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The Relationship of the Reflection-Impulsivity Dimension and the Quality of Intellectual Achievement.

BY

© Malcolm L. West

A THESIS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled "The Relationship of the Reflection-Impulsivity Dimension and the Quality of Intellectual Achievement" submitted by Malcolm L. West in partial fulfilment of the requirements for the degree of Doctor of Philosophy (or Doctor of Education).

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ABSTRACT

This investigation was concerned with determining the relationship between reflection-impulsivity and the quality of intellectual achievement as measured by the WISC, as well as with the relationship between reflection-impulsivity and a WISC verbal-performance discrepancy. Data for the study were obtained from a sample of 80 elementary school children.

The results of the statistical analysis indicated that there was a significant curvilinear relationship and a non-significant linear relationship between MFF response time scores and WISC full scale IQ scores. Significant differences among mean full scale IQ scores of groups classified according to MFF response time scores were also indicated. Among the boys, moderate reflectives achieved higher IQ scores than high impulsives. Among the girls, not only did the moderate reflectives achieve better IQ rating than high impulsives, but they also showed superior IQs to the high reflective group. No significant differences were found in the global IQ scores of the high impulsive and reflective groups.

With regard to a WISC verbal-performance discrepancy, the high impulsive groups generally earned higher scores on the performance subtests relative to their verbal achievement. An exact opposite pattern of achievement was found to exist among high reflective children, that is, their verbal scores exceeded their performance scores. With the exception of moderate impulsive boys, no significant differences between verbal and performance IQs were found among the moderate groups.

It was concluded that the relationship between response latency

and the quality of intellectual achievement is marked by a "ceiling effect" in that moderate latency levels were optimal for achievement. Also of interest was the fact that reflection-impulsivity does not appear to be a unitary dimension, but may be composed of different subgroups.

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INTRODUCTION

The purpose of this study is to investigate the relationship between the reflection-impulsivity aspect of cognitive style and the child's overall intellectual achievement as measured by the WISC. A second objective of this research is to examine the relationship between the reflection-impulsivity dimension and a WISC VIQ-PIQ discrepancy. An attempt is made to provide an explanation for the relationship between the reflection-impulsivity dimension and intelligence test performance within the theoretical framework of this study.

Organization of the Study

Chapter One is devoted to a discussion of conceptual bases for the study and statements of the general hypotheses. Chapter Two considers the concept of intelligence and its measurement through IQ tests. Chapter Three presents a review of the related research dealing with the reflection-impulsivity dimension and a WISC VIQ-PIQ discrepancy. The origins of reflection-impulsivity are considered in Chapter Four, where an integrative hypothesis combining both biological and psychological bases is proposed. Experimental hypotheses, definitions, method and statistical procedures employed in the analysis of the data are considered in Chapter Five. Chapter Six reports the findings related to the testing of the hypotheses as well as a discussion of these findings. The final chapter provides a summary of the findings, implications and conclusions.

CHAPTER 1

THEORETICAL FORMULATION AND GENERAL HYPOTHESES

In their early work with children, Kagan and his associates (Kagan, Moss, and Sigel, 1963) were primarily concerned with stylistic preferences in the use of conceptual groupings. On a concept sorting task, Kagan et al. discovered that some children tended to analyze the stimulus environment while others characteristically responded in a relatively undifferentiated or global manner. This general pattern, having at one pole the tendency to respond to sub-elements of a stimulus field in contrast to a reaction based on the stimulu-as-a-whole, was labelled the analytic versus non-analytic dimension.

From these initial studies, an incidental and accidental discovery was made. Specifically, Kagan et al. noted that the production of analytic concepts seemed to be associated with longer response times, whereas faster response times were usually counterproductive of such groupings. Kagan and his co-workers (Kagan, Rosman, Day, Albert and Phillips, 1964) subsequently identified these individual differences in response time displayed by children with a conceptual tempo dimension called reflection-impulsivity. Thus, the early research work on preferred conceptual groupings may be viewed as the "mother" of the reflection-impulsivity variable, toward which the bulk of Kagan's subsequent research has been directed.

Having noted that children who utilized analytic categories tended to display longer response times, Kagan and his co-workers

undertook to measure this decision time variable more directly. The Matching Familiar Figures (MFF) test was thus constructed for evaluating individual response time differences in tasks in which alternative solutions are available. Although a series of instruments (Conceptual Style Test, Delayed Recall of Designs, and Haptic-Visual Matching) all yield information concerning response latency, the MFF test is considered to be the most effective procedure for assessing a child's conceptual tempo (Kagan, 1965). A detailed description of these experimental tasks is presented in a later chapter.

Analytic Attitude vis-a-vis Reflective Variable

Kagan et al. (1963) demonstrated individual styles of conceptual approach along an analytic-non-analytic dimension. This was the first dimension, perhaps best called a conceptual style variable, isolated by Kagan's research program.

As already indicated, an undercurrent in the preliminary investigations of conceptual style was the idea that the production of analytic concepts were associated with longer response times. This notion of a capacity for delay gave rise to a second dimension, the conceptual tempo variable, and was labelled reflection-impulsivity. Kagan et al. (1964) contend that this disposition, described as "the tendency to consider alternate solution hypotheses when many alternatives are available simultaneously" appears to be distinct from other cognitive styles reported in the literature. Results from the MFF test indicated a continuum ranging from the one extreme of children who exhibited short decision times to the other extreme of those who

displayed longer responses times. The first mode of conceptual tempo was labelled impulsive; the second, reflective.

With the emergence of the reflection-impulsivity dimension, it was natural to inquire as to its relationship with the analytic-non-analytic dimension. At a theoretical level, Kagan seems to regard the reflection variable as the more fundamental one in that analytic concepts are postulated to be the product of its action. In short, a reflective disposition is assumed to contribute substantially to the production of analytic concepts.

Despite Kagan's above hypothesis that the reflection variable is an antecedent condition of an analytic preference, the evidence (also reviewed in a later chapter) bearing on this contention is somewhat equivocal. For example, studies by Kagan (1963, 1966) revealed that criterion measures of an analytic preference were only slightly related to the predictor variable of reflection, suggesting little warrant for the hypothesis that reflection contributes greatly to the production of analytic concepts.

In the present study, the exclusive concern is with the reflection-impulsivity dimension, conceived of as a consistent personality attribute which exerts a directive influence on the child's behavior. Since a stylistic preference for analytic concepts is not pertinent to the hypotheses of this study, no assumption concerning its relationship to the reflection variable is made.

It probably will have been noted by the reader that Kagan's conception of reflection-impulsivity is quite different from what is typically subsumed by most personality theories (for example, Freud,

the Neo-Freudians, Murray, Allport, to name but a few) under the general rubric of impulses and their control. As employed by Kagan, reflection-impulsivity possesses the status of an instrumental trait in the sense that it refers to strategies calculated to further the attainment of a specific goal - the solution of a cognitive problem. More precisely, then, Kagan's reflection-impulsivity variable is limited to the preferred conceptual tempo used by children in solving problems with several alternatives. Hence, impulsivity in this sense is delimited to what Kagan calls a "fast conceptual tempo".

The above usage of impulsivity as a stylistic preference in the cognitive sphere is to be distinguished from the more inclusive concept of impulsivity as a style of living. For example, from the standpoint of clinical practice, impulsivity has typically been used to describe individuals who fall into such diagnostic categories as psychopathic personality, impulse-ridden personality, anti-social personality, or conduct disorders. Indeed, the tendency to study individuals who have been labelled impulsive in psychiatric settings has resulted in a generally negative valence being attached to this mode of functioning. Later in the present report, the suitability of such a negative perspective in relation to an impulsive conceptual tempo is questioned.

In sum, the cognitive style of impulsivity is best thought of as but one aspect of personality, and is not to be confused with the more pervasive and embracing concept of impulsivity as applied to the total functioning of a given personality. (This is not to deny, how-

ever, that a preferred cognitive style of functioning may not later be developed into a more or less total style of living). Throughout this study, and unless otherwise explicitly stated, the impulsivity variable is discussed in Kagan's more restricted usage of it as a preferred cognitive style. For the sake of verbal economy, "the impulsive child" is used in this study to refer to the child who exhibits a fast conceptual tempo.

It should perhaps also be emphasized that Kagan's conception of reflection-impulsivity is made entirely within the framework of normal child behavior. Again, Kagan's approach is to be differentiated from the majority of clinical studies in which the predominant focus tends to be upon the psychopathological. Thus, instead of reflection, it is more usual to encounter studies dealing with obsessive thought patterns. On the impulsive side, the typical clinical orientation has been confined to rather extreme manifestations of impulsivity such as the impulse-ridden or "acting-out" child. This distinction should not be construed to mean that one approach is inherently more valuable than the other, for it is obvious that both approaches have a legitimate place in psychology, but rather the distinction was made to highlight the fact that Kagan's reflection-impulsivity dimension is conceptualized solely within the realm of normal child behavior.

Some preliminary considerations

As seen later in the review of the literature, there has been scant attention paid to the facets of reflection-impulsivity in intelligence test performance. What little attention has been given has in the main been restricted to investigations utilizing a group

intelligence test as their instrumentation. One might ask the following questions concerning the suitability of group intelligence tests (Primary Mental Abilities, Lorge Thorndike, and California Mental Maturity Tests) for assessing the abilities of impulsives and reflectives: Does the fact that they almost always assume at least a minimal amount of reading proficiency influence the obtained results in any way? Since group intelligence tests also rely heavily upon items of a verbal nature, does this composition favour one group over the other? Finally, does the fact that group intelligence tests are usually in the form of multiple-choice items affect differentially the likelihood of success for reflectives and impulsives on these tests? It is hoped that a review of what others have discovered about reflection-impulsivity will shed some light on these questions.

Turning now to a consideration of the VIQ-PIQ discrepancy, it cannot be said that the voluminous research on this topic has clarified its nature to any great extent. It is suggested that the main reason for this state of affairs has been the tendency of previous studies to relate VIQ-PIQ discrepancies to general diagnostic categories, e.g. psychopathy, delinquency, depressive states, and organic brain syndromes. The use of such clinical groupings in the study of a VIQ-PIQ discrepancy seems to assume that these diagnostic categories can be precisely delineated and accorded some degree of operational status. The inconclusive results of much of this research appears to justify the adoption of a pessimistic attitude toward this strategy.

In light of the above considerations, the following conclusion may be warranted: that a specific psychological variable which can

be accurately defined and re-presented on a graduated scale replace the use of general diagnostic categories as validity criteria in psychometric studies of a VIQ-PIQ discrepancy. It is suggested that one such variable, which appears to be a reliable dimension of behavior and which may also possess crucial implications with regard to intelligence test performance, is the reflection-impulsivity aspect of cognitive style.

Three primary considerations influenced the decision to focus on reflection-impulsivity and the quality of intellectual performance. First, intelligence tests are one of the most commonly used instruments in schools and clinics in the evaluation of children's general problem-solving ability. However, the near-universal practice of intelligence testing in our public schools is not without its hazards, of which the following two may be the most outstanding. Since most IQ tests do not permit the evaluation of the reflection-impulsivity variable, it is likely, in those instances where the child's perferred conceptual tempo is inimical to good achievement with certain kinds of test material, that a spurious estimate of his ability might be the result. To put it another way, it is not only possible but also probable that in some cases the achieved IQ rating may be as much a reflection of the child's perferred conceptual tempo than a measure of what he is actually able to do. Secondly, one of the misconceptions of IQ testing is the assumption that two children who attain the same IQ score are equally adept at handling the same types of cognitive problems. For these reasons, if the present study is able to demonstrate that reflection-impulsivity influences IQ test achievement, such a finding

will have significance for test users by alerting them to the importance of incorporating a cognitive style approach to the assessment of a child's abilities in addition to the more usual IQ test approach.

The second consideration, a hint of which was given in the preceding paragraph, has to do with the relative merits of reflection versus impulsivity in different problem situations. As indicated earlier, the clinical approach has been generally confined to studying rather extreme instances of impulsivity as a pervasive personality style. This approach, while valid in and of itself, has had the unfortunate, incidental effect of associating behaviors exhibited by the impulsive child with unadaptive behavior. One could question whether the same picture would emerge if impulsivity were studied in its more restricted sense as a preferred cognitive style and within a sample of normal children.

Even apart from clinical studies, however, when attention is directed to non-clinical investigations, it is evident that a somewhat similar bias obtains, despite the following warning by Kagan (1964):

> "It seems reasonable to assume that efficient learning and performance on varied intellective tasks will sometimes be facilitated by a reflective or analytic approach; sometimes by a more impulsive or less analytic orientation." (p. 35).

Much of the experimental work on reflection-impulsivity has been directed toward establishing the relationship between this dimension and various indices of scholastic achievement. For example, the

studies reviewed in Chapter Two have in the main sought to show that the reflective child makes fewer errors in reading, possesses greater verbal ability, and exhibits better achievement in school subjects that his impulsive counterpart. It is to be recognized that the present study does not deny the existence of these differences in achievement between reflective and impulsive children on tasks where verbal facility is most obviously an asset. However, this study does argue that varying cognitive styles are useful for different things, and that the esteem accorded by previous researchers to verbal ability seems to have meant that other potential abilities of the impulsive child were overlooked.

The above argument is put very well by Nash (1970), and can serve most aptly as a conclusion to this discussion. He has stated:

> "One cannot say in the abstract that certain cognitive styles are better than others; one can only say that for certain types of problems, certain cognitive approaches are more suitable than others. In an increasingly specialized society, the development of more specialized cognitive skills seems demanded. Education in the future should become more diversified, identifying early a greater range of potential cognitive styles and providing a variety of educational environments to foster these. The aim should be the maximizing of individual differences rather than the present tendency to minimize them (p. 376)."

The third consideration is of a more methodological nature, but not exclusively so, for it also has conceptual implications with respect to the reflection-impulsivity dimension. A majority of

previous investigators have assumed a linear relationship between reflection-impulsivity and various performance criteria. Perhaps the reason for this assumption derives from the tendency to relate increases in reflectivity to scholastic proficiency indices. However, if the range of abilities is widened, it may be that their relationship with reflection-impulsivity will be marked by non-linearity.

Finally, the notion of reflection-impulsivity as a unitary dimension is questioned. Reflection and impulsivity might be described as rather large variables in the sense that they may subsume different sub-types under them. It seems reasonable to assume that reflection and impulsivity may undergo some change in meaning as one moves from moderate expressions of each to more extreme manifestations. These methodological issues are discussed more fully in Chapter Five.

