests. In their study, standard tests in reasoning, numerical ability and perceptual speed under conditions of strict and normal timing were administered to 100 boys and 100 girls in the fifth grade from four elementary schools in Hamburg. The strict timing condition involved the use of a stopwatch and frequent announcements of the remaining time. The results

showed that the students' speed of calculating increased significantly under pressure without an increase in errors. Performance was highest in the obviously timed group, although those with low grades in math performed poorly under pressure. As well, subjects who suffered from high test anxiety achieved the lowest scores, even when not under time pressure. This study was of particular interest since it showed that changing students' perceptions of time limits, as opposed to changing the limits themselves, could change the results on certain types of tests. Also of interest was the fact that the Wechsler Scales contain tests in perception, reasoning and numerical ability that are similar to those used in the Rost et al., (1974) investigation.

The Effects of Removing Intelligence Test Time Limits on Subject Performance

Wechsler (1958) stated that both the Object Assembly and Block Design subtests of his intelligence scales appeared to reflect creative ability, particularly if the performance was done rapidly. Martin et al., (1977) found that both the Object Assembly and Block Design subtests of the WAIS did correlate highly with the Torrance Tests of Creative Thinking, and therefore suggested that they may indeed reflect some sort of creative ability. Some research has been done on the relationship of time limits and tests of creativity. Torrance (1969) stated that tests of creative thinking have been attacked because the imposition of time limits reduced or limited the time necessary for the incubation of ideas. This was supported by Wagner (1972) who stated the untimed

method of creativity testing offered several advantages: It is consistent with psychological theory relevant to the creative process; the reliability of fluency subtests is higher; batteries of subtests are cohesive; the untimed tests of divergent thinking are related to academic achievement as well as to talented nonacademic achievement; and the tests are valid when creative accomplishments are used as the criterion measure. Cropley's (1972) findings tended to support the Christenson, Guilford and Wilson (1957) view that highly original responses on tests of creativity would be found more frequently in later responses.

A study by Towell (1972) also demonstrated differences between tests of creativity which have time limits and those which don't. Exceptionally curious subjects made significantly higher scores on the timed Torrance Tests of Creative Thinking (TTCT) than did their less curious counterparts. However, he found no significant differences between these groups on the untimed, extended version of the tests.

The research on timed versus untimed tests of creativity suggests that time limits may alter the information processing strategies of many subjects. This suggests that altering subjects' perceptions of the time limits on the creativity tests of the Wechsler Scales may affect the subjects' scores on these subtests.

Berg (1966) found that when time limits were removed from timed subtests on the WISC, there were significant differences in the scores of subjects on Block Design, Object

Assembly and Picture Completion. Of course, the manipulation of test time limits contravenes the standardization procedures for the test. Still, the contravention revealed an interesting result. It demonstrated that the altering of the time limits affected subject performance. Similarly, altering subjects' perceptions of the time limits through variation of the timing procedures may also produce differential results. Acey (1968) produced evidence which demonstrated that timing, when used on normally timed personality inventories, changed the entire construct being measured. This result again suggested the idea of different cognitive processes occurring in subjects on timed as opposed to untimed tests. Generally speaking, the Berg (1966) and Acey (1968) investigations suggest that a subject's perceptions of whether a test is timed or untimed affects his cognitive processing of information and thus his test scores.

Summary of Part II: The Connection between Changing Subjects' Perceptions and Removing Time Limits on the Wechsler Scales

Based on the research cited in this section of the literature, the following statements can be made:

1. The scores of older subjects may be more affected than the scores of younger subjects by variations in the timing procedures on Wechsler Scales.

2. The altering of subjects' perceptions of the time limits of tests and the importance of speed can affect their

scores on several types of tests, some of which are similar to those of the Wechsler Scales.

3. The altering of time limits on certain types of tests similar to those of the Wechsler Scales can affect subjects' scores.

4. The second and third conjectures above may interact; that is, the variation of the timing procedures on the Wechsler Scales from obvious to subtle might affect a subject's perceptions of time limits and influence resulting scores in a manner similar to that which would occur with the altering of the time limit.

