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ABSTRACT

Abstracts of important research on cognitive style, which has implications for individualized instruction, are presented. Studies are presented which investigate the effect of early childhood coorelates of cognitive style, consider the impact of family environment on the highly intelligent and highly creative adolescent, examines similarities and differences in cognitive style between parents and their children, and investigate the functions of status variables in the development of a preferred response mode. Studies on cognitive styles and information processing deal with concept learning and information processing in the child, relate inductive reasoning to cognitive style, and investigate the interaction between cognitive style and information processing under conditions of distraction. Studies on cognitive style and academic performance, cognitive mappings, and modifiability of a conceptual tempo are also abstracted. For each study, the purpose, review of procedure, conclusion, and comment are given. (JK)

PARAMETERS OF INDIVIDUALIZATION:

Part I, Cognitive Style / Abstracts of Educational Research

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Part I, Cognitive Style Abstracts of Educational Research

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PREFACE

When discussing the problems of the individualization of instruction, most contemporary educators affirm the importance of understanding how individual learning styles of students function in programs of individualization. So that Maryland educators may have available in convenient form selected, research-based findings to assist them with thinking about the problem, a fairly sizeable body of research on cognitive style has been mined for educational relevance. The results are presented in this issue of the "Abstracts."

We hope that educators will find the abstracts valuable. The Department also hopes that readers will suggest ways to make the series more useful and will recommend topics for inclusion in future issues.

James A. Sensenbaugh

JAMES A. SENSENBAUGH
State Superintendent of Schools

FOREWORD

The Division of Planning, Research, and Evaluation of the Maryland State Department of Education is pleased to present *Parameters of Individualization: Part I, Cognitive Style,* the fourth volume in the series, "Abstracts of Educational Research."

The issue was prepared by the Division under the direction of James B. League, Jr., Consultant in Research, with the assistance of Marcia S. Rosenfeld, Assistant Supervisor of Research.

We want to thank Phyllis M. Sunshine who provided valuable consultant help. Thanks are also due to the Advisory Committee for the Abstracts of Educational Research, whose membership for the present issue included Ann A. Beusch and Mrs. Louella H. Woodward from the Division of Instruction; Irving W. Herrick, Jr., of the Vocational Education Research Coordinating Section, and Elizabeth A. Spurrier of the Research and Evaluation Section, both from the Division of Planning, Research, and Evaluation. They gave very helpful advice in the planning of this issue.

We hope that the "Abstracts" will continue to be of use to members of the educational community in Maryland.

Richard K. McKay

RICHARD K. McKAY
Assistant State Superintendent in
Planning, Research, and Evaluation

INTRODUCTION

With Volume IV in its series of "Abstracts of Educational Research," the Division of Planning, Research, and Evaluation of the Maryland State Department of Education presents selected research studies that might be helpful in the improvement of instructional programs in Maryland. As with the previous issues, studies have been selected which provide educators with research findings on a topic of current concern to the educational community.

Many contemporary discussions concerning the improvement of teaching and learning inevitably focus on the need to individualize instruction. Although the majority of educators agree on the necessity of individualizing instruction, they unfortunately agree far less on the parameters—that is, the characteristics of individualization. Because individualization is such a complex concept, attempts to plan and implement practices of individualization often meet with difficulty and confusion. The failure to identify and assign importance to each of the multiple factors comprising the concept of individualization is frequently a major source of confusion. For example, many educators approach the individualization of instruction primarily as a problem of designing instructional materials for pupils. A more productive approach demands the recognition that true individualization is a multidimensional complex involving several parameters such as individual assessment procedures, teacher deployment, learning environment, pupil learning style, *and* instructional materials.

To further the understanding of individualization, several issues of the "Abstracts" will present research findings regarding selected parameters of individualization. The present issue includes studies which investigated a dimension of learning style—namely, cognitive style. Neither the intent nor the scope of this volume permits exhaustive presentation of research findings. Rather, the abstracts and the bibliography should serve to stimulate thinking about cognitive style as a parameter of individualization.