The General Hypotheses

The following generalized hypotheses, which are stated operationally in the chapter on methodology, were formulated for the study:

Hypothesis 1. The disposition of reflection-impulsivity will be curvilinearly related to quality of intellectual performance.

Hypothesis 2. Impulsive children will show higher achievement on non-verbal tasks as compared to verbal ones.

Hypothesis 3. Reflective children will show higher achievement on verbal tasks as compared to non-verbal ones.

There exists a wide consensus of opinion that a delayed response time, which enables the child to generate alternate solutions increases his ability to solve problem situations and hence contributes to achievement. For example, Sieber (1969) has made the point that an impulsive response style greatly inhibits the child's ability to think through a problem situation. Bruner (1966) has extended the notion of such a reflective approach when he spoke of intellectual development as being marked by the capacity to deal with many alternatives. Various investigators have shown that a reflective or impulsive orientation greatly influences the quality of a child's performance on such diverse tasks as a mathematics achievement test, a standardized reading test, and a group intelligence test (Souch, 1970; Kagan, 1965; Gupta, 1970). Thus, the majority view is that increases in response latency are facilitative of problem solving ability, whereas a tendency to respond quickly is regarded as exerting a disruptive influence upon this ability.

However, it may be asked whether there is not an optimum level of response latency beyond which further increases interfere with efficient problem solving ability. The position taken here is that at some point response latency turns from a positive to a negative force. Stated more precisely, there is a level of response latency below which performance is disrupted, but also a level at which responses latencies are so long as to be maladaptive. Put another way, this study proposes that level of response latency has an inverted U-shaped curvilinear relationship with efficient problem solving ability.

This is not to deny, of course, that developmentally direct and unmodulated responding tends to be replaced by indirect and delayed modes of responding in which the child tries out, in thought, alternate courses of action. Aside from this general principle, however, the problem for the developmentalist is to define that level of response latency necessary for optimum functioning. Plain common sense would dictate that once a certain level of response latency has been reached, any further increases would add little to performance; indeed, in the view maintained here such further increases may result in a decline of performance. Perhaps a plausible addition, then, to the equation of adaptive problem solving with increases in response latency is the concept of a response latency ceiling. Essentially, the idea expressed by this concept is to the effect that, when response latency reaches a certain optimum ceiling level (somewhere in the middle range), any further increases are likely to result in a relative decline in performance.

The present study also proposes that the many aspects of the problem solving process are in a sense equivalent to what is tested by an intelligence test. Conceptualizing intelligence test performance in this manner, the comments of Kagan (1966) on the problem solving process in general are most relevant. He believes that evaluation (that is, a tendency to reflect) touches the problem solving process at three points: 1) in considering the validity of the initial coding, 2) in assessing the validity of hypothesis competing for expression, and 3) in assessing the appropriateness of the hypothesis selected. Since the kind of tasks employed in an

intelligence test confront children with a large number of problem situations that involve evaluation before responding, it should be possible to demonstrate a relationship between overall achievement and measures of response latency.

The task remains to elaborate the preceding general considerations with specific reference to the relationship between reflection-impulsivity and the qualitative aspects of WISC test performance. It is to be noted that the scoring system for the Comprehension, Similarities, and Vocabulary subtests of the Verbal scale differentiates between superior and inferior responses by allowing different credits for each. Thus, the range of possible scores assigned to a given response on these subtests varies between 0, 1, and 2 credits. It is to be further noted that all the subtests comprising the Verbal section, with the exception of the Arithmetic subtest are untimed. In contrast, all of the subtests that compose the Performance section possess a time limit. Also, on three of the non-verbal tests - Block Design, Object Assembly, and Picture Arrangement - the child is able to achieve bonus points for quick execution. The number of bonus points attainable range from 1 to 3 additional credits which are then added to the child's basic score on any given test item. For example, a speeded execution of a Block Design test item can earn the child up to 3 extra credits which added to the basic item score of 4 gives him a total of 7 points for that item.

A child who is disposed toward fast decision times may not persevere when the difficulty of the task increases or it becomes apparent that a quick solution is not forthcoming. He may tend to characteristi-

cally respond quickly whereas a delay in giving his answer and reflecting a moment might permit him to develop a response which would score two points instead of one. On the other hand, a child who is disposed to reflect upon alternate solutions increases his probability of ultimately rendering a response which would be worth two points instead of one.

Basically, then, on the Verbal scale of the WISC, the long decision time of the reflective child would appear to be an asset in that the situation is structured in such a way that cautiousness and persistence is rewarded. Conversely, the insufficient reflection of the impulsive child may at best interfere with his development of a superior answer or at worst cause him to respond with a completely inadequate one. In conclusion, it is likely that achievement on the untimed Verbal section would be more strongly related to the probability of ultimately solving a given subtest item than to the rate with which it was solved.

However, the situation is not as unambiguous on the subtests of the Performance section. Here it will be recalled that not only are all the test items timed but in addition a fast execution time is rewarded by bonus points. In this case, children with long response latencies could be handicapped in one of two ways: 1) their ultimate response would exceed the time limit allotted, or 2) their completed performance, while within the time limit, would be too slow to earn them any extra points. In sum, it appears probable that achievement on the timed non-verbal section would be equally a function of the rate with which a solution was worked out as well as a function of

ultimately solving any given subtest item.

It could be speculated that the most effective performance on the WISC intelligence test would be those children who displayed a moderate response latency. At the extremes, a too slow or too fast decision speed time would make the child prone to an ineffective mode of responding as outlined in the above discussion.

Reflection-Impulsivity and a VIQ-PIQ Discrepancy

The conceptual bases and related research of this study also indicated that a VIQ-PIQ discrepancy could be approached from the perspective offered by the reflection-impulsivity dimension. In discussing the role of reflection-impulsivity in a VIQ-PIQ discrepancy, the intellective and non-intellective aspects of intelligence test performance are important.

With regard to the intellective factors, there is some evidence to suggest that reflective children do better than impulsive children in tasks that involve verbal skills. For example, Kagan (1965) has reported that impulsive children have a tendency to show impaired verbal functioning as compared to reflective children. This was later confirmed in a study by Gupta (1970) in which a reflective group of adolescents exhibited higher verbal ability than the impulsive group. Also, Kagan (1965) has found a correspondence between impulsivity and a poor reader factor.

The existence of such differences might be taken as an indication that the impulsive child, unlike his reflective counterpart, does not place a high positive value on "intellect"; manipulating abstract

verbal concepts, building a vocabulary, and gathering bits of information about the world may not serve as a source of gratification for him. Rather, the emphasis seems to be away from attaching a positive value to "intellect" and more toward an active interaction with the physical world. In short, the impulsive child as compared to the reflective child may favor manipulation of things instead of words, and be more responsive to the physical properties of objects; activities that are more likely to promote non-verbal skills. Applying this thinking to a VIQ-PIQ discrepancy gave rise to the prediction that impulsive children whould portray a cognitive pattern in which performance exceeded verbal functioning.

Approached from the standpoint of non-intellective factors, it could be suggested that children with long response latencies would fare less well on the timed Performance section than their impulsive counterparts. Specifically, and after the fashion of Rapaport (1950), achievement on the Block Design and Object Assembly subtests appears to depend upon the free movement of the blocks or parts in order that various possibilities of arrangement can be attempted. The necessity for such experimentation derives from the fact that often the solution of a given item is not evident without some trial motor activity. In the course of this motor action, "clues" are given whereby a restructuring of the problem situation can take place. To take a concrete example, the less easily structured items of the Object Assembly subtest, i.e., the Horse, Face and Car items, require that the child move the parts around freely in order that a "clicking together" of the parts into a meaningful pattern may occur. If this movement of

the parts is done too slowly, there may be no opportunity to try the various possibilities of arrangement within the time limits alloted for a particular item. Hence, the overcautious approach of the reflective child could be expected to result in poor achievement on the Performance section, since it lowers the possibility of achieving extra credits at best and may at worst reduce the possibility of completing the tasks within the time limits. Taken together with the previous discussion of the reflection child's superior verbal ability relative to that of the impulsive child gave rise to the prediction that reflective children would tend to show lower Performance IQ's.

CHAPTER 2

WHAT IS INTELLIGENCE?

Two major approaches to the question of intelligence can be distinguished within psychology. The first, and by far the more traditional approach, has been an almost atheoretical preoccupation with the techniques of measurement leading in the extreme to the psychometric definition of intelligence as that which the tests test. If the psychometric approach to intelligence has been based upon a physical science paradigm, then it may be said that the organic viewpoint, exemplified by Piaget's living organism, has taken biology as its model. One thing to follow from this organic approach has been the reevaluation of intelligence tests as insufficient measures of all important aspects of intelligence.

One of the issues preoccupying what we have called the psychometric tradition has been a debate about the "structure" of intelligence. Not very surprisingly, the behaviorists deny any such structure since it connotes a tendency to think of intelligence as an essence or an entity, preferring instead the view that intelligence is simply behavior (Skinner, 1957) or a collection of overlearned habits (Ferguson, 1956). Amongst non-behaviorists, however, this debate took the form of asking whether the nature of intelligence is best conceptualized as a general unitary function or as a composite of many more or less independent abilities. Thus, on the one hand Spearman (1927), Burt (1955), and Wechsler (1958) have made a strong case for the general nature of intelligence, whereas Thurstone (1947)

and Guilford (1959) have advocated a multifactor conception of intelligence on the other.

A more fundamental issue is involved here. Perhaps the most distinctive featur of these psychometric theorists is their conception of intelligence as nothing more than a mere enumeration of capacities. Instead of starting with a notion of intelligence holistically conceived, the emphasis has rather been reductionistic in that psychometry has attempted to get at the essential nature of intelligence through analytic dissection. This practice has led psychometrists to regard intelligence as nothing but an aggregate of measurable factors. Such an approach stands in sharp contrast to that of Piaget, who has clearly gone beyond reductionism by rejecting the idea that intelligence is a set of discrete capacities--such as Spearman's, Burt's or Guilford's.

As discussed by Furth (1969) the lesson of Piaget's approach, rather, is that intelligence is not just a set of factors but a continuous process of adaptation to the environment, the nature of which changes with each successive stage of development. Intelligence, for Piaget, is a form of equilibration, that is, an intrinsic self-regulating factor according to which development proceeds. Thus, along the developmental sequence, more or less equilibrated stages have been distinguished by Piaget. At each stage, from sensory-motor through the period of concrete operations to the formal operation period, there is always a corresponding structure through which behavior at any given stage is co-ordinated.

It is evident that a wide gulf exists between Piaget's approach

to intelligence and that embodied by the psychometric tradition. As Laurendeau and Pinard (1962), for example, point out, intelligence tests are exclusively concerned with the child's position on a scale of difficulty, expressed either in terms of an IQ or mental age rating, relative to others of his same age group. Because the selection of test items is not derived from any firm theoretical view about the development of intelligence in children, IQ test are not, and could not be, a measure of the psychological processes involved in rendering an answer. In short, these commonly used tests indicate only the end product of intellectual activity, but they provide no information concerning the internal dynamics of mental operation. (Of course, it has also been commonplace to point out that psychometric assessment is used as a basis for social role allocation, in that IQ tests are regarded as measures of the probability of educational and social success in our society).

What, then, can be said of the role of IQ tests in light of Piaget's work on intelligence? Quite obviously, the practice of reducing the notion of intelligence to the result of an IQ test is no longer tenable; an error to which psychometricians have been especially prone. This is not to deny the continuing useful application of IQ tests to indicate the level of intellectual achievement within a given developmental stage of Piaget's scheme. It is more to the point, as Laurendeau and Pinard suggest, that the maturity of a child be formulated both in terms of stages of development as well as in terms of mental age. In this sense, Piaget's scheme may be seen as complementing rather than supplanting the use of intelligence tests.

CHAPTER 3

REVIEW OF RELATED LITERATURE

The presentation of related research is divided into two major sections, each related to some aspects of the general problem. The initial section of the review outlines the research dealing with the reflection-impulsivity variable. This is followed by an overview of the research findings as they relate to a WISC Verbal-Performance (V-P) discrepancy. The concluding portion discusses the findings of the above two sections in relation to the problem of the present study.

Research on Reflection-Impulsivity

Before exploring the relationship between reflection-impulsivity and a variety of behaviors, it might be useful to first examine the experimental tasks developed by Kagan and his co-workers to assess the reflection and analysis variables.

Criterion Measures

Conceptual Style Test. The CST, one of the original procedures devised by Kagan, is used as an index of the relative preference for analytic or non-analytic groupings in a concept sorting task. In this test, which consists of 30 items each depicting drawings of 3 familiar objects, the child is asked to select 2 pictures that are alike or go together in some way. The child's responses are scored for analytic, relational, and inferential concepts. In an analytic concept, the objects are grouped together on the basis of a shared subelement of

the total stimulus, whereas relational concepts are based on a functional relationship between the two stimuli. Inferential responses, the production of which Kagan attempted to suppress, are said to involve an inference about the stimuli grouped together. Scoring is in terms of number of analytic concepts and the average response time to concept selection.

Delayed Recall of Designs. This test requires a subject to select from variations of geometric designs the form that he was previously shown. The DRT is scored in terms of number of errors and average response time.

Haptic-Visual Matching. In this task, the child is allowed to explore haptically a wooden form hidden from view. After exploration, he is presented with a visual array of 5 stimuli and requested to select the one pattern which corresponds to the form palpated. Three major variables are scored: errors, response time, and palpation time.

Matching Familiar Figures. The MFF test consists of a familiar picture, the standard, and six variants. The child is asked to select the one stimulus that is identical to the standard. The major variables scored are average response time to first selection and number of errors.

As already mentioned in a previous chapter, Kagan has postulated that a tendency to be reflective is associated with the formation of analytic concepts. Viewed in this way, the MFF test assumes the status of a predicator variable whereas the CST represents a criterion measure.

However, the research evidence bearing on this hypothesis is rather ambiguous. On the one hand, Kagan (1963) found that the average reaction time for analytic responses on the CST for sixth grade children was 5.4 seconds whereas for relational responses the average reaction time was 4.0 seconds, indicating a significant relation between these two variables. However, the correlations between other reflection measures and the criterial measure of analytic sorting range from -.05 to +.47 with a median correlation of about +.15 (Kagan, 1966). Thus, criterion measures of an analytic preference seem to be only marginally related to the predictor variable of reflection, indicating only slight support for the hypothesis that reflection contributes greatly to the production of analytic concepts. It may well be that the CST and MFF test are not necessarily measures of an unidimensional delay variable, but rather constitute two relatively independent indexes of reaction time.