Part III

The Relationship between Speed of Performance and Intelligence Level

Speed has traditionally been thought to be an important aspect of intelligence (Thorndike, 1913). McFarland (1930) stated:

> Speed of reaction is one of the most important factors in individual differences in ability to react to mental tasks. It has been shown that subjects will monitor their relative speed rankings in various kinds of mental reactions. Ability in respect to speed therefore is an individual trait which is characteristic of mental behaviour. (p. 95)

Mollenkopf (1960) made the statement that if time is an inherent aspect of a given complex performance, then the time limits employed should be such as to make time an appropriately

significant factor in the resulting scores. Wechsler apparently believed that speed was an important aspect of intelligence. This would account for the design of three subtests with bonus points for speed as well as the inclusion of the very speeded Digit Symbol/Coding subtest.

In recent years, the theory that speed is a major factor in intelligence has met with some opposition. Wesman (1960) stated that the Digit Symbol subtest has long been accepted as a measurement of intellectual power in children and adults alike. Wesman claimed that this was clearly a subtest which measured perceptual speed moreso than intelligence for a very large proportion of the population. The number of items attempted under the usual speeded administration is almost as good a score as the number of items correctly done. The timing procedure used, whether obvious or subtle, and therefore the subject's perception of the importance of speed, may well affect the resulting score on the Digit Symbol/Coding subtest, where timing and speed play such an important role.

Kagan (1965) added a new dimension, conceptual tempo, to the idea that speed was an important factor in measuring intelligence. Using his Matching Familiar Figures (MFF) test, he identified four conceptual tempos: fast-accurate, fast-inaccurate, slow-accurate and slow-inaccurate. Fast-accurate individuals work fast and make few errors. Fast-inaccurate individuals work quickly, but make many errors. Kagan labelled this group "impulsive". Slow-accurate individuals work slowly, but make few errors. Kagan labelled these

individuals "reflective". Finally, slow-inaccurate individuals work slowly and make many errors.

These findings were quite significant. Kagan had shown the existence of two groups of subjects who performed with a high number of accurate responses. However, one group performed at a slower rate than the other group, although their number of accurate responses did not differ. In addition, the number of accurate responses for one group of "fast" workers was less than the number of accurate responses for one of the "slow" groups. This suggested that response speed might not be as directly connected to intelligence level as previously thought. It also supported Wesman's (1960) claim that a test such as Digit Symbol/Coding, where a subject's score was based almost entirely on his speed of performance, might not be a good indicator of intelligence.

Miller and Weiss (1976) identified three different viewpoints in the relationship between speed and accuracy in ability test performance:

1. Speed of response and accuracy of response measure the same ability in a subject.

2. Speed of response and accuracy of response indicate separate abilities in a subject.

3. The relationship between speed of response and accuracy of response depends on personality and motivational factors.

These authors studied the effects of time limits on test taking behaviour with elementary school students. Higher response rates were identified under the time limit conditions; however, response accuracy and response rate were not significantly correlated. This observation lent support to the idea that the relationship between speed and intelligence was more complex than theorists originally thought.

Sternberg (1979) generated an interesting theory about the relationship between speed and intelligence. Sternberg admitted that fast performance on many types of problems was a good indicator of intelligence. However, Sternberg said it was wrong to believe that subjects with a high level of intelligence spend less time encoding information than do less intelligent persons. This was because "better problem solvers purposely decide to spend more time on encoding the terms of a problem in order to carry out more efficiently the operations they must later perform upon these encodings" (p. 53). Because individuals of high intelligence spend more time encoding information, less time is actually spent in combining and comparing terms, and in responding. In other words, while more time is spent in preparing for operations which aid in encoding stimuli, less time is spent in carrying out these operations. Sternberg did not deny that speed was important in problem solving.

> But faster is not always better. Although speed in executing most components is associated with higher scores on various measures of intelligence, the reverse is true for at least

> one critical component: encoding.... Thus, higher intelligence is indicated by faster execution of some components and slower execution of others. (p. 50)

According to Sternberg, persons with high intelligence may take more time encoding information on unfamiliar tasks and be "slower off the mark" than those with less intelligence. But once the information has been properly encoded, response speed increases and more intelligent persons will surpass less intelligent persons in both response speed and accuracy.

The Wechsler timed subtests with bonus points seem to have been constructed according to an earlier theory of the relationship between speed and intelligence. That is, one which stated that speed of performance and intelligence are directly related; such that, the more intelligent a person is, the faster he/she works. In contrast, modern theories have become increasingly complex. A study, such as this one, where two timing procedures were used on the Wechsler Scales, would likely change the subjects' perceptions of the importance of time and speed in problem solving. Based on the increasing complexity of the theories which relate speed of performance to intelligence, the effects of using different timing procedures on the scores of subjects became increasingly difficult to predict.