Teachers have long recognized that each child has a specific learning style which includes, among other things, a characteristic response mode of processing information. Investigators have classified such characteristic modes of information processing under the construct of cognitive style. For experimental purposes, cognitive style has been defined operationally in terms of performance on tasks. J. Kent Davis supplies a broader approach for conceptualizing the construct of cognitive style:

> A number of different dimensions have been suggested within the rather general domain of cognitive style. There is one characteristic, however, which is common to a number of these dimensions. Although various labels are applied to this characteristic, it is concerned primarily with the manner in which an individual perceives and analyzes a complex stimulus configuration. The two poles of this dimension are characterized by subjects (*S*s) who analyze and differentiate the components of the stimulus complex and by *S*s who fail to analyze and differentiate the components and respond to the "stimulus-as-a-whole." Kagan et al. (1963) classified the former *S*s as ***analytical*** and the latter as ***relational*** and believed that their classification system was similar to the ***field independent-dependent*** classification of Witkin, Lewis Hertzman, Machover, Meissner, and Wapner (1954). A similar classification system was suggested by Gardner (1953)

> in which the continuum was described as ranging from *differentiated Ss* to undifferentiated *Ss*. Thus, there appears to be one dimension which involves an active analysis on the one hand and a more passive, global acceptance of the entire stimulus on the other hand.[1]

From Davis's discussion of the different dimensions of cognitive style, it can be seen that each investigator gives emphasis to the perceptual component of cognitive style. This emphasis is appropriate because interest in cognitive style was initially stimulated by research findings in the field of perception. Early work on cognitive style—carried out primarily with adult populations—focused on the interaction between an individual's perception and cognitive functioning. Only recently have cognitive style variables been related to school learning. Herman A. Witkin, in an extensive overview of cognitive style, suggests some implications and directions for educational practice.[2]

Pupil evaluation, pupil placement, and teaching methods were identified by Witkin as three areas for which the research findings of cognitive style seem to have particular relevance. For example, the development of test batteries which map cognitive style may, in time, be used as supplements or alternatives to intelligence test scales such as the Binet. As Witkin comments, "whereas unidimensional assessments like the IQ encourage us to think in terms of 'more or less' and 'better or worse,' the cognitive-map concept focuses on the ways in which children are unique and the multiplicity of ways in which they may be different."[3] Secondly, if cognitive mapping proves to be a valid evaluation technique, educators would have a more sensitive measure on which to base pupil placement decisions. Finally, with the improved basis for pupil placement, teaching methods could be more appropriately tailored to meet individual needs. Thus, the correct sequence of matching materials and methods to individual cognitive style needs and preferences would be followed, rather than the unfortunate practice of expecting individuals to adjust to existing materials.

Although the present issue of the "Abstracts" makes no attempt to give extensive representation to studies which investigate personality correlates of cognitive style, this area appears to be an exciting one in its own right. In developing this idea, Witkin suggests that:

> . . . A cognitive style appears to be the manifestation, in the cognitive sphere, of a broader dimension which extends into the domain of personal functioning—or personality—and so carries a message about the child as a person. In fact, performance in our tests of perceptual field dependence is coming to be used as a source of information about personality. In this connection, . . . perceptual performance may be taken as a 'tracer element' identifying a large psychological dimension of which such performance is a part.[4]

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[1] J. Kent Davis, "Concept Identification as a Function of Cognitive Style, Complexity, and Training Procedures," (Technical Report No. 32; Wisconsin Research and Development Center for Cognitive Learning; Madison, Wisconsin: University of Wisconsin, 1967), p. 1.

[2] Herman A. Witkin, "Some Implications of Research on Cognitive Style for Problems of Education," ***Archivio di psicologia neurologia e psichiatria,*** XXIV (1965), pp. 45–53.

[3] ***Ibid.***

[4] ***Ibid.***, p. 45.

As investigators pursue further research on cognitive style, undoubtedly other factors will emerge which have implications for educational practice.

In addition to recognizing the limited scope of this volume, the reader should be aware of the limitations of the studies themselves. Experimentation in the area of behavioral research in general presents many procedural problems. For example, each dimension of cognitive style has been measured by several tests which may or may not be measuring the same dimension.

Also, caution is needed in applying the reported results directly to the classroom without careful consideration of program designs. As noted above, the purpose of the present volume is to present research findings which may enhance understanding of one of the parameters of individualization—cognitive style. However, a study's inclusion should not be construed as endorsement by the Maryland State Department of Education of any reported findings and applications.

The "Abstracts" are presented in five sections. The first section discusses some of the influences on the development of cognitive style; the second and third sections examine the effects of cognitive style on information processing and academic performance; the fourth section discusses cognitive mapping; finally, the fifth section presents the modifiability of a conceptual tempo.

Section I

INFLUENCES ON THE DEVELOPMENT OF COGNITIVE STYLE

Without question, the construct which investigators define as cognitive style is determined by a variety of factors which interact to produce relatively stable response sets. One cluster of factors which has received attention from investigators can be characterized as developmental determiners—that is, influences which are believed to play important roles in the shaping of a preferred response mode.

Studies suggest that behavioral correlates of cognitive style can be identified as early as two and one-half years of age. Environmental variables such as the family milieu and socio-economic status have been investigated for their effects on the acquisition of a response mode. Other developmental variables under investigation include sex, age, and intelligence.