Stability of Conceptual Tempo

Evidence for the stability of the reflection-impulsivity dimension derives from the following studies. In one study (Yando, 1968), second grade children were tested for ten consecutive weeks on variations of the MFF test in which the number of variants was increased by one each week. This study yielded an average correlation of .70 for response time over the ten week period, indicating marked short-term stability of conceptual tempo.

Support for the long-term stability of this dimension was provided through a study in which 102 children were retested with the MFF

test a year after the initial testing. The test-retest correlations for response time between the two administrations were .48 for boys and .52 for girls. In conclusion, these results strongly indicate that a penchant to exhibit fast or slow decision times is a relatively enduring characteristic of children.

Correlates

Interest in the concept of reflection-impulsivity has generated considerable research. Kagan (1965) has found that, in the case of the performance of grade one children, impulsivity is correlated significantly with the tendency to make word errors of all kinds in reading. Based upon their MFF test performance, 130 first grade children were assigned to impulsive or reflective groups. They were then shown a card with five words printed on it. The examiner read one word aloud and asked the subject to point to the word on the card that matched the one read aloud. The results revealed that reflective subjects made fewer recognition errors than did the impulsive subjects. Kagan contended that one reason for the more numerous errors of impulsives is insufficient reflection on the validity of their hypotheses.

Further to this, Siegelman (1969) has found clear differences of attention between children identified on the MFF test as impulsives and reflectives. In this study, the MFF test was administered in an apparatus that required the subjects to press manipulada to view the standard stimulus or its variants. These instrumental responses indicated that reflective subjects had a longer average duration of viewing the stimuli, particularly the variants; and that reflective subjects tended to view

all the alternatives stimuli prior to responding, while impulsive subjects responded after viewing only one or two alternative stimuli. In short, the reflectives looked longer at the problem material while the impulsives showed greater inequality within the range of stimuli to which they attended.

Kagan (1966b) has shown that reflective and impulsive children differ in the extent to which they make errors of commission in a serial recall task. Using the MFF, over 200 third grade children were evaluated on the reflection-impulsivity dimension. Three months later, each child was required to recall the words from three lists of 12 familiar words. Following the first two lists, three experimental treatments were executed: (1) Arousal of anxiety over possible failure by informing Ss that the previous two lists were practice lists in prepartion for a difficult third list, (2) Criticism of previous performance, and (3) control, wherein Ss were told nothing prior to beginning the third list. The results indicated that Ss in both anxiety treatments produced more errors of commission than did Ss in the control condition. Impulsive Ss made many more commission errors than reflective Ss on both the prethreat and postthreat lists. Reflective Ss showed a significant increase in commission errors under both threat conditions and reflective Ss in the control condition committed the least number of commission errors. Thus both a disposition toward impulsivity and anxiety increase the substitution of incorrect for correct words in recall tasks.

Reflection-impulsivity has also been shown to be related to the quality of solutions chosen in an inductive reasoning task. Kagan,

Pearson, and Welch (1966a) administered two tasks to first-grade children. In the first task, Ss were given three attributes of an object (e.g., What is yellow, melts in the sun and you can eat it?) and asked to name the object. In the second task, Ss were shown three pictures in a fixed order that portrayed the beginning of a story. They were then asked to select from among four alternatives the picture that indicated the next thing that happens in the story. On both tasks, impulsive Ss responded more quickly and made more errors than did reflective children.

Studies by Schuebel (1968), and Souch (1970) were aimed at determining the relationship between the R-I dimension and social class membership. These studies have generally indicated that children from low income groups tend to be more impulsive in terms of their response time than their middle class counterparts. For example, Souch reported that his study revealed significant social class differences in children's cognitive style, specifically, a larger proportion of impulsive children came from lower socioeconomic homes.

A factorial investigation of the correlates of R-I among 217 high school students was reported by Gupta (1970). Despite the unfortunate lack of a well-developed theoretical rationale for his postulates, some of his findings are pertinent for this study. He demonstrated that the reflective group has significantly higher verbal ability, exhibited greater persistence, and showed better achievement in school subjects. All other variables, including mental speed, extraversion, risk taking, to cite only a few, failed to correlate significantly with the R-I dimension.

In a previously referred to study (Souch, 1970) of reflection-

impulsivity in elementary school children, it was found that impulsive boys and girls performed significantly more poorly than reflective boys and girls on a mathematical achievement test. However, no differences were reported between these groups on a standardized reading test. The most important implication of this study for the present study was the incidental and unhypothesized finding of a relationship between IQ quotient and the R-I dimension. Preliminary evidence was offered to indicate that impulsives, determined by MFF decision time and error count, had the lowest mean IQ scores.

This review was able to uncover only two other studies dealing with differences in intelligence scores between impulsive and reflective subjects. While the results of a study by Cathcart and Liedtke (1969) were inconclusive, they did suggest a tendency for reflective children to be more intelligent than their impulsive counterparts. A study conducted by Michenbaum and Goodman (1969) reported that reflective kindergarten children scores significantly higher than impulsive children on all subtests of the Thurstone Primary Mental Abilities test (PMA) for grades K-1.

Literature on Wechsler VIA-PIQ Discrepancy

Empirical studies of the child in terms of a significant WISC VIP-PIQ discrepancy are extremely infrequent. Most of the work reported has been based upon adolescent or adult populations. In this vein, Prentice and Kelley (1963) on reviewing the literature on a PIQ-VIG pattern and delinquency concluded:

> "With respect to Wechsler's contention that PIQ-VIQ is diagnostic of adolescent psychopathy, the findings are in substantial agreement. Almost without exception, these studies based largely on adolescent populations report the significant elevation of Performance over Verbal IQ's. Moreover, this pattern is sustained generally in the majority of other studies in spite of decided variations in age, sex, race, setting, and form of Wechsler scale administered, as well as substantial differences between the criteria for delinquency. (p. 333)

In a discussion of possible explanations for such an association, their finding that in many of the studies reported the PIQ was in the normal range while the VIQ tended to be in the dull normal range led them to suggest that a lower VIQ than PIQ "may be diagnostic of some learning disabilities whether or not they occur in a delinquent context (p. 335)."

A similar interpreation was advanced in a more recent study by Camp (1966). In this study, the WISC records of 139 acting-out and delinquent children were examined. The results indicated that while the girls did not differ significantly from the standardization population, the boys showed a significantly larger proportion with PIQ>VIQ than in the standardization population. However, she argued that this finding should not be translated to mean that a PIQ>VIQ pattern is diagnostic of delinquency but rather it is more likely to reflect a specific learning disability.

Corroborative evidence as to the necessity for taking into account the possible influences of a learning difficulty comes from a series of independent studies by Graham and Kamano (1958); Kallos,

Crabow, and Guarine (1961); and Neville (1961) in which the WISC profiles of disabled readers were examined. For the purposes of this study, the study conducted by Graham and Kamano is exemplary. These researchers first recognized that a similarity existed between the Wechsler pattern of unsuccessful readers and that pattern attributed to delinquents. Their results demonstrated that in their sample of delinquent males the traditional adolescent delinquent pattern of VIQ-PIQ held for poor readers but not for adequate readers.

In a subsequent study concerning the VIQ-PIQ difference of delinquents tested with the WISC, Henning and Levy (1967) demonstrated that:

1. The delinquent group again exhibited a superior PIQ relative to their VIQ.
2. The Wechsler intra-subtest pattern of delinquents was a function of a reading disability factor rather than a sociopathic personality.
3. Inferiority of the VIQ to PIQ did not seem to be a function of this poor reader subtest pattern. In their words, "a VIQ-PIQ disparity may be largely independent of reading disability and the result of an unknown influence (p. 167)".

In essence, the above interpretations, in which some kind of learning disability has been posited to account for a PIQ-VIQ pattern, may be incorporated into the idea of a "restricted language code" as advanced by Bernstein (1965). He states:

> "The most general condition for the emergence of this code is a social relationship based upon a common, extensive set of closely-shared identifications and expectations self-consciously held by

> the members. It follows that the social relationship will be one of an inclusive kind. The speech is here refracted through a common cultural identity which reduces the need to verbalize intent so that it becomes explicit...(p.155)."

Viewed from a psychological perspective, Bernstein makes the point that the restricted language code retards the orientation to symbolize in an explicit verbal form. Briefly, children who have developed only such a code are seen as exhibiting different intellectual procedures. The implications of the preceding discussion for intelligence test performance are clear. In this regard, Bernstein (1964) comments:

> "There is also firm evidence showing a relative deterioration in verbal IQ between the ages of eight and eleven years for working-class children when compared with middle-class children between the same ages...This deterioration in verbal IQ; discrepancy between verbal and nonverbal IQ tests...is thought to be closely related to the control on types of learning induced by a restricted code...(p. 69)."

Research pertaining to the opposite WISC configuration, that is, a VIQ-PIQ pattern, was found to be far less extensive and almost totally confined to the analysis of subtest patterns consequent to brain damage. While such investigations of brain-damaged subjects are not applicable to the intent of this study, they do provide a flavor as to the consistent perceptual-motor incoordination interpretation ascribed by clinicians to a VIQ>PIQ (Clements and Peters,

1962; Bortner, 1968; Berko, Berko, and Thompson, 1970; Waugh and Bush, 1971).

Rapaport (1945) has stated that motor-activity plays an essential role in determining success or failure on the Performance section of the W-B scale. He has further pointed out that three Performance subtests, Block Design, Object Assembly, and Digit Symbol are primarily dependent upon visual-motor coordination ability for successful performance.

A factorial analysis of the WAIS by Cohen (1956) showed that the Digit Symbol, Block Design, and Object Assembly loaded consistently on a non-verbal organization factor. In a later downward extension of factors established on the WAIS, Cohen's (1959) factorilization study of the WISC confirmed the higher perceptual-motor content of the Performance section. Particularly, he noted that the Block Design and Object Assembly subtests loaded exclusively on a specific ability in speeded perceptual organization.

It is not the intention of the present study to make any statement with regard to psychological deficit attendent upon childhood brain damage.* However, perceptual-motor incoordination has been treated as a major component system of the more inclusive category of childhood brain damage. Therefore, the reveiw which follows has been obligated to deal in a very cursory fashion with the literature on brain damage. It is to be recognized that no claim as to a comprehen-

*This subject, under the label of minimal brain dysfunction, has been comprehensively reviewed by Reitan (1962), Yates (1966), and Zimet and Fishman (1970).

sive statement is made.

Guertin, Ladd, Frank, Rabin, and Hiester (1966) have reviewed the literature relating to WAIS performance and brain damage. These authors concluded that:

1. "The research literature continues to validate the finding that the garden variety type of neuro-pathology is manifest most apparently in the performance of relatively non-verbal tasks of the Wechsler. ."(p. 399).

2. "Most sensitive to the effect of cerebral dysfunction are Block Design, Object Assembly, and Digit Symbol . ."(p. 400).

In an intensive review of the literature on the WISC during the decade prior to 1960, Littell (1960) reported only one study dealing with brain damage in children. This study, by Beck and Lam (1955), investigated the records of 104 children divided into two diagnostic groupings, organic and non-organic. It was found that organics tended to score lower on the WISC Performance than on the Verbal scale.

Identical results were reported in a study by Dennerll, Broeder, and Sakolov (1964) in which the WISC VIQ>PIQ pattern was found to be present in a group of children with confirmed cerebral damage.

It is evident that these two studies have had a concurrent validity emphasis in the sense that a VIQ>PIQ WISC pattern has been validated on clearly demonstratable brain damaged groups. The next group of studies to be considered have focused upon a predictative validity approach in that they have assesed the diagnostic potency of a WISC sign approach in

the identification of suspected childhood brain damage.

In brief, these investigators, among them Rowley (1961); Horne and Justin (1967); Reed and Reed (1967) reported the following general finding: that the WISC pattern of VIQ>PIQ did not provide a basis for differentiating the suspected brain damaged child from non-damaged children.

To sum up, this review has attempted to show that the perceptual-motor incoordination explanation for a VIQ>PIQ pattern has derived from two main sources:

1. Factorilization studies of the WAIS and the WISC in which a majority of the Performance section tests have been found to load on a factor requiring the organization of visually perceived materials against a time limit.
2. The literature pertaining to intelligence test performance of children with central nervous system disorders.

While the predominant view is that a VIQ>PIQ often reflects a specific deficit in perceptual-motor functioning, one might ask if there is not another way of looking at the matter. An essential (but often neglected) element in this area is the timed nature of the Performance subtests. As pointed out elsewhere, the child who works in a cautious and deliberate manner runs the risk of being penalized on such timed items. It makes one wonder, therefore, how many children, diagnosed as perceptually handicapped on the basis of their having Performance scores considerably lower than their Verbal scores, were not instead simply reflective in attitude. It should be made clear that this study is not maintaining that such a profile is never indicative of some kind

of perceptual-motor impairment. However, if this study demonstrated that a reflective disposition was associated with a lowered Performance score, such a finding would lead one to question whether or not the label of perceptual handicap is applied too frequently and perhaps indiscriminately, to children showing this profile.

Some General Conclusions

Although there is a considerable body of research in which investigators have reported on correlates of reflection-impulsivity, very few studies have yet attempted to investigate this dimension with regard to intelligence test performance per se. It was already indicated that those studies which have investigated the intelligence test performance of reflectives and impulsives employed group intelligence tests as their instrumentation. An attempt can now be made to answer the questions raised earlier as to whether this kind of instrumentation yields an optimal measure of intelligence for impulsives and reflectives alike. Three main conclusions are suggested by the review of the literature:

1. Being paper and pencil tests, they nearly always require good reading and thus may be unreliable with poor readers. If Kagan's findings as to reading errors being significantly related to the index of impulsivity are taken into account, then it is apparent that impulsives would be handicapped on such group intelligence tests.
2. The content of group intelligence tests are of a relatively homogeneous nature, that is, most of the items presuppose a certain verbal facility. In this sense, these tests may

be more appropriately regarded as tests of scholastic aptitude. Again, if Kagan's findings as to an association between reflection and verbal superiority are accepted, it is evident that impulsives would fare much worse on such tests than reflectives.