Bridgeman (1980) recognized that many tests are "specifically constructed to reward the quick student because speed of performance in problem solving has long been thought to be an important aspect of intelligence" (p. 211).

He mentioned the Wechsler Scales as an example. With Kagan's (1965) findings on conceptual tempo in mind, Bridgeman suggested that reflective students may be at a distinct disadvantage on tests which have speed as an important component. He tested this hypothesis as follows. First he divided a group of elementary school students into two smaller groups, reflective and fast-accurate, through the use of the Matching Familiar Figure (MFF) test of conceptual tempo. Then, he administered a number of speeded and unspeeded measures of achievement and aptitude to each group. A discriminate function analysis was employed to discriminate between the fast-accurate and slow-accurate (reflective) groups. According to Bridgeman, it was expected the speeded measures would be heavily weighted in favour of the fast-accurate students. The results failed to show this. Bridgeman concluded that elementary school children seem to be able to adjust their tempo of performance according to the demands of a particular task. Barstis and Ford (1977) had previously found similar results which showed that during the early school years children learn to modify information processing tempo according to situational demands. In his conclusions, Bridgeman (1980) calls for further research to ascertain whether older students have the same ability to adjust their performance tempo, or whether reflective students actually are at a disadvantage at a later age.

The results of the studies of Barstis and Ford (1977) and Bridgeman (1980) have implications for a study which investigates the effects of different timing procedures on the Wechsler Scales. If individuals do have the ability to adjust their tempo according to the demands of the task, then their perception of the importance of speed might well affect this adjustment process. Individuals who have been obviously timed and who sense the importance of speed may adjust their performance tempo, whereas those who have been subtly timed may not. In addition, the use of different timing procedures may produce different sets of results for older subjects than for younger subjects, since speed of performance has been shown to be a greater factor in Wechsler Scales' results with older subjects, particularly since older subjects may not have the same ability to adjust performance tempo.

CHAPTER III

METHODOLOGY

Subjects

This study was conducted with undergraduate students who were registered in one of four summer session undergraduate, educational psychology courses at Memorial University of Newfoundland. All of the individual testing took place in the same testing room over a period of three weeks.

Sample

Since neither the sex nor age variables have been shown to yield significant differences in timing studies of adult subjects, neither sex nor age was controlled in the sampling procedure. It was anticipated that the random sample would include numbers of males and females that would be proportionate to their ratio in the undergraduate population. The mean age of these subjects was expected to approximate the mean age for the undergraduate population at Memorial. With regard to the intelligence variable, it was anticipated that the sample mean would lie between the population mean and one standard deviation above that mean, that is, between IQ scores 100 and 115.

All students in the four classes were given the

opportunity of either participating in the experiment or completing a research-oriented assignment. Both constituted a small part of the course curriculum. Seventy students volunteered and from these sixty subjects were randomly selected for the study.

Procedure

Two timing procedures, both of which could be interpreted as standard procedure, were selected for use with the subjects. Procedure 1, an obvious approach, represented a casual, straightforward approach to timing, wherein, the stopwatch was manipulated in full view of the subject. Procedure 2 represented the subtle approach to timing. The stopwatch was attached to a clipboard used by the examiner to hold test materials. The clipboard was tilted toward the examiner, which kept the stopwatch hidden from the subjects' view. In accord with the test's standardized directions, no mention of timing was made during the administration of the test for either procedure. Subjects were randomly assigned to either one of the two timing treatments. At the conclusion of the testing, thirty subjects had been administered the WAIS-R with an obvious approach to timing, and thirty had been administered the WAIS-R with a subtle approach. The randomization of the sample was assessed to take care of perceptual differences among subjects in each group as to whether they were being

timed or not.

Each subject was instructed by the examiner upon his arrival at the testing room. The subject was told that s/he would be administered an intelligence test as a part of some educational research being undertaken by the examiner. Each subject was asked to try his best, and told that the examiner was interested in examining the effects of some of the administration procedures for the test on the performance of the volunteers as a group. However, if the students wished to know their individual scores, they were told they could have their results, expressed as percentile ranks, in approximately one month.

The entire WAIS-R was administered to all subjects. Although the effects of different timing procedures on timed subtests was of primary interest, partial administration of the test would have been a violation of standard procedure and would not have represented a true testing situation. This had been a limitation of some of the previous research. Another reason for the use of the entire instrument was that the rationale of this study indicated that different timing procedures could alter subjects' perceptions of the importance of speed and of the time limits. This could affect performance on untimed, as well as timed, subtests.