In this section, the first two studies investigated the effect of early childhood correlates of cognitive style. The third study considered the impact of family environment on the highly intelligent and highly creative adolescent. In the fourth study, similarities and differences in cognitive style between children and their parents were examined. The final two studies investigated the function of status variables in the development of a preferred response mode.

EARLY SOCIAL CORRELATES OF COGNITIVE FUNCTIONING IN SIX-YEAR-OLD BOYS

Purpose: To use a longitudinal study as a cross-validation for the results of cross-sectional studies which investigated the relationship between dependency behavior and certain forms of cognitive and perceptual abilities

Review: Forty-four boys from Caucasian, intact middle-class families in the Washington, D. C. area comprised the initial group of subjects for this study. The boys were enrolled in a research nursery school for a period of four weeks and were two and one-half years of age when their dependency behavior was rated by a male and a female teacher. The teachers, who both held master's degrees in the child development area, independently rated each boy for dependency behavior on several 11-point scales. Both teachers rated each boy a median of four times during the four-week period. From the intercorrelations of the 11-point scales, four behavior rating clusters were developed. The clusters and the behavior ratings which comprised them were:

1. Physical contact—seeking physical contact from the male and the female teacher; responding to physical contact offered by both teachers; soothing effect when the child became upset
2. Attention seeking—seeking help without need; seeking attention or recognition
3. Orality—licking and drooling; sucking on thumb and mouthing
4. Sustained directed activity—contentment and absorption in play; persistence in maintaining play sequences

Four years after the boys were rated on dependency, a follow-up testing program was held. Since 14 of the original subjects were unavailable for testing at that time, the three cognitive measures were administered to only 30 of the boys whose mean age now was 6 years, 9 months. The first cognitive measures taken were verbal and nonverbal intelligence as assessed by a shortened form of the ***Wechsler Intelligence Scale for Children.***

Categorization style, another cognitive measure, was assessed by the ***Sigal Sorting Task*** in which the subject was required to select one of three response pictures which he thought "was most like" a stimulus picture shown to him. Each of the 12 sets of response pictures was designed to elicit three kinds of categorization style:

1. Analytic-descriptive—grouping is based on a similarity between a particular attribute or differentiated part of the stimulus pictures, ***e.g.***, a picture of a shark is paired with the stimulus picture of a saw "because they both have teeth"
2. Relational—grouping is based on the functional relationship between items, ***e.g.***, a picture of a board is paired with the picture of a saw "because a saw cuts wood"
3. Inferential-categorical—grouping is based on a subordinate conceptual label or some inferred quality, ***e.g.***, a picture of a pair of pliers is paired with the stimulus picture of a saw "because they are both tools"

The analytic-descriptive style, which requires active analysis of the stimuli was considered a higher level of perception than the relational style which represents global acceptance of stimulus material. Each boy was categorized on the basis of the reasons he gave for his choices.

The final variable, field dependence-independence, was measured by the ***Children's Embedded Figures Test*** which assessed the child's ability to locate a stimulus figure in a complex design. Subjects who located the figures rapidly were considered field-independent while children who experienced difficulty in the task were considered field-dependent.

Correlational analyses between the behavior clusters and cognitive rneasures yielded several major longitudinal results. The correlations pertaining to the intelligence measures indicated that nonverbal IQ was significantly associated with early social behavior. Children who had been rated high on physical contact and attention seeking were lower on nonverbal IQ (significant at the .05 level of confidence) and children who had been rated high in sustained directed activity were higher on performance IQ (significant at the .01 level of confidence). Verbal IQ was not significantly correlated with any of the behavior clusters.

The correlations between the behavior clusters and categorization style revealed that physical contact, attention seeking, and orality were all negatively associated with the inferential-categorical style but that sustained directed activity was positively associated with it. Physical contact and orality were positively correlated with the use of the relational style (significant at the .01 level of confidence). The analytic-descriptive style showed no correlation with the behavior rating clusters.

The field-dependence-independence dimension correlated significantly with only one of the behavior clusters. Boys who had been rated high on orality were more field-dependent (significant at the .01 level of confidence).

Conclusion: Since several significant correlations were found between early social behavior and various aspects of cognitive functioning, the investigators concluded that ". . . these results generally corroborate previous findings which have been reported from cross-sectional studies with somewhat older subjects."

Comment: The present study demonstrates that researchers may be able to predict a child's cognitive style from his behavior patterns exhibited as early as two and one-half years of age. Because cognitive styles appear to be pervasive over time and across various spheres of behavior, subsequent studies may indicate the feasibility and value of developing a "cognitive map" of each child before he enters school for the first time.

Source: Pedersen, Frank A., and Wender, Paul H. "Early Social