3. Group intelligence tests rely on questions where the answer is usually a choice among alternatives (multiple choice). This type of format bears on obvious similarity to the kind of tasks employed in the MFF test. In short, both formats emphasize response uncertainty. As a result, the differences in IQ scores between reflectives and impulsives may be attributed to the effect of response uncertainty situations employed in the test construction of both the MFF and group intelligence tests. This would seem to be a reasonable interpretation if account is taken of the fact that the impulsive child fails to give careful consideration to alternatives.

With a view to arriving at a more accurate assessment of the relationship between reflection-impulsivity and intelligence, it seems advisable, therefore, to employ an individually administered test of intelligence containing a heterogeneous sampling of cognitive tasks.

The review of the literature pertinent to a VIQ-PIQ discrepancy indicated that the typical approach to the bulk of these studies has been the attempt to place individuals on the basis of their difficulty with certain types of Wechsler content into a given diagnostic category. This has proved to be an extremely unfortunate tendency for as pointed

out in a previous chapter it is doubtful whether these diagnostic categories can be regarded as of fundamental significance to an empirical analysis of intellectual functioning. Basically, the previously cited researchers have treated these diagnostic labels as if they were accurately defined and easily detectable experimental variables. However, it is to be recognized that these diagnostic categories do not possess the status of a scientific concept, and therefore efforts to relate a VIQ-PIQ discrepancy to them are of questionable value. Further, even in those instances where correlations were obtained between a VIQ-PIQ discrepancy and these labels, the reasons for these correlations have not always been clear. Thus, the importance given earlier to the use of a specific psychological variable, such as reflection-impulsivity, in the study of a VIQ-PIQ discrepancy appears to be justified by the review.

CHAPTER 4

ANTECEDENTS OF REFLECTION-IMPULSIVITY

Although Kagan and his co-workers admit the possibility that constitutional factors may play a role in the development of reflection-impulsivity, the main emphasis with respect to the origins of this disposition is upon psychological bases. Thus, Kagan's speculations as to the dynamics of reflection-impulsivity range from the assumption that a strong desire to appear competent underlies the tendency to be cognitively impulsive (Kagan, 1966) to his current view that anxiety over error is the primary determinant of a cognitive reflective orientation (Kagan, 1970). Before discussing further these dynamic bases, it may be worthwhile, in order to provide a balance to a strictly psychological interpretation, to consider the influence of consitutional differences in the genesis of reflection-impulsivity.

Two trends in Kagan's thinking on the relationship between constitutional factors and reflection-impulsivity can be discerned. On the one hand, Kagan (1966) speaks of subtle cerebral insult as a possible antecedent condition of cognitive impulsivity. Specifically, in commenting on the neurophysicological bases of inhibition, he states:

> "Higher frequencies of anoxia, hyperbilirubinemia, and toremia in pregnancy increases the risk of subtle damage to the brain stem centres and, therefore, insult of inhibition systems. The hyperkinesis of a child with brain damage is presumed to be a partial result of such insult and could be one of the determinants of conceptual impulsivity." (p. 510).

The above statement suggests the idea that some kind of pathological, organic etiology is involved in cognitive impulsivity. In this instance, Kagan seems to be leaning toward the hypothesis that cognitive impulsivity may be part of either a minimal brain dysfunction syndrome (Clements and Peters, 1962) or Eisenberg's (1957) diagnostic category of hyperkinesis.

The main difficulty with this line of theorizing is that the assumption about brain dysfunction in children who exhibit cognitive impulsivity derives from the observation of motor restlessness and distractibility in these children. It is evident, therefore, that the main criterion for positing a congenital deficit factor is a strictly behavioral one, and not one established by neurological means. Hence, the validity of the organic etiological assumption as a causative agent in cognitive impulsivity is an interesting but largely unsubstantiated hypothesis.

More recently, Kagan (1970) has speculated that apart from brain deficits, there may be biological variables which contribute to this disposition. In this regard, Kagan speaks of a conceptual tempo factor, and notes that "some people appear to process information rapidly; others process information slowly, even in situations where the negative sanctions of public failure are lifted (p. 1317)." He further goes on to suggest that differences in tempo of processing may not be completely the product of experience but may also be a product of biological individuality.

There is some evidence that may be interpreted as supporting the hypothesis that differences in tempo and inhibition have a genetic base.

For example, Schaefer and Bayley (1963) have found that extremely active one-year-old infants were minimally attentive to intellectual problems at five and six years of age. Preliminary evidence from an ongoing longitudinal study by Kagan (1970) suggest that children who as infants were motorically active tend to be cognitively impulsive in later school years. Further evidence supporting Kagan's view that reflection-impulsivity is partially related to biological bases is provided by Thomas, Chess, and Birch (1963) who studied tempermental individuality in childhood. The results of this longitudinal study indicated individual differences in activity level, attention span, and persistence among infants which were still apparent during later childhood. At this stage the matter is far from conclusive, however, the above data are persuasive of the notion that reflection-impulsivity may be influenced by biological factors.

As already mentioned, Kagan places by far the most weight on psychological factors regarding the antecedents of reflection-impulsivity. The first interpretation formulated by Kagan (1966) asserted that the child's definition of competence determines whether he will adopt a cognitively reflective or impulsive strategy. Because impulsives tend to equate speed with competence, they are consequently predisposed to produce answers quickly. For the reflective, competence is defined in terms of avoidance of making a mistake which predisposes him to consider his answers carefully.

At present, Kagan (1970) believes that a child's tendency to be reflective or impulsive (in tasks having response uncertainty) is a function of anxiety over error. He states:

> "Minimal anxiety over a potentially inaccurate answer is likely to be a primary determinant of an impulsive performance. Reflectives seem to be overly concerned with making a mistake and wish to avoid error at all costs. Impulsives seem minimally apprehensive about error and consequently respond quickly." (p. 1314).

Studies which have attempted to change the child's disposition to be reflective or impulsive possess a direct relevance for a consideration of the relative influence of constitutional and environmental factors upon this dimension. In one study (Kagan, Pearson and Welch, 1966b), first-grade children were divided into training and control groups. Children in the training group were required to inhibit a response for 15 seconds, while the control group experienced no training. After several 30-minuted training sessions, children in the training group showed longer response times to a strange examiner who did not impose any time constraints.

In another study, Debus (1968) attempted to modify response time through exposure to reflective and impulsive models that responded to tasks with latencies of 30 and 7 seconds respectively. His results showed that subjects exposed to the reflective model increased their response time, while subjects exposed to the impulsive model decreased their response time.

In a related study, Yando and Kagan (1968) classified 20 first-grade teachers as reflective or impulsive according to their performance on an adult version of the MFF test. To determine whether the teachers' conceptual tempo would influence the tempo exhibited by his students,

a random sample of subjects from each of the 20 classrooms was administered the MFF test at the beginning and end of the academic year. The subjects showed a significant change in tempo in the direction consonant with the teacher's tempo. This effect was greatest for impulsive boys assigned to a reflective teacher.

Although one might question the permanence and generality of the changes produced by the above training procedures, nonetheless, these studies do suggest that reflection-impulsivity is a dimension that can be modified by training. If this is so, then environmental influences appear to exert a stronger influence in the genesis of reflection-impulsivity than do constitutional bases. However, this position is not without qualification. It could be that the band of freedom with regard to modification is greater in the moderate range of reflection-impulsivity but decreases as the extreme ends of this continuum are approached. Although there is no experimental data on individual differences in the modifiability of reflection-impulsivity, it may well be that the amount of change possible is also marked by a curivilinear effect, i.e. the efficiency of training procedures decline beyond the midranges of a reflective or impulsive disposition.

In sum, the present study proposes the following integrative hypothesis concerning the origins of cognitive style. It is assumed that any given child begins life with a certain predisposition to style which may change under the impact of environmental forces. The effect of environmental influences, of which parental child-rearing practices are perhaps the most significant, is to modify these early proclivities to style, either by increasing or decreasing their tendency to expression.

Thus, the approach to the determinants of reflection-impulsivity advocated here is to regard this dimension as the product of both constitutional and environmental factors. There are two senses in which this integrative position can be conceptualized. First, and after the fashion of Kagan, relatively more weight may be assigned to environmental influences in the genesis of reflection-impulsivity than to constitutional ones. However, to understand reflection-impulsivity as an almost pure consequence of experience seems difficult to maintain in the case of those children who occupy extreme positions on this continuum. In these children, initial proclivity to style may be a stronger determinant thus rendering them relatively impervious to environmental influences.

CHAPTER 5

METHODOLOGY

Some Methodological Problems

Previous studies have treated the reflection-impulsivity variable as a categorical variable in which the continuously measured dimension of reflection-impulsivity has been reduced to two categories. The biserial coefficient was thus used to assess the degree of relationship between reflection-impulsivity and various measures of cognitive ability (Kagan, 1963; Souch, 1970). Since the biserial coefficient is a product moment coefficient, the demand for linearity of regression must be satisfied. This study could not find any instance where previous researchers have evaluated this requirement of linear regression. It seems reasonable to conclude, therefore, that ETA coefficients were not computed in these studies. The present study did not assume linearity of regression. Rather, this study has employed appropriate statistical procedures, which are outlined below, to ascertain whether or not the relationship between reflection-impulsivity and the quality of intellectual achievement assumes a linear or a non-linear regression.

In addition, it will be recalled that the question was earlier raised as to the suitability of treating reflection-impulsivity as a unitary dimension. It was suggested that the variables of reflection and impulsivity might undergo some change in meaning as the extremes of each were approached. To check this possibility, the following major refinement of Kagan's procedure for classifying subjects into reflectives and impulsives was introduced.

Rather than splitting the sample into the reflective and impulsive groups at the median of the subjects response time, the median response time was employed as a reference point to treat the reflection-impulsivity dimension as a continuous variable. Specifically, since Kagan has adopted the median as a measure of central value, the measure of variability used in this study was the semi-interquartile range. This refinement of Kagan's procedure allowed for the reflection-impulsivity dimension to be treated as a spectrum in which differentiation among groups of reflectives and impulsives into moderate and high forms of each were made. Whereas Kagan and later researchers have assumed homogeneity among these two groups, it seemed likely to expect that differences might exist between subjects whose average response time placed them toward the extremes of the reflection-impulsivity continuum and subjects whose scores were closer to the sample median.

In sum, all subjects were coded for analysis into groups 1, 2, 3 and 4. Subjects categorized as Groups 2 and 3 (moderate reflectives and impulsives) represented average response time scores which fell in the low middle and high middle quarters. Groups 1 and 4 (high reflectives and high impulsives) contained subjects whose average response time scores fell within the lowest and highest quarters. This differentiation into groups according to the subject's average MFF response time is represented graphically in Figure 1.

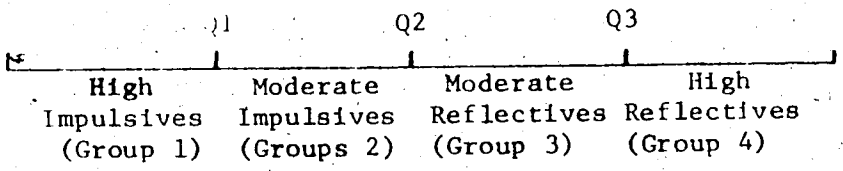

Figure 1. Diagrammatic representation of the groups classified according to average MFF response time.

Operational Definitions

The following restricted definitions of concepts which are basic to the discussion and propositions in this study were employed:

1. Reflection-Impulsivity is defined according to the MFF test as developed by Kagan. As defined by Kagan, the disposition of reflection-impulsivity indicates a tendency to reflect over alternative solution possibilities in problems with high response uncertainty. The chief operational index of this variable is response latency in visual discrimination tasks requiring the subject to match a standard stimulus with an identical stimulus located in an array of highly similar variants.

(a) Latency is the average response time in seconds to first response for all tasks on the MFF test.

(b) Reflective is defined by scores on the MFF test that are above the median on response time.

(i) Moderate reflectives were defined by scores which fell in the high middle quarter.

(ii) High reflectives were defined by scores which fell in the highest quarter.

(c) Impulsive is defined by scores on the MFF test that are below the median on response time.

(i) Moderate impulsives were defined by scores which fell in the low middle quarter.

(ii) High impulsives were defined by scores which fell in the lowest quarter.

2. General Intelligence is equated with behavior and is limited to specific overt responses as measured by the WISC. Hence, IQ is the score obtained by a subject on the above intelligence test.

Research Hypotheses

Based on the discussion presented in Chapter One, the following operational hypotheses were formulated for the study.

Hypothesis 1. The subjects' average MFF response time scores will be curvilinearly related to their Full Scale WISC IQ scores.

Hypothesis 2. Short response latency subjects will show a pattern of achievement in which their performance scores will exceed their verbal scores.

Hypothesis 3. Long response latency subjects will show an opposite pattern of achievement in which their verbal scores will exceed their performance scores.

Sample

A total of 80 children (40 females and 40 males) from two elementary schools in the Edmonton area were selected for testing. This was not a random sample. Rather, the sample represented all children in classrooms

of grade four from the two schools who met the Blishen criteria of a middle-class social status level and who had passed their tenth birthday but not reached their eleventh birthday. Since relatively more work has been done to study the relatedness of social-class to reflection-impulsivity, it was considered desirable to obtain information on how this dimension manifests itself in children who come from a homogeneous social background. Hence, the sample consisted of children from a mid-socioeconomic level. Blishen's (1967) Canadian Occupational Scale was employed to provide quantitative validation that the subjects selected from the schools were representative of individuals from middle-class socioeconomic backgrounds. The mean Blishen scale score for the sample was 62.4 with a range of 81.2 (Professor) to 54.8 (Teacher).

In addition, the reflection-impulsivity dimension was examined from the adaptive role it played in intelligence test performance. In short, this was not a developmental study in which the assumption of a linear development from impulsivity to reflection was made. As a result, children aged 10 served as subjects. This age level is consistent with Kagan's assertion that reflection-impulsivity is a stable behavioral style at age 10. Further, the study by Souch (1970) failed to demonstrate a tendency for boys and girls to become more reflective as they grow older.

Materials

The Matching Familiar Figures (MFF) Test was used to provide a measure of reflection-impulsivity. Kagan et al (1964) have stated that the MFF test is the most sensitive technique for assessing an individual's conceptual tempo. The twelve items of the MFF test consist of a familiar picture, the standard, and six variants. The subjects were shown a

familiar picture (the standard) and six stimuli, only one of which was identical to the standard. They were asked to select the one picture that was an exact duplicate of the standard. A record was kept of response time only for reasons which are presented later.