The author, a certified school psychometrist, administered all tests to all subjects to avoid the possible contamination of the effects of more than one examiner.

Such factors as place of testing and examiner-examinee interactions were also tightly controlled.

CHAPTER IV

ANALYSIS OF THE DATA

Descriptive statistics were calculated on all variables for the entire sample. Results revealed that the sample contained 24 males and 36 females. The sample had been divided into two groups of 30 subjects, each of which was administered the WAIS-R under a different timing procedure. As a result of the random selection of the two groups, males and females were divided equally in both groups. Each group contained 12 males and 18 females. The subjects ranged in age from 18 to 45, with 23.2 being the mean age for the sample. The full scale IQ of the subjects ranged from 81 to 144. The mean full scale IQ for the sample was 103.3, and the standard deviation 12.4. See Table 1 for the Performance means and standard deviations for all subtests of the WAIS-R for the present sample.

Means and standard deviations of each subtest of the WAIS-R for both the obviously timed and subtly timed groups were calculated for each dependent variable. The scores for two additional dependent variables were computed. These computed variables were (1) the sum of three, timed, bonus point subtests (BONUSSC3), and (2) the sum of all timed subtests - including those with and without bonus points (BONUSSC5). The purpose of this was to ascertain clearly whether timed subtests were differentially affected by variations in timing.

TABLE 1

WAIS-R Means and Standard Deviations of the Entire Sample

Variable	Mean	Standard Deviation
Information Scale Score	9.05	2.45
Digit Span Scale Score	9.88	2.36
Vocabulary Scale Score	10.75	2.35
Arithmetic Scale Score	10.43	2.60
Comprehension Scale Score	12.06	2.51
Similarities Scale Score	10.78	2.24
Picture Completion Scale Score	9.71	2.10
Picture Arrangement Scale Score	9.61	2.66
Block Design Scale Score	10.4	2.91
Object Assembly Scale Score	10.0	2.90
Digit Symbol Scale Score	11.4	2.04
Verbal IQ Score	104.4	11.47
Performance IQ Score	101.3	13.82
Full Scale IQ Score	103.36	12.45

The results indicated that the obviously timed group outperformed the subtly timed group on 9 of the 11 subtests. The obviously timed group also outperformed the subtly timed group on all composite scores computed from the subtests; namely the Verbal IQ Score, Performance IQ Score,

Full Scale IQ Score, the scale score computed from the timed subtests with bonus points, as well as the scale score computed for timed subtests - including those with and without bonus points. The obviously timed group scored higher than the subtly timed group on all sections of the WAIS-R other than the Digit Symbol and Picture Arrangement subtests.

The means and standard deviations of each section of the WAIS-R for males and females were obtained. Results showed that males outscored females on 9 of the 11 subtests and on all composite scores computed from the subtests. Males scored higher than females on all but the same Digit Symbol and Picture Arrangement subtests.

Figures 1 through 6 illustrate in graphic form the mean scores on all sections of the WAIS-R for both the sex and timing condition variables. From these figures, it can be clearly seen that the obviously timed group outscored the subtly timed group in a large number of cases. It is also clear that males outscored females in an equally large number of cases. Exact scores for the obviously timed and subtly timed groups, and for males and females on each section of the WAIS-R can be obtained from Appendix A.

Two-way analyses of variance were conducted on each dependent variable to test the null hypotheses. In accord with the hypothesis that there is no timing x sex interaction on the WAIS-R, the two-way analysis of variance revealed that no timing x sex interaction existed on any of the variables analyzed. Confirmation of this hypothesis for all dependent