Blishen's Canadian Occupational Scale (1967) was used to provide documentation of the social class background of the subjects selected for study. Blishen's 1967 index, based on 1961 national census data, was constructed according to the major variables of income level and educational level of the father's occupation. For each of 320 occupations, a socioeconomic index scores was thus calculated. The occupations were then ranked on the basis of these socioeconomic index values, resulting in a scale ranging from 25.36 to 76.69. Previous research (Elley, 1961) has demonstrated the adequacy of Blishen's scale for measuring social stratafication in the Edmonton area.

The Wechsler Intelligence Scale for Children was used to provide a measure of intellectual ability. The correlation coefficient used for the WISC was the split-half coefficient, corrected by the Spearman-Brown formula. The Full Scale, Verbal Scale, and Performance Scale reliability coefficients based upon an N of 200 for age 10 are .95, .89, and .96, respectively. Further, the standard error of measurement expressed in IQ units for Verbal, Performance and Full Scale IQs are 3.00, 4.98,and 3.35. The score represented a prorated value for reasons which are outlined in the next section. This was not felt to be any great difficulty since the correlation between almost any short form and the score derived from the full scale is very high. Zimmerman and Glasser (1967) indicate that a combination of Information, Similarities, Vocabulary, Block Design, and Coding correlate with Full Scale IQ above .96.

Procedure

All 80 subjects were seen individually by the author over a period of two months. First, the MFF test was administered to all subjects followed immediately by the WISC in one session. The subjects were assured that the test results would not be entered into their school records. All of the subjects were cooperative and participated eagerly in the testing procedures.

Verbal, Performance and Full Scale IQ scores were obtained from the WISC which was administered, following standard instructions as outlined by Wechsler (1949) to each subject by the investigator.

The MFF test was administered according to the set of instructions provided by Kagan. Each subject was presented with two sample items and told, "I want you to find one figure among these (pointing to the variants) that matches exactly the one in this picture (pointing to the standard)." After the correct figures had been identified for each sample item, the investigator said:

> "I'm going to show you twelve more cards. For each one, I want you to first look at the top figure and then find one exactly like it. Remember, only one of the figures is exactly the same as the top one."

The twelve cards were presented in order and no further instructions were given to the subjects.

As previously indicated, the MFF test was scored according to the major variable of response time only. This deviates somewhat from the typical scoring procedure as set forth by Kagan (1965, 1966) in which a subject's score is based upon number of errors as well as response

time. However, since the theoretical bases of this study were formulated in terms of latency of response as the major independent variable, the tabulation of total number of errors was not relevant to the predictions of the present study. Therefore, the major MFF variable scored was the average response time to the nearest half-second to first selection across the twelve-item test.

With regard to the prorated WISC IQ method, the main criterion used for selection was construct validity with the type of ability demonstrated by Cohen (1959) to be basic to performance across different tasks. Flieshman's (1966) distinction between ability and skill, wherein the former is postulated to account for consistencies in performance among specific subtests, and the latter referring to the level of proficiency exhibited on any given subtest, provided the rationale for selection.

On this basis, the Information, Comprehension, Similarities, and Vocabulary subtests of the Verbal section were chosen because they have been shown to lead consistently on a specific ability in Verbal Comprehension (Cohen, 1959). Similarly, Block Design, Object Assembly and Digit Symbol were selected from the Performance section since Cohen had also demonstrated that the variance of these subtests is almost completely accounted for by perceptual-motor coordination. Also, it was felt that the Picture Completion and Picture Arrangement subtests possess some commonality to the tasks which constitute the MFF test and could, therefore, have been a source of contamination.

Statistical Analyses

The following statistical devices were employed to test the hypotheses:

Hypothesis 1. The subject's average MFF response time scores will be curvilinearly related to their Full Scale WISC IQ scores. The present study computed both a Pearson Product-Moment coefficient and a correlation ratio to establish the degree of relationship between the stated variables. Using the above coefficients, the F test of linearity of regression was applied to determine if any curvature in regression was present. Finally, a one-way analysis of variance was computed for the subjects' scores on the MFF test and the WISC.

In order to obtain a clearer picture of the meaningfulness of these correlations in terms of IQ points, the distribution of MFF response times were split at the median, and mean IQs for each of the four groups compared. A Newman-Keuls comparison between ordered means was executed to determine if there were significant differences among the group means.

Hypothesis 2. Short response latency subjects will show a pattern of achievement in which their performance scores will exceed their verbal scores.

Hypothesis 3. Long response latency subjects will show an opposite pattern of achievement in which their verbal scores will exceed their performance scores.

The following statistical procedures were used to test the above hypotheses:

1. The sample of respondents were divided at the median response time into a top quartile group and a bottom quartile group (high reflectives and high impulsives) as well as low middle quartile group and a high middle quartile group (moderate reflectives and moderate impulsives).

The mean Verbal and Performance IQ's for each group were calculated. The Verbal Minus Performance IQ were computed for each group along with a "t" ratio to test the significance of the V-P difference. Finally, to investigate the relative merits of a reflective versus impulsive response style, the mean subtests scaled scores for the high reflective and impulsive groups were ranked.

CHAPTER 6

RESULTS AND DISCUSSION

In this Chapter the results of the statistical analysis of the data pertaining to the hypotheses proposed in this study are presented. The first section reports on the testing of the hypotheses. The second section presents a discussion of the results.

Testing the Hypotheses

The achievement of the subjects was generally above average, the average WISC Full Scale IQ score being 110.5 (SD = 6.50). The mean IQ for female subjects was 111.4 (SD = 7.02), with a range of 99 to 125. For male subjects, the mean IQ was 109.7 (SD = 6.00), with a range of 99 to 121.

The 80 children on the MFF test had a mean response time to the subject's first selection of 25.32 seconds (Males = 18.72 seconds; Females = 32.05 seconds). Compared with the data reported by Kagan (1966a), the present sample of children had a higher level of response time (i.e. Kagan's fourth graders had a mean response time of 15.50 seconds). The mean response time for the 20 male impulsive children was 12.3 seconds, whereas for the males classified reflective, the mean response time was 23.6 seconds. When the male impulsive and reflective groupings were broken down further into high and moderate forms of each, the following mean response times were obtained: High Impulsives (Group 1) = 10.3 seconds; Moderate Impulsives (Group 2) = 14.3 seconds; High Reflectives (Group 4) = 27.5 seconds, and Moderate Reflec-

tives (Group 3) = 19.7 seconds. For the 20 female subjects classified as impulsive, the mean for response time was 22.5 seconds, whereas the mean response time for the 20 female reflectives was 41.8 seconds. Of the impulsive female grouping, the mean response time for High (Group 1) and Moderate (Group 2) groups were 17.1 and 27.9 seconds, respectively. Mean response times of 47.4 and 36.6 seconds were obtained for the High (Group 4) and Moderate (Group 3) female reflective groupings. Table I presents a summary of the above results.

TABLE I

MEAN RESPONSE TIME SCORES OF
THE REFLECTIVE AND IMPULSIVE GROUPS

	Reflectives	High	Moderate
Males	23.6	27.5	19.5
Females	41.8	47.4	36.6

	Impulsives	High	Moderate
Males	12.3	10.3	14.3
Females	22.5	17.1	27.9

Testing the Hypotheses

Hypothesis 1. The first hypothesis stated that there would be curvilinear relationship between MFF average response time scores and WISC Full Scale IQ scores. The results of the analysis of data are presented separately for each sex. However, the discussion of these findings is presented together for Hypothesis One. The statistical analysis of the data with respect to this hypothesis was in two parts: a correlational analysis and an analysis of variance.

It was considered most expedient to employ scattergrams to illustrate the quality of intellectual performance according to the different positions occupied by the subjects on the reflection-impulsivity dimension. Figures 2 and 3 present data with reference to MFF response time scores in relation to WISC Full Scale IQ scores for female and male subjects, respectively. In order to facilitate the presentation of these figures, the mid-points of the class intervals for the MFF test scores were used. For example, instead of a class interval of 10-14 for female MFF scores, the mid-point of 12 was used to represent this interval. An identical format was employed with the male MFF test scores as well.

Inspection of these figures indicate that response time has an inverted U-shaped relationship with intellectual achievement. Thus, it is evident from these figures that in general, quality of achievement initially increases with response time to a maximum in the center and then shows impairment with further increase in response time.

The correlation analysis of the relationship between MFF response

FIGURE 2

A SCATTER DIAGRAM OF MFF RESPONSE TIME SCORES AS COMPARED WITH WISC FULL SCALE IQ SCORES (FEMALES)

Full Scale IQ Scores	MFF Response Time Scores								
	12	17	22	27	32	37	42	47	52
123 - 125						1	1		
120 - 122				2	1	1			
117 - 119				1	1		1	1	
114 - 116			1	2	1	1			
111 - 113					1		1		
108 - 110		2	2		2		1	1	1
105 - 107	1		1		1	1	1	1	2
102 - 104	1	1	1						1
99 - 101	1			1					
TOTAL	3	3	5	6	7	4	5	3	4

FIGURE 3

A SCATTER DIAGRAM OF MFF RESPONSE TIME SCORES AS COMPARED WITH WISC FULL SCALE IQ SCORES (MALES)

Full Scale IQ Scores	MFF Response Time Scores								
	7	10	13	16	19	22	25	28	31
120 - 122					2				
117 - 119					3				
114 - 116				3	2			2	1
111 - 113			1	2			2		
108 - 110	1	2	2			1	2		
105 - 107		1	1						1
102 - 104	2	2	2		1				
99 - 101			1			2			1
TOTAL	3	5	7	5	8	3	4	2	3

time scores and WISC Full Scale IQ scores for male and female subjects yielded Pearson Product-Moments of .237 and .196, respectively. These values were not significant at the .05 level, indicating that no positive linear relationship existed between response latency and intellectual achievement. However, since Figures 2 and 3 suggested a systematic divergence from linearity, that is, the scattering of points was considerably dispersed from any straight line regression, it is likely that the above recorded coefficients were conservative estimates of the true relationship. To check this possibility, a correlation ratio was calculated between the two variables. When a correlation ratio was calculated between the two variables, eta coefficients of .636 and .608 were obtained for males and females, respectively. These coefficients were significant at the .01 level.

The fact that the eta coefficients were much larger than the Pearson coefficients suggested that curvature in regression was present. To evaluate whether or not this curvature was genuine and not merely a chance deviation from linearity, the F test of linearity was employed. The obtained F values of 3.12 and 2.38 for male and female subjects, respectively were significant beyond the .05 point. These data indicated acceptance of the general hypothesis predicting a curvilinear relationship between MFF response time scores and WISC Full Scale IQ scores.

The analysis of variance for the subject's scores on the WISC scale are presented in Tables II and III, where it is evident that the obtained F's of 4.30 and 3.95 for male and female subjects, respectively, are significant at the .01 point.

TABLE II

SUMMARY OF ANALYSIS OF VARIANCE FOR IQ SCORES (MALES)

Source	MS	df	F	P
Groups	119.67	3.	4.30	0.01
Error	27.82	36.		

TABLE III

SUMMARY OF ANALYSIS OF VARIANCE FOR IQ SCORES (FEMALES)

Source	MS	df	F	P
Groups	177.48	3.	3.95	0.01
Error	44.95	36.		

In order to obtain a clearer picture of the meaningfulness of the curvilinear relationship in terms of IQ points, the distributions of MFF response time scores for girls and boys were split at the median, and mean IQs for the upper and lower halves of each were compared. The IQ differences were not significant, by t test, for reflectives and impulsives (females, t = .585; males, t = 1.87). However, significant IQ differences were found when these homogeneous reflective and impulsive groups were broken down into moderate and high sub-groupings. The Newman-Keuls procedure was used in order to determine if there were significant differences between the groups means. Tables IV and V show the results of the Newman-Keuls comparisons between ordered means for males and females, respectively.

TABLE IV

NEWMAN-KEULS COMPARISON BETWEEN ORDERED MEANS FOR IQ SCORES (MALES)

Groups	3	2	4	1
Means	113.100	110.300	108.200	104.900
1. 104.900	8.200*	5.400	3.300	0.0
4. 108.200	4.900	2.100	0.0	
2. 110.300	2.800	0.0		
3. 113.100	0.0			

*significant at .05 level.

TABLE 4

NEWMAN-KEULS COMPARISON BETWEEN ORDERED MEANS FOR IQ SCORES (FEMALES)

Groups	3	2	4	1
Means	116.400	115.000	109.300	107.800
1. 107.800	8.600*	7.200	1.500	0.0
4. 109.300	7.100*	5.700	0.0	
2. 115.000	1.400	0.0		
3. 116.400	0.0			

* significant at .05 level.

An inspection of Table 4 shows that the mean for Group 1, the high impulsive boys, was not significantly different at the .05 level than the mean for Group 4, the high reflective boys, while the mean of the moderate reflective boys, Group 3, was found to be significantly higher than Group 1, the high impulsive boys. The results depicted in Table 5 indicate that, similar to the male subjects, no significant differences were found between the means of the high female reflective and impulsive groups. Among the female subjects, the moderate reflective group, Group 3, was found to have a mean IQ score significantly higher than both Groups 1 and 4, the high impulsive and reflective groups.

Hypotheses 2 and 3.

Since hypotheses 2 and 3 were closely linked in their predictions, the presentation of the results of the analysis of the data is

combined for these hypotheses. Hypothesis 2 predicted that short response latency children would show a pattern of achievement in which their performance scores exceeded their verbal scores. Hypothesis 3 predicted an obverse pattern of achievement for long response latency children, that is, their verbal scores would exceed their performance scores. As was the case in Hypothesis 1, the findings pertaining to these hypotheses are presented separately for each sex, but discussed together.

The mean Verbal and Performance I.Q.'s for the reflective and impulsive groups are contained in Tables VI and VII. Verbal minus Performance I.Q.'s (V-P) is also presented along with a t ratio computed to test the significance of the V-P differences.