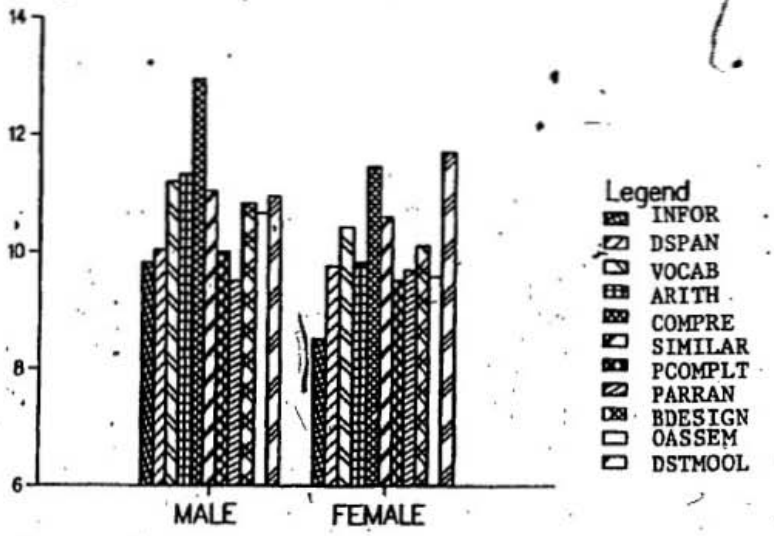

FIGURE 1: Scale Score Means for Males and Females on all Subtests of the WAIS-R

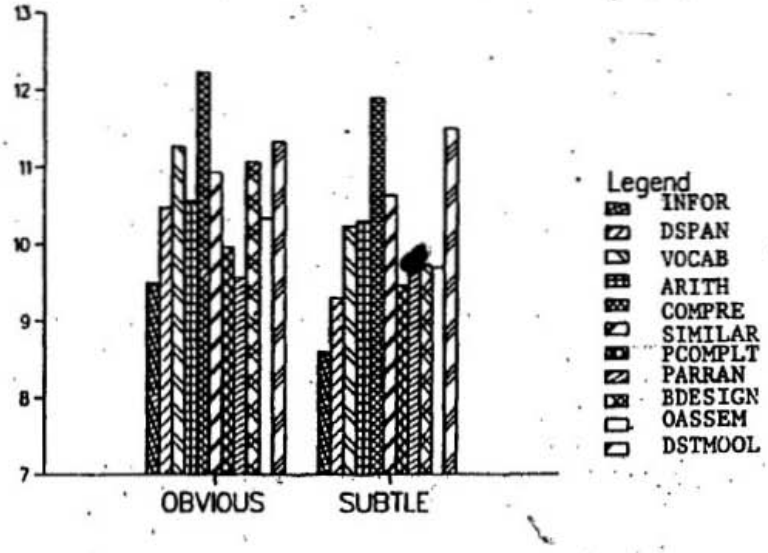

FIGURE 2: Scale Score Means for Obviously Timed and Subtly Timed Groups on all Subtests of the WAIS-R

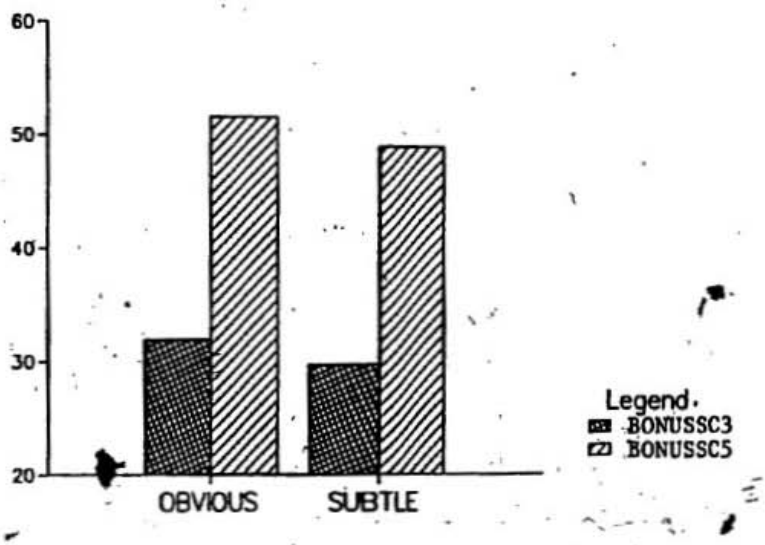

FIGURE 3: The Means for the Obviously Timed and Subtly Timed Groups on the Computed Subtest Combinations

FIGURE 4: The Means for Males and Females on the Computed Subtest Combinations

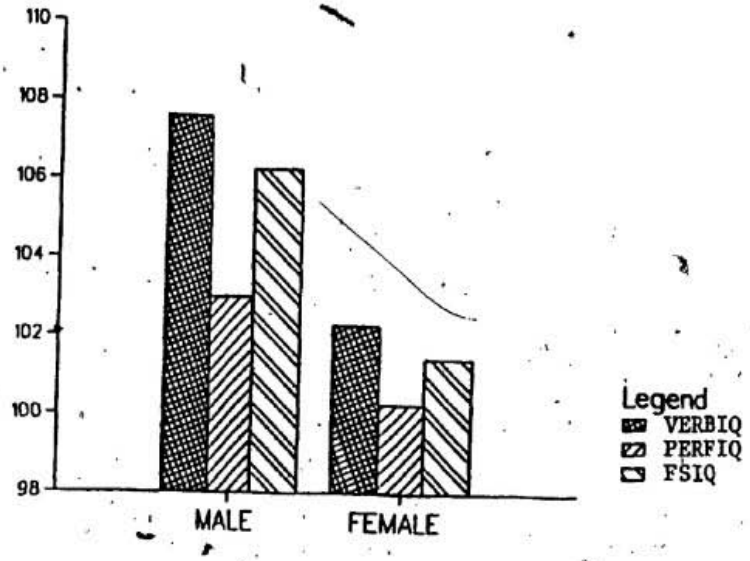

FIGURE 5: The Verbal, Performance, and Full Scale IQ Means for Males and Females

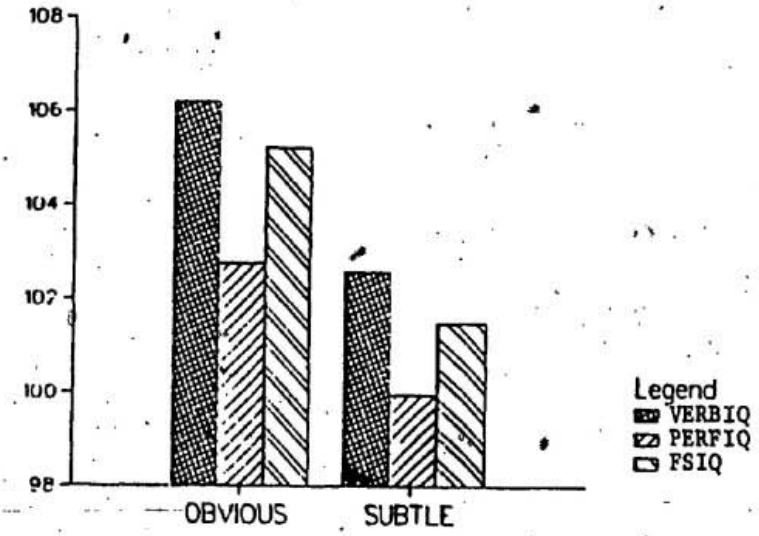

FIGURE 6: The Verbal, Performance, and Full Scale Means for the Obviously and Subtly Timed Groups

variables analyzed strongly suggested that there are no significant differences in the way males and females react to different timing procedures on the WAIS-R. The observation of a nonsignificant interaction between the timing and sex variables permitted an analysis of their main effects.

An analysis of the timing variable yielded no significant main effects. For this variable the null hypothesis was confirmed for all dependent variables. Thus, this investigation supports the position that there are no significant differences between the two timing procedures, subtle and obvious, on the WAIS-R.

A similar analysis of the sex variable yielded significant differences on several dependent variables; namely, the Arithmetic, Information and Comprehension subtest scale scores. Males scored significantly higher than females on these three subtests. The Information Scale Score results are typical of the results for each of these variables. They are presented as Table 2. The results for the other subtests which showed significant sex differences are presented as Appendix B. From these results it must be concluded that the null hypothesis concerned with significant differences between the scores of males and females on the WAIS-R was not supported for all the dependent variables outlined in this investigation.

TABLE 2

Timing x Sex Analysis of Variance for Information Scale Score

Source	df	MS	F	P
A (Cond)	1	12.15	2.17	0.14
B (Sex)	1	24.54	4.40*	0.04
A x B	1	5.87	1.05	0.30
Error	56	5.57		

*p < .05

CHAPTER V

DISCUSSION AND CONCLUSIONS

The Timing Variable

The findings indicate that varying the timing procedures on the WAIS-R produced no significant differences in subjects' scores, despite the fact that the obviously timed group outscored the subtly timed group on 9 of 11 subtest scale scores and on all the composite scale and IQ scores analyzed. This trend is surprising since it is not supported by the statistical tests of mean differences. If varying the timing procedures on the Wechsler Scales did not influence performance, one would not expect a trend of this nature. This result invites speculation about the possible influence of moderator variables such as intelligence level, anxiety and conceptual tempo. However, variables such as these can only be considered after the fact, which would not be in keeping with good experimental practice. It seems preferable to accept the null hypothesis for the timing variable and simply note the unusual trend evident in the data as a source of evidence to support the need to replicate the results of this investigation.