As can be seen from Table VI, both moderate and high impulsive boys earned significantly higher Performance IQs than Verbal IQs. For example, the high impulsive boys' Performance IQ was 109.1 or 9.6 IQ points higher than their Verbal IQ of 99.5. The analysis of the results for moderate and high reflective boys shows that, in general, reflective boys had a depressed Performance IQ compared to their Verbal IQ, but that this difference achieved statistical significance only in the case of the high reflective boys. An examination of Table VII reveals a consistent superiority of the Performance IQ to Verbal IQ among the female impulsive groups. Although the patterning of achievement of the moderate impulsive girls was in the expected direction, the high impulsive girls' difference of 8.2 IQ points between the Performance and Verbal scales was the only difference to attain statistical significance. While moderate reflective girls showed only a very slight

TABLE VI

COMPARISON OF MEAN VERBAL AND PERFORMANCE IQs FOR REFLECTIVE AND IMPULSIVE GROUPS (MALES)

	VIQ	PIQ	MEAN DIFFERENCE	"t"
Reflectives				
High (Group 4)	111.8	104.5	+7.3	2.45*
Moderate (Group 3)	113.6	110.1	+3.5	.873
Impulsives				
High (Group 1)	99.5	109.1	-9.6	4.25*
Moderate (Group 2)	106.7	112.5	-5.8	2.58*

* significant at .05 level

** significant at .01 level

TABLE VII

COMPARISON OF MEAN VERBAL AND PERFORMANCE IQs FOR REFLECTIVE AND IMPULSIVE GROUPS (FEMALES)

	VIQ	PIQ	MEAN DIFFERENCE	"t"
Reflectives				
High (Group 4)	112.9	105.9	+7.0	2.29*
Moderate (Group 3)	115.6	114.5	+1.1	.276
Impulsives				
High (Group 1)	103.6	111.8	-8.2	2.50*
Moderate (Group 2)	111.4	116.5	-5.2	1.17

*significant at .05 level.

discrepancy between their Verbal and Performance scores, there was a marked tendency among high reflective girls for their Verbal IQ to dominate as noted from the positive V-P difference of 7.0 IQ points. These results would appear to indicate that the premises underlying hypotheses 2 and 3 were substantiated.

To investigate the possible cause of the V-P discrepancies, the mean subtest scale scores for the high reflective and impulsive groups were ranked. These groups were selected for subtest analysis because, with the exception of the moderate impulsive boys, they showed the most dramatic split in their verbal and performance achievement. Further, since the subtest scores are correlated with the IQs, it was expected that the subtests would also discriminate the achievement of the high reflective and impulsive children. In Tables VIII and IX the mean scores on the subtests and their respective ranks for the high reflective and impulsive groups are presented.

As shown in Tables VIII and IX, the differences in subtest rankings between the high reflective and impulsive groups is generally in line with the previously described sharp break between verbal and performance scores of these two groups. Thus, one of the most evident characteristics of the patterning is that for the high impulsive groups all verbal subtest ranks are low, while the high reflective groups show higher verbal subtest ranks, especially on the vocabulary and information subtests. The one striking, and unanticipated, exception to this trend is the similarities subtests, where both groups share similar high rankings. On the other hand, the high impulsive groups outrank their high reflective counterparts on most of the visual-motor subtests.

TABLE VIII

COMPARISON OF HIGH REFLECTIVES AND IMPULSIVES ON THE WISC SUBTESTS

(MALES)

WISC	High Reflectives		High Impulsives	
Subtests	Mean	Rank	Mean	Rank
Verbal				
Information	12.2	3	9.8	5
Comprehension	11.6	4	8.5	7
Similarities	12.6	1	11.6	2
Vocabulary	12.4	2	9.2	6
Performance				
Block Design	11.0	5	11.4	3
Object Assembly	10.9	6	11.6	1
Coding	10.6	7	11.2	4

TABLE IX

COMPARISON OF HIGH REFLECTIVES AND IMPULSIVES ON THE WISC SUBTESTS (FEMALES)

WISC	High Reflectives		High Impulsives	
Subtests	Mean	Rank	Mean	Rank
Verbal				
Information	11.2	3	10.1	6
Comprehension	10.9	5	9.5	7
Similarities	13.1	1	12.9	1
Vocabulary	11.6	2	10.3	5
Performance				
Block Design	9.1	6	11.6	4
Object Assembly	9.0	7	12.2	2
Coding	11.0	4	12.1	3

in coding, the difference in rank was slight between the high reflective and impulsive girls, but still in favour of the impulsive group. On the block design and object assembly subtests, however, the difference in rank was dramatic, with these tasks clearly favouring the high impulsive groups.

DISCUSSION

The findings of the first hypothesis provide evidence to uphold that portion of the conceptual framework of this study which suggested that the most efficient problem solving ability is associated with intermediate response latency levels. With short response latencies, overall achievement on the WISC suffered. Going to the other extreme, the WISC achievement of long response latency children was also inferior to achievement associated with moderately long response latencies. In brief, the curvilinear relationship was such that moderate response latencies produced maximum achievement, while both short and long response latencies resulted in poorer achievement. This finding of a curvilinear relation between response latency and achievement suggests the utility of postulating a response latency ceiling to account for the occurrence of a decline in achievement of high reflective children.

On the basis of Kagan's theory, it is not difficult to account for the relatively poorer achievement of short response latency children. These high impulsive children who make fast decisions do not sufficiently reflect on the validity of their answers, thereby increasing the likelihood of their rendering an inferior response. A more difficult problem is posed by the occurrence of a decline in achievement of long response latency children. In Kagan's theory, increased response

latency should facilitate problem solving ability. The findings of this study indicate that, while moderate response latencies facilitated achievement, long response latencies were related to a relative decrease in achievement. What seems to be required to handle these findings within the Kagan framework is the auxiliary concept of a response latency ceiling.

In discussing in Chapter One the relationship between reflection-impulsivity and intellectual achievement, the argument was advanced that when response latency reached a certain ceiling level, further increases might sometimes produce a decrement in achievement. The results of the first hypothesis seem to have provided some empirical support for this response latency ceiling concept, in that the more moderate latency levels were optimal for achievement. One should hasten to point out that this concept of a response latency ceiling is in no way intended to deny the general validity of Kagan's assertion that the tendency to reflect upon alternate answers increases problem solving efficiency. What is being suggested is that the findings of this study would seem to call for a bridling of the unrestrained assumption that increases in response latency are always facilitative of problem solving ability. The point to be made is that a law of diminishing returns seem to hold, increasing response latency producing smaller and smaller increments in achievement until this levels out at a point where further increases either yield no further gains, or as demonstrated here, actually produce a decrement in achievement.

A point that deserves emphasis is that the label of "dull" cannot

be meted out to describe the achievement of the high reflective groups. A global IQ rating of 109 falls well within the respectable average range, and may even be considered slightly above average. This fact is cited in order to forestall the argument that the long response latencies of the high reflective children resulted from their inferior ability and not from their active consideration of alternative answers. Had their overall achievement fallen in the mid-nineties or lower, it would have been tenable to claim that their slowness reflected incompetence instead of reflection over competing answers. Clearly, the attained average IQ level does not permit of such an interpretation. Rather, one might speculate that in the high reflective groups what has been taken to be an adaptive cautiousness does not instead belie an overinhibited tendency. This possibility is discussed more fully later where the qualitative aspects of test performance are considered.

A further point for attention is the fact that, unlike the previous studies by Souch (1970) and Michenbaum and Goodman (1969) in which reflectives were found to achieve higher IQs than impulsives, the present study found nonsignificant differences in the global IQ scores of the high impulsive and reflective groups. While in the case of both boys and girls, the moderate reflective groups showed superior IQs to the high impulsive groups, one fact deserves special notice: among the girls, the moderate reflective group achieved higher IQs than their high reflective counterparts. (This difference in achievement between boys and girls suggests the possibility of a sex influence, a possibility that we consider shortly.) It is of further interest to note that the effect of treating impulsives and reflectives as homo-

geneous groups was to cancel out any significant differences in total IQ scores between them. Such results raise the question whether the reported IQ differences of the earlier investigations may not have been contaminated by similarities between the format of their measures of intellectual ability and that of the MFF test.

Perhaps the point might be put this way: different kinds of tests have characteristics which determine whether or not a child's preferred conceptual tempo will work to his advantage or disadvantage. Multiple-choice tests require that the child identify the fine line which divides the false and true alternatives, a process to which the reflective child's tendency to consider alternative answers would appear to be especially amenable. Keeping in mind Kagan's characterization of impulsivity as the insufficient consideration of alternatives, it may be that the IQ differences between impulsive and reflective children on multiple-choice tests is attributable to the formats of these tests, and not to differences in intelligence. This is a point which we consider most important because it highlights the necessity of taking into account the interaction between the child's preferred conceptual tempo and the nature of the test in order to accurately predict his achievement.

As noted above, an interesting finding was that among the girls, moderate reflectives not only achieved better than the high impulsives but were also superior to their high reflective counterparts, whereas among the boys, the moderate reflectives showed significantly better achievement than the high impulsives. Such findings cannot be regarded as by any means ironclad, but they are at least persuasive of the idea

that the reflection-impulsivity dimension may be subject to a sex influence. It may be that girls and boys differ in their attitude toward the importance of cautiousness, with girls guided more by the socio-cultural aphorism of "Look before you leap" and boys by the opposite one of "he who hesitates is lost". The data with regard to response latency tend to lend support to this view, in that the girls as a group had considerably longer response latencies than those of the boys. As a generality, it might, therefore, be valid to say that girls need to become less cautious and boys more cautious in order to improve the quality of their intellectual achievement.

The data discussed are all final intelligence quotient scores. This tells us nothing about the distinctiveness of the pattern of achievement that make up these scores. Obviously, reflectives and impulsives could get roughly similar end results by different routes. In fact, an analysis of the achievement of reflectives and impulsives into specific verbal and performance scores reveals differences in achievement that would be otherwise obliterated by an exclusive focus on their gross final IQ scores.

Broadly, high reflective children were consistently better in most tests than involved largely verbal skills (verbal IQ in the bright-normal range) as compared to their achievement on the non-verbal sub-tests (performance IQ in the average range). On the other hand, high impulsive children did better in most tests involving visual-motor skills (performance IQ in the bright-normal range) relative to their achievement on verbal items (verbal IQ in the average range). With the exception of moderate impulsive boys who showed a superiority of

the performance level over the verbal level, the moderate groups generally had a balanced or even pattern of verbal and performance achievement. This may seem to revive the old idea that individuals superior in one area are usually superior in other areas as well, in that these moderate reflective and impulsive children achieved the best overall IQ ratings. In sum, while this study showed that the high reflective and impulsive groups attained numerically similar final scores, there were striking differences between them in the pattern of achievement that made up these scores.

Another factor of significance is that there are qualitative differences in the manner in which high reflective and impulsive children approach a cognitive task. Here to be discussed are the non-intellective aspects of intelligence test performance.

In the development of the thinking from which hypothesis one was derived, the contention had been that achievement on the verbal section would be less dependent upon the rate with which a given subtest item was solved and more a function of its ultimate solution. Implicit in the above premise is the idea that persistence is an important determinant of the child's score, and that it plays an increasingly important role when the specific subtest items do not possess a time limit. Therefore, while not overlooking the impact of differential aptitudes on achievement, it is possible that one explanation of the high impulsive child's lowered overall achievement stems in part from his lack of perseverance on the untimed verbal subtests. One would suspect that the lack of persistence, combined with the tendency to respond with the first thought that comes to

mind, would seriously disadvantage the high impulsive child in the development of a superior answer. This argument would appear to be especially applicable as the gradient of item difficult increased.

Earlier in the discussion, we proposed that too much yielding to the importance of caution may lead to undue inhibition. For the high reflective child, making a mistake would seem to be an extremely painful experience, with the result that control and delay are greatly increased at the expense of the freedom to be spontaneous and causal. This pressure for the tight control of any wayward actions - to the point almost of being action-paralyzing - would clearly be disruptive of performance on those subtests where speed and the willingness to experiment are accentuated. Part, then, of the reason for the high reflective child's lowered overall achievement involves the pulling down of his scores on the visual-motor subtests as a consequence of hig excessive planful and cautious approach.

These qualitative differences in the approach of the high reflective and impulsive child can perhaps best be illustrated by "real-life" examples. For comparative purposes, two boys, at roughly similar IQ levels, have been selected.

Frank, a high impulsive boy

In his testing session, this youngster was exuberant and rarely still. He wiggled, played with the examiner's test material, and often left his chair to walk about the room. He showed little interest in most of the verbal subtests, loudly protesting that the questions were "dumb and boring". Typically, he blurted out answers without due

consideration as to their appropriateness. For example, when asked what he would do if a boy much smaller than himself started to fight with him, he replied instantly, "hit him back". He felt that one quick answer was sufficient, and could not be coaxed to elaborate in order to reach a more satisfactory one. At times, this failure to delay his answer suggested an almost deliberate avoidance of reflection, possibly because such delay would be too anxiety-arousing. On most of the more difficult items, he alternated between wild, reckless guessing and "I don't know" responses. One had the impression that "I don't know" frequently meant "I don't ~~care~~", suggesting a low level of aspiration and little interest in intellectual activities. A much more receptive and enthusiastic attitude was evidenced on the performance subtests, where the emphasis upon "doing things" seemed to mesh with his action-oriented style.

Jim, a high reflective boy

Shyness, reticence, and an inability to loosen up characterized this boy during his testing session. It was as if he was working within an atmosphere of dangers, with the result that spontaneity had to be sacrificed for the sake of safety. His answers, offered only after much forethought, wre invariably followed by the query, "Is that right?". This emphasis upon doing the "right" thing permeated the quality of his verbalizations. For example, when asked why civil servants must take an examination, he replied, "To see if they're good enough to do all the things they're told to do"; the word "nonsense" in the vocabulary subtest was defined as "when you don't listen". One had the impression

that his feelings of self-worth were closely tied up with the inhibition of the inappropriate, leaving little room for calculated risk and active experimentation. This behavior was penalized heavily on the timed items, where his failure was due primarily to time-consuming checks and rechecks. Thus, two block design items and one object assembly item were completed beyound the time limits allowed. Throughout, he anxiously watched the examiner for signs of disapproval when he made a mistake, seeming on occasion to almost apologize for his being alive.

We may have here a clue to the dynamics of reflection-impulsivity. [illegible]ce Kagan (1970) has conceptualized problem-solving to involve a search among a number of competing alternatives, it is possible to speak about decision-making. The child must decide among a number of probability estimates the one which appears to him to be the "best bet". It is speculated that a certain degree of tension accompanies this search process. For the reflective child, the tension stems from the possibility of making a mistake or choosing the wrong alternative. For the impulsive child, the search process itself which precedes the rendering of an answer seems to be the primary source of tension. The crucial difference between the impulsive child and the reflective child lies in their divergent manner of dealing with this tension.