The Sex Variable

The results of this study indicated that males scored

significantly higher than females on the Information, Arithmetic and Comprehension subtest scale scores. Figure 2 on page 39 indicates that males outscored females on 9 of 11 subtests in all, although only the three above-noted subtest score differences were significant.

With regard to the obtained sex differences, Lutey (1977) found patterns which showed that males tended to score higher than females on the WAIS Arithmetic and Information subtests. Miele (1958) found that males achieved higher scores on Arithmetic as age increased. Sex differences on this subtest were found to be significant for the WAIS but not the WISC-R. Similarly, both Miele (1958) and Quereshi (1968) found that males scored significantly higher on the WISC Comprehension subtest. Lutey (1977) has recognized that the sexes do not always perform equally on Wechsler Scale subtests.

> Studies of the Wechsler Scales have generally indicated that sex differences in Verbal, Performance and Full Scale IQ's are not significant. IQ scores tend to favour males on the WAIS, WISC and WISC-R, significantly so in some age groups (on the WISC-R boys score significantly higher on Full Scale and Verbal IQ's). Most studies show sex differences in subtest scores. (p. 56)

Even Wechsler (1958) believed there are sex differences in abilities favouring males on some tests and females on others.

Seashore, Wesman and Doppelt (1950) provided a framework within which differences in performance of males and

females can be interpreted. Basically their position is that one of the following three cases must be true:

> (a) The scales are unbiased and one sex actually is superior.
> (b) The sexes are equal in ability, but the items are biased in favour of one group or the other.
> (c) The sexes are equal, but the normative sampling was biased. (Lutey, 1977, p. 56)

Lutey (1977) stated that no adjustment is made for sex differences on the Wechsler Scales; therefore if (b) above is true and certain items actually are biased in favour of a particular sex and are not counterbalanced by those favouring the other, there will be systematic discrimination.

If the subtest sex biases are not clearly balanced for both sexes, the implication is that an overall sex bias may exist on the Wechsler Scales. However, there is no real evidence to suggest the scales are not equally balanced, or that any of the three possible explanations given for differential sex performance by Seashore et al., (1950) is more applicable to this study than to others.

There may be another possible explanation for the findings. Pedersen et al., (1968) found that males tended to outperform females when the examiner was a male, and the reverse was true when the examiner was a female; although this study was done using the WISC on subjects in the third grade and the findings may not directly relate to the present study, the examiner in the present study was a male. Lutey (1977) made the following comment when referring

to studies on the effects of sex and age of examiner, sex and age of subject, and their interactions on subject performance: These relationships are complex, the variables do not function systematically in isolation, and clear-cut conclusions are unlikely until interactions of these variables and others (e.g., race of subject and examiner) are investigated together.

The results of this study, which demonstrated significant sex differences in performance on certain Wechsler subtests, are not inconsistent, then, with previous research findings. Although possible explanations for these differences exist, there is no evidence to suggest the exact cause of these differences.

Conclusions

The main effects of the sex variable on Wechsler Scale performance indicated that males significantly outperformed females on three of the eleven WAIS-R subtests, and outscored females overall on nine of the eleven subtests. Previous research had also indicated sex differences on certain sections of the Wechsler Scales, however, the evidence did not seem to account for the superior performance of males in this study. An interaction between the sex of the examiner and the sex of the subject in combination with a possible bias affecting males on certain subtests may have worked together to negatively influence the performance of

females in this study. However, this is only one of a number of possible explanations, and there is little evidence to support the possibility.

Analysis of the timing procedure variable indicated that the two timing procedures produced no significant WAIS-R performance differences. However, despite the nonsignificant results for the timing variable, an unusual trend in the results indicated that for 14 of 16 dependent variables, subjects tended to do better when an obvious approach to timing was used than when a subtle approach was used. The magnitude of this trend suggested that the differences between the timing treatments may have been mitigated by moderator variables that were not controlled in this investigation. It was suggested that it may be worthwhile to replicate this investigation to assess the importance of the noted trend. Nevertheless, on the basis of the present analysis it must be concluded that timing procedure differences for the WAIS-R do not significantly influence test performance.

Recommendations

Based on the findings of this study it appears examiners can use either the obvious or subtle approach to timing without significantly affecting subjects' performance. However, since an unexplained trend indicated that obviously timed subjects scored higher than subtly timed subjects on 14 of 16 measures, and this trend has repeatedly appeared in

previous investigations, it is reasonable to conclude that the role of timing practices in Wechsler Scale performance requires further investigation. Until then, if the examiners wish to maximize the performance of the majority of examinees on the Wechsler Scales, then it is recommended they employ an obvious approach to timing.