To elaborate, it is contended that in the extreme the impulsive child experiences the tension generated in the carrying out of the search process as a psychologically painful state of affairs. Consequently, a negative decision is made in that it appears to be based not so much on the positive seeking of a good answer, but more on the

basis of avoiding tension. The emphasis is thus upon the end result so that the tension created by an extended search process may be avoided. As a result, the impulsive child's search is so accelerated that premature closure occurs and not enough possible avenues to the solution are considered. Expressed figuratively, the impulsive child holds to the belief that the shortest distance between the initial presentation of a problem and its final solution is a direct path.

Not so for the reflective child who in keeping with the above metaphor appears to be guided more by the law of detours. While the impulsive child tends toward a direct route to the possible solution of a problem, the reflective child approaches the final decision via a zig-zag course in which a search among a number of alternatives is carried out. It is suggested that the reason for this extended search process derives from the fact that tension for the reflective child is attached to the outcome goal of making a good decision and not as in the case of the impulsive child to the preceding process. Thus, to the extent that the reflective child is anxious over making errors, then to that extent a need for a fairly complete search of possible alternatives in relation to any given problem is required. An incomplete search would not provide the reflective child with a "safe" definition of the problem area and would be experienced as a dissonant state of affairs. It is argued that an extended search of possible alternatives furnishes the reflective child with a "safe" definition of the problem and thereby serves to reduce the dissonance.

The second of the present findings to be discussed concerns Hypotheses 2 and 3 which predicted that impulsive children would have

a performance score substantially greater than their verbal score, while reflective children would show an opposite pattern of achievement. The results obtained here have provided some support for these hypotheses, in that high impulsive children were found to have a significant elevation of performance over verbal IQ, whereas high reflective children has systematically higher verbal scores as compared with their performance scores. There are perhaps two reasons that may account for these results.

One explanation to which reference has already been made, involves the speed factor of the performance subtests. For the high reflective child, because of his cautious and methodical approach, the time allotted on the block design and object assembly items was sometimes not adequate, or if he was able to complete these items within the time limits, his execution was not quick enough to earn extra bonus points. Some concrete examples of the high reflective child's deliberateness follow. On the block design subtest, hesitancy was exhibited by repeatedly comparing his constructions with the pattern given. Caution on occasion gave way to suspicion, the child asking if the number of object assembly pieces were adequate to construct a given item. Meticulous drawing of the symbols in the digit symbol subtest, where speed is so obvious a requirement, resulted in low scores. Undoubtedly, these behaviors affected the high reflective child's achievement on the performance section, causing some of the disparity between his verbal and performance scores.

The fact that the high reflective child's overinhibition appeared to contribute to a lowering of his performance scores is of particular

interest because it supports the idea suggested in Chapter 3 that a VIQ>PIQ often may reflect a cautious approach and not a perceptual-motor handicap. It is not maintained here that a lowered performance score is never indicative of some kind of perceptual-motor incoordination. The results on the VIQ>PIQ discrepancy, however, would seem to suggest that a reflective disposition contributes to such a profile. This might be taken into consideration by the clinician in viewing a VIQ>PIQ pattern. This point is taken up in more detail in the next chapter where the practical implications of the study are discussed.

Another factor that has to be considered in the explanation of the V-P discrepancies is the differences in the pattern of abilities of the high reflective and impulsive children. It will be recalled that in a previous chapter we argued that the impulsive child may be too much oriented to the cues of the environment to assimilate verbal material. Put another way, the primary orientation of the impulsive child seems to be to the senses and things so that perception and the tactual sphere take precedence over the "intellect" and words. When one examines the subtest variations, some weight is given to this line of thinking.

Thus, the high impulsive child tended to lack abilities in those subtests which Cohen (1959) has identified as Factor A. According to Cohen, Factor A is a verbal comprehension factor and is best represented in such tests as Information, Comprehension, Similarities, and Vocabulary. In addition, Wechsler (1958) has pointed out that these subtests are highly representative of typical school-influenced learning. It could be argued, therefore, that differences in school

achievement caused some of the disparity between the high reflective and impulsive child's verbal and performance scores. On the other hand, it also is certain that the impulsive child who is weak in verbal skills will, on the average, do poorly in school since teaching in the elementary grades tends to be heavily verbal. Perhaps, then, we are safe in saying that it is difficult, if not impossible, to distinguish the egg of impaired verbal functioning from the chicken of poor school results. It would appear more reasonable to suggest that the WISC pattern displayed by the high impulsive child reflects the additive effects of a verbal impairment factor and/or a specific learning disability as discussed by Prentice and Kelley (1963). Any attempt to apportion the relative weights of these two conditions is questionable.

The above discussion calls for qualifying comments. For one thing, poor achievement on the comprehension subtest was most marked in high impulsive children, but even among high reflective children this subtest ranked lowest relative to their other verbal subtest scores. As to why there was this general lowering of Comprehension subtest scores, one possible explanation may involve the necessity for the child to give more than one answer on the later items in order to achieve maximum credit. Among younger children, it is not uncommon for them to feel that one good answer is sufficient; thus, their failure to elaborate means that they are often penalized on this subtest.

As mentioned elsewhere, the one outstanding exception to the high impulsive child's generally low verbal scores was his achievement on the Similarities subtest which equalled that of the high reflective child. Of the four subtests comprising the verbal comprehension factor, the

Similarities subtest appears least related to both formal learning and verbal ability. This subtest requires the child to comprehend meaningful relationships between things which superificially appear quite different, and to bring them together under a single label. In fact, it could be said that the Similarities subtest corresponds to a Piagetian reasoning and concept formation task in that the child is required to deal with classes and their combinations, or to use a Piagetian term, "similarities" demands the ability to "nest" classes. The finding that both impulsive and reflective children are equally adept at this task is especially significant because it strongly reinforces our earlier contention that there are no basic differences in intelligence between impulsive and reflective children.

CHAPTER 7

SUMMARY, IMPLICATIONS AND CONCLUSIONS

The present study was concerned with determining the relationship between the reflection-impulsivity aspect of cognitive style and the quality of intellectual achievement. Although considerable research on reflection-impulsivity has been conducted, there was very little previous research on this dimension with regard to intelligence test achievement. A second purpose was to ascertain if a WISC V-P discrepancy could be approached from the perspective offered by reflection-impulsivity. In this final chapter, the report of the investigation is summarized and some implications and conclusions put forward.

The data relevant to the testing of the hypotheses were obtained from an analysis of eighty elementary student scores on the MFF test and the WISC. The main findings may be stated in terms of the three hypotheses.

It had been the contention of this study that the quality of intellectual achievement would be curvilinearly related to the dimension of reflection-impulsivity. The correlational analysis yielded a significant curvilinear relationship and a non-significant linear relationship between MFF response time scores and WISC full scale IQ scores. This was interpreted in light of a response latency ceiling concept, which claims that achievement increases as response latency increases up to a moderate level, but then tapers off beyond this moderate point.

A further prediction of this study was that impulsive children

would show a lower verbal score than performance score, whereas reflective children would display an elevation of verbal scores over performance scores. With the exception of moderate impulsive boys, these verbal minus performance differences were confirmed only in the high reflective and impulsive groups. The moderate groups showed a balanced pattern of verbal and performance achievement. These verbal-performance differences among the high reflective and impulsive groups were explained by specific differences in abilities and the qualitative aspects of ...st performance.

IMPLICATIONS

The findings of this study appear to have important implications at three levels: (1) Theoretical, (2) Research, and (3) Practical.

Theoretical Implications

In Kagan's work, the following basic principle plays an important part: a developmental shift in which young children react to the world impulsively, whereas with increasing maturity reflection comes to predominate more and more. Looking at this principle more closely, we find here a representation in which impulsivity and reflection contrast as opposites. As a result, we almost unavoidable yield to the temptation of establishing opposing evaluations. For instance, and as discussed in Chapter One, one pole (reflection) has a positive value while the other pole (impulsivity) has a negative value.

We may ask whether a final "terra firma" has been reached. The findings from the present study only partially fit this developmental

model. On the one hand, it is true that high impulsive children betray a certain inefficiency of performance. However, the thesis that increases in reflection are accompanied by parallel increases in the efficiency of performance is not entirely consistent with the findings of this study. Given that unadaptive outcomes are sometimes associated with reflectivity, the reality basis of assigning all the advantages to this pole is in doubt. Employing the empirical finding of an inverted U-shaped relationship between reflection-impulsivity and performance as our conceptual "springboard", it is conceivable that the optimum stage of development may lie in uniting the opposites, where reflection and impulsivity are linked together in a constructive synthesis.

Driving the argument to a fine point, we may say that it seems to have been mistaken to use an explanation of development that moves in one direction only, and to unilaterally fixate our attention at the one pole of reflection to define its highest stage. Such a principle may hold in general, but our understanding suffers once we attempt to apply this vague principle to specific cases. For one thing, we may note that in the case of both high reflectives and impulsives, a tendency that is without a tempering by its opposite tendency brings rigidity and limitation. Expressed in another way, the more one-sided the expression is (i.e. when the opposite is excluded), the more unadaptive it is likely to be. A plain implication of this study is that the progression from impulsivity to reflection provides us with a convincing picture of development only to the extent that we allow for reciprocity. A plasticity seems to be called for through which a holding-together of the reflection and impulsivity opposites may

occur so that neither one of them becomes a victim of independence.

In more concrete terms, such a plasticity, where one tendency is not without its counter-tendency, means that the child has both potentially available to him, and may call one or the other into play as the situation demands. Different styles are required, depending on the situation. Some situations require the ability to wait and reflect before action is taken; others call for prompt action where delay would be inappropriate. It would, of course, be utopian to suppose that the child could always mesh his speed perfectly with the occasion. However, a capacity for some switchover from one tendency to the other to meet different circumstances is clearly superior to a fixed style preference.

A related implication that this study makes clear is that it is inappropriate to talk about reflection-impulsivity as if it were a unitary dimension. We find transitions all along this dimension. Thus, a tendency to respond quickly becomes recklessness, reflection becomes restrictiveness. Perhaps as a consequence of the limited unilateralism which viewed adaptiveness as persisting in the one direction of reflectivity only, the possibility of reflection splitting off from its counter tendency, and becoming unadaptive was overlooked. When reflection exists in an extreme degree, we may speak of unadaptiveness. For the explanation of such unadaptiveness, the idea of over-inhibition does not seem out of place. In short, a question that this study raises, but does not fully answer, is whether the very cautious approach of the high reflective child does not bespeak of an overinhibited inclination instead of an adaptive consideration of alternatives. This is a matter that might reward further study.

Research Implications

The curvilinear relationship found between response latency and quality of achievement means that future investigators cannot shut their eyes to the possibility that the same "ceiling effect" may not be true of other functional relationships in which reflection-impulsivity is the predictor variable. One of the major assumptions of previous studies has been that increases in response latency are related in a linear fashion to problem solving proficiency. Repeatedly throughout this study we have insisted that long response latencies can be just as bad prognostically as short latencies in connection with such proficiency. This definitely means nonlinear regressions. While the optimum latency level probably depends on what function is under consideration, it is suggested that this matter cannot be decided on a priori bais, but that appropriate statistical procedures must be employed to deal with the possibility of nonlinear relationships. It is likely that this "ceiling effect" will be found to be more general than has been supposed. Failure to take this effect into account, with the subsequent application of inappropriate statistical methods, may very well result in a spurious estimate of the acutal degree of correlation.

Reference has already been made to the idea that reflection-impulsivity may be a complex of different sub-types and not a unitary dimension. From the evidence of this study, something rather different from reflection seems to be present in the case of excessively long response latencies. If future investigators conceive of reflection-impulsivity as a simple, unitary phenomenon in which the reflective and

impulsive groups are treated as if they were homogenous, their results may be attenuated by this formulation. It would seem that reflection-impulsivity will be best understood eventually as a composite of different sub-types. The immediate usefulness of defining such subgroups is that it permits finer discriminations to be made within the larger variables of reflection and impulsivity.

Practical Implications

One point that this study makes clear is the inseparability of the child's preferred conceptual tempo and the nature of the test in dealing with the assessment of his problem solving ability. Because this study has shown that reflectives and impulsives vary in their respective strengths with different types of test material, it would be easy to prove that either one of them is superior by a judicious selection of these materials. Thus, if we were to select predominately verbal material and present it within a multiple-choice format, the chances are good that were we to administer such a test to a group of reflective and impulsive children, the reflective children would attain superior scores. Presumably, we could produce a reverse pattern of achievement were we to select only items involving spatial relationships that required the manipulation of objects instead of words. Admittedly, these are extreme examples, but they do underscore the danger that a test user, focusing upon the gross final score only without noting the child's preferred conceptual tempo, might draw entirely inaccurate inferences.

A plain corollary of the finding that reflectives and impulsives show a distinctiveness in their respective strengths and weaknesses is

that it would be beneficial for test administrators to include a measure of conceptual tempo in their assessment batteries. In this way, they might come closer to a realization that in order to predict the child's potential achievement with any reasonable degree of accuracy, attention must be paid to the interaction between his preferred conceptual tempo and the nature of the assessment devices. The fact that multiple-choice tests are typically group-administered obviously precludes their yielding any information concerning the child's conceptual tempo. However, individually administered tests such as the WISC could be used to provide an indication of the child's decision speed time. For example, the Picture Completion subtest of the WISC, which requires the child to distinguish essential from non-essential detail (a task quite similar to that required by the MFF test) could be easily adapted to give a rough estimate of the child's preferred tempo. All that would be demanded of the examiner is to keep a record of the number of seconds to the child's first response on this 20-item subtest.

It is also important to say something about remedial procedures. It is not stretching a point to say that our schools conceive of a stereotype, ideal child, for example, one who is verbal, hard-working, and achieves a fair measure of scholastic success. While such an emphasis may suit the reflective child, it is not difficult to imagine this emphasis running afoul of the impulsive child. Typically, failure to match the stereotype means that the wayward child is referred for remedial help. A question that needs to be asked at this point is: "Remediation for what?". Even if we grant that a reflective style augments the likelihood of scholastic success, do we want to have the

impulsive child fit this mold as the price he must pay to succeed academically? Perhaps it would make more sense to follow the "line of least resistance" and to build upon the impulsive child's strengths instead of trying to bring his weaknesses up to the level of his strengths. The answer will, of course, vary depending upon the particular child, but at least the question should be considered. Clinical experience has taught that sometimes there is more potential harm in attempting to change the child for the sake of scholastic success than there would be in accepting this deficit and building upon his other, more obvious assets.

It is very popular today to make the diagnostic inference of perceptual-motor dysfunction to explain learning and behavioral disorders of many children. Too often one has the impression that this perceptual handicap concept is a "wastebasket" designation for poorly understood behavior. As discussed in Chapter Three, a WISC pattern in which the verbal IQ exceeds the performance IQ has been one basis frequently employed to diagnose perceptual-motor disturbance. However, a possibility that seems to have escaped notice in the literature is that such a pattern of achievement may be indicative of a reflective attitude and not of a perceptual handicap. As repeated several times already, one point that should not be lost sight of is that all the performance subtests impose a time limit on the child. Consequently, the child who proceeds in a deliberate manner may be prone to achieve lower scores on the perceptual-motor subtests. In fact, this was found to be true of the high reflective child who achieved significantly lower performance scores relative to this verbal scores. The implication

of findings of these kinds is that we may have to revise our thinking on a VIQ>PIQ as a sign of perceptual-motor handicap, and regard it as sometimes merely a matter of an overcautious approach.

The insistence in this study that a VIQ>PIQ may be a product of a reflective disposition is not to be taken as a total rejection of the idea that this pattern may not also reflect a specific perceptual-motor deficit. However, it is appropriate to suggest that before the clinician labels a child as a perceptual cripple, he should look seriously at the possibility that the child's achievement on these perceptual-motor tasks may have been underestimated due to their timed nature. This might be especially the case in children with average or above average ability. It would be of interest to determine whether the reflective child would achieve better results here if he was allowed to proceed beyond the time limits allotted, or if a second measure of perceptual-motor functioning without any time limits were given to him. This is a question which merits further study.

CONCLUSIONS

The conclusions put forward here were arrived at on the basis of the evidence provided by this investigation.

1. The study presented evidence for a rather significant overriding generalization. The evidence supports the conclusion that moderate latency levels are optimal for achievement. If we consider the lowered achievement of the high reflective and impulsive groups, we may say that achievement suffered in the first instance because of a too slow and careful tact, while in the second instance it suffered from a

too speedy approach. The crucial point is that the relationship between response latency and the quality of intellectual achievement appears to be characterized by a "ceiling effect" wherein increases in response latency facilitate achievement only up to a certain point, with further increases producing a relative decline in achievement.

2. The evidence in this study also indicated that there is reason to believe that reflection-impulsivity is not a unitary dimension, but may consist of "segments" in the sense that there appear to be different subgroups within these larger variables. Although the evidence of this is somewhat slender, one might propose that for research purposes the delineation of specific subgroups is a more useful and heuristic approach than the treatment of reflection and impulsivity as homogeneous variables.

3. On the basis of the evidence provided by the analysis of the global IQ scores, it is concluded that no differences exist between the homogeneous reflective and impulsive groups. Although this contradicts previous investigator's findings of superior achievement on the part of reflectives, it is conceivable that these differences are referrable to the nature of the instruments used by them to assess intellectual ability. It would, of course, be inaccurate to conclude that no differences existed between the reflectives and impulsives when they are categorized according to moderate and high forms of each. In general, the moderate groups achieved superior IQ ratings, while no differences were found among the high reflective and impulsive groups.

4. A final basic conclusion is that the high reflective and impulsive groups showed a distinctive pattern of strengths and weaknesses.

Thus, high reflective children generally did better on tasks involving verbal skills, while high impulsive children achieved better results on the visual-motor tasks. More specifically, the high impulsive child did poorest in those subtests most closely resembling school learning and which also require verbal ability. Their best achievements occurred in those subtests clearly removed from verbal skills and in activities divorced from school tasks. The high reflective child displayed an exact opposite pattern of achievement.

At first glance, the above conclusions may appear to be somewhat universalistic in their statement. However, so that enthusiasm will not outweight prudence, a salutory note of caution must be sounded. For example, because the sample of this study consisted of children selected from a mid-socioeconomic background and a restricted age range, the degree of generalization to other groups is a function of the extent to which these groups are similar to or dissimilar from the present sample. Further, the limitation imposed by the categorizat of the reflective and impulsive groups according to decision speed time only should be recognized in onsidering these conclusions. Finally, it should be noted that the evidence for a generalized tendency to respond impulsively or reflectively across different situations is by no means fully established. Therefore, it should be borne in mind that a child's relative position on the reflection-impulsivity dimension may vary from situation to situation.

REFERENCES

Beck, H.S., and Lam, R.L. Use of the WISC in predicting organicity. Journal of Clinical Psychology, 1955, 11, 154-158.

Berko, R.G., Berko, M., and Thompson, S. Management of brain damaged children. Illinois: Charles C. Thomas, 1970.

Bernstein, B. Elaborated and restricted codes: their social origins and some consequences. American Anthropologist, 1964, 6, 55-69.

Blishen, B.R. A socioeconomic index for occupations in Canada. The Canadian Review of Sociology and Anthropology, 1967, 4, 41-53.

Bernstein, B R. Socio-linguistic approach to social learning. In J. Gould (Ed.), Penguin survey of the social sciences, 1965. London: Penguin Books, 1965, 144-168.

Bortner, M. Evaluation and education of children with brain damage. Illinois: Charles C. Thomas, 1968.

Bruner, J.S. Toward a theory of instruction. Cambridge, Mass.: Belknap Press of Harvard University, 1966.

Burt, C. The evidence for the concept of intelligence. British Journal of Educational Psychology, 1955, 25, 158-177.

Camp, B.W. WISC performance in acting-out and delinquent children with and without EEG abnormality. Journal of Consulting Psyc Psychology, 1966, 30, 350-353.

Cathcart, G.W., and Liedtke, W. Cognitive style and arithmetic achievement. Unpublished manuscript, University of Alberta, 1968.

Clements, S.D., and Peters, J.E. Minimal brain dysfunction in the school-age child. Archives of General Psychiatry, 1962, 6, 185-197.

Cohen, J. The factorial structure of the WISC at ages 7-6, 10-6, and 13-6. Journal of Consulting Psychology, 1959, 23, 285-299.

Cohen, J. A comparative factor analysis of WAIS performance for 4 age groups between 18 and 80. American Psychologist, 1957, 11, 449.

Debus, R.L. Effects of brief observation of model behavior on conceptual tempo of impulsive children. In P. Mussen (Ed.), Carmichael's manual of child psychology. Vol. 1. New York: Wiley, 1970.

Dennerll, R.D., Broeder, J., and Sakolov, S.L. WISC and WAIS in children and adults with epilepsy. Journal of Clinical Psychology, 1964, 20, 236-240.

Eisenberg, L. Psychiatric implications of brain damage in children. Psychiatric Quarterly, 1957, 31, 72-92.

Elley, W.B. A comparative analysis of the socioeconomic bias in selected intelligence tests. Unpublished doctoral dissertation, University of Alberta, 1961.

Ferguson, G.A. On transfer and the abilities of man. Canadian Journal of Psychology, 1956, 10, 121-131.

Fleishman, E.A. Human abilities and the acquisition of skill. In Bilodeau, E.A., (Ed.) Acquistion of skill. New York: Academic Press, 1966, p. 539.

Furth, H. Piaget and knowledge. New Jersey: Prentice-Hall, 1969.

Graham, E., and Kamano, D. Reading failure as a factor in the WAIS subtest patterns of youthful offenders. Journal of Clinical Psychology, 1958, 14, 302-305.

Guertin, W., Ladd, C., Frank, G., Rabin, A., and Hiester, T. Research with the Wechsler intelligence scale (WAIS), 1960-65. Psychological Bulletin, 1966, 66, 385-409.

Guilford, J.P. Three faces of intellect. American Psychologist, 1959, 14, 469-479.

Gupta, P. Correlates of reflection-impulsivity. Unpublished doctoral dissertation, University of Alberta, 1970.

Henning, J., and Levy, R. Verbal-Performance IQ differences of white and negro delinquents on the WISC and WAIS. Journal of Clinical Psychology, 1967, 23, 164-168.

Horne, B.M., and Justiss, W.A. Clinical indicators of brain damage in mentally retarded children. Journal of Clinical Psychology, 1967, 23, 464-465.

Kagan, J., Moss, H.A., and Sigel, I.E. Psychological significance of styles of conceptualization in basic cognitive processes in children. In Wright, J.C., and Kagan, J., (Eds.), Monographs of the society for research in child development. 1963, 28, 2.

Kagan, J., Rosman, B.L., Day, D., Albert, J., and Phillips, W. Information processing in the child: significance of analytic and reflective attitudes. Psychological Monographs, 1964, 78. (1, Whole No. 578).

Kagan, J. Impulsive and reflective children: significance of conceptual tempo. In J.D. Krumboltz (Ed.), Learning and the educational process. Chicago: Rand McNally and Company, 1965 (a), 133-161.

Kagan, J. Reflection-impulsivity and reading ability in primary grade children. Child Development, 1965, 36, 609-628.

Kagan, J. Reflection-impulsivity: the generality and dynamics of conceptual tempo. Journal of Abnormal Psychology, 1966(a), 71, 17-24.

Kagan, J., Pearson, L. and Welch, L. Conceptual impulsivity and inductive reasonsing. Child Development, 1966, 37, 583-594(b).

Kagan, J., Pearson, L. and Welch, L. The modifiability of an impulsive tempo. Journal of Educational Psychology, 1966, 57, 359-365.

Kagan, J. Biological aspects of inhibition systems. American Journal of Diseases of Children, 1967, 114, (5), 507-512.

Kagan, J., and Kogan, N. Individual variation in cognitive processes. In P. Mussen (Ed.), Carmichael's manual of child psychology. Vol. 1. New York: Wiley, 1970, pp. 1273-1365.

Kallos, C.L., Crabow, J.M., and Guarine, E.A. The WISC profile of disabled readers. Personnel and Guidance Journal, 1961, 39, 476-478.

Laurendeau, M., and Pinard, A. Causal thinking in the child. New York: International Universities Press, 1962.

Littell, W. The WISC: review of a decade of research. Psychological Bulletin, 1960, 57, 132-156.

Michenbaum, D., and Goodman, J. Reflection-impulsivity and verbal control of behavior. Child Development, 1969, 40, 785-797.

Nash, J. Developmental Psychology. New Jersey: Prentice-Hall, 1970.

Neville, D. A comparison of the WISC patterns of male retarded and non-retarded readers. Journal of Educational Research, 1961 54, 195-197.

Prentice, N.M., and Kelly, F.J. Intelligence and delinquency: a reconsideration. Journal of Social Psychology, 1963, 60, 327-337.

Rapaport, D. Diagnostic Psychological Testing. Volume 1. Chicago: Yearbook Publishers, 1945.

Reed, J.C., and Reed, H.C. Concept formation ability and non-verbal abstract thinking among older children with chronic cerebral dysfunction. Journal of Special Education, 1967, 1, 157-161.

Reitan, R.M. Psychological Deficit. Annual Review of Psychology, 1962, 13, 415-437.

Rowley, V. Analysis of the WISC performance of brain damaged and emotionally disturbed children. Journal of Consulting Psychology, 1961, 25, 553.

Schaefer, E., and Bayley, N., Maternal behavior, child behavior, and their intercorrelations from infancy through adolescence. Monograph of Social Research and Child Development, 1963, 28, No. 87.

Schafer, R. The clinical application of Psychological tests. New York: International Universities Press, 1948.

Schwebel, A.I. Effects of impulsivity in performance of verbal tasks in middle and lower class children. American Journal of Orthopsychiatry, 1966, 36, 13-21.

Sieber, J.E. Teaching children to think. The Instructor, 1969, 78, p. 39.

Siegelman, E. Reflective and impulsive observing behavior. Child Development, 1969, 40, 1213-1222.

Skinner, B.F. Verbal behavior. New York: Appleton, 1957.

Souch, S. A cross-sectional study of reflection-impulsivity. Unpublished doctoral dissertation, University of Alberta, 1970.

Spearman, C. The abilities of man. New York: Macmillan, 1927.

Thomas, A., Birch, H., and Chess, S., Behavioral individuality in early childhood. New York: New York University Press, 1963.

Thurstone, L.L. Multiple factor analysis: a development and expansion of "the vectors of mind". Chicago: University of Chicago Press, 1947.

Waugh, K.W., and Bush, W.J. Diagnosing learning disorders. Ohio: Charles Merrill, 1971.

Wechsler, D. The measurement and appraisal of adult intelligence. Baltimore: Williams and Wilkins, 1958.

Wechsler, D. The WISC Manual. New York: The Psychological Corporation, 1949.

Yando, R.M. and Kagan, J. The effect of teacher tempo on the child. Child Development, 1968, 39, 27-34.

Yates, A.J. Psychological Deficit. Annual Review of Psychology, 1966, 17, 111-135.

Zimet, C.N., and Fishman, D.B. Psychological deficit in schizophrenia and brain damage. Annual Review of Psychology, 1970, 21, 113-154.

Zimmerman, I and Glasser, A. Clinical Interpretation of the Wechsler Intelligence Scale for Children. New York: Grune and Stratton, 1967.

APPENDIX A

LETTER TO PARENTS

FACULTY OF EDUCATION
DEPARTMENT OF EDUCATIONAL PSYCHOLOGY
TELEPHONE (403) 432-5245

THE UNIVERSITY OF ALBERTA
EDMONTON 7, CANADA

January 7, 1973

Dear Parents:

I have been given permission by the Principal of your School to carry on a research project.

Briefly, the purpose of this study is to examine the optimal development of the child's abilities within the context of his preferred style of doing things. As unique individuals, we all work out for ourselves a certain tempo or rhythm which "fits" best in the utilization of our abilities. It is my belief that for the child's optimal development of his talents, we must be sensitive to the style of doing with which he is most comfortable.

Further, the results of this study will be communicated to each teacher and recommendations made with regard to meeting their students' needs.

We hope that you will have no objections to having your child participate in this educational study.

Yours very truly,

Mr. M.L. West
Graduate Student
Department of Educational Psychology
University of Alberta

MLW*gjm

APPENDIX B

DEMONSTRATION FIGURE FROM THE MATCHING FAMILIAR FIGURES TEST