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APPENDICES

APPENDIX A

TABLE A

Raw and Scale Score Means and Standard Deviations for WAIS-R Variables Broken Down by Timing Procedure and Sex

	Timing Procedure				Sex			
	Obvious		Subtle		Male		Female	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Information Raw Score	18.13	6.70	16.50	3.59	19.13	4.21	16.11	5.44
Information Scale Score	9.50	3.01	8.60	1.65	9.83	2.21	8.52	2.48
Digit Span Raw Score	15.62	4.23	15.08	3.38	15.62	4.23	15.08	3.38
Digit Span Scale Score	10.46	2.24	9.38	2.27	10.04	2.66	9.77	2.17
Vocabulary Raw Score	53.66	9.23	48.56	8.95	53.91	8.37	49.02	9.66
Vocabulary Scale Score	11.26	2.49	10.23	2.12	11.20	2.16	10.44	2.65
Arithmetic Raw Score	12.98	3.23	12.03	3.01	13.91	2.63	12.00	3.18
Arithmetic Scale Score	10.56	2.77	10.20	2.43	11.33	2.46	9.83	2.54
Comprehension Raw Score	24.70	3.91	24.43	3.24	25.66	3.80	23.83	3.30
Comprehension Scale Score	12.23	2.80	11.96	2.21	12.95	2.64	11.47	2.26
Similarities Raw Score	21.16	3.37	20.93	3.09	21.16	3.64	20.93	2.94
Similarities Scale Score	10.93	2.31	10.63	2.16	11.04	2.52	10.61	2.04
Picture Completion Raw Score	15.80	3.18	15.40	1.88	15.83	1.88	15.44	2.19
Picture Completion Scale Score	9.96	2.18	9.46	2.01	10.00	1.91	9.52	2.22
Picture Arrangement Raw Score	12.76	3.74	13.13	3.71	12.62	3.69	13.16	3.74
Picture Arrangement Scale Score	9.36	2.71	9.66	2.65	9.50	2.63	9.69	2.71
Block Design Raw Score	34.83	10.51	30.93	8.19	34.25	9.12	31.97	9.84
Block Design Scale Score	11.06	3.30	9.73	2.34	10.83	2.82	10.11	2.96
Object Assembly Raw Score	31.66	6.03	30.53	6.25	32.91	3.97	29.88	7.00
Object Assembly Scale Score	10.33	2.68	9.76	2.93	10.66	2.14	9.58	3.27
Digit Symbol Raw Score	64.66	9.65	65.76	8.76	63.16	9.39	66.58	8.71
Digit Symbol Scale Score	11.33	3.15	11.50	1.96	10.95	2.09	11.72	1.98
Verbal Scale Score	64.76	11.66	60.96	8.63	66.08	9.89	60.66	10.19
Verbal IQ Score	106.26	12.79	102.60	9.88	107.58	10.76	102.27	11.68
Performance Scale Score	52.26	10.27	50.40	6.83	52.37	8.08	50.63	9.15
Full Scale Scale Score	117.33	19.81	111.36	13.58	118.91	15.29	111.38	17.77
Full Scale IQ Score	105.23	14.39	101.50	10.05	106.25	10.94	101.44	13.16
Timed Subtests with Bonus Points Total Raw Score	79.46	15.80	74.10	13.07	81.08	13.81	73.86	16.32
Timed Subtests with Bonus Points Total Scale Score	31.96	7.20	29.73	5.84	32.83	5.73	29.52	6.88
Timed Subtests Total Raw Score	187.96	30.33	182.63	15.84	189.54	15.44	182.47	19.83
Timed Subtests Total Scale Score	51.56	10.48	48.86	8.07	52.33	8.56	48.75	9.70

APPENDIX B

TABLE B

Timing by Sex Analysis of Variance for Arithmetic Scale Score

Source	df	MS	F	P
A (Cond)	1	1.06	0.16	0.68
B (Sex)	1	32.40	4.97*	0.03
C (Cond x Sex)	1	0.54	0.08	0.77
Error	56	6.51		

*p < .05

TABLE C

Timing x Sex Analysis of Variance for Comprehension Scale Score

Source	df	MS	F	P
A (Cond)	1	1.66	0.27	0.60
B (Sex)	1	31.80	5.26*	0.02
C (Cond x Sex)	1	0.06	0.01	0.91
Error	56	6.03		

*p < .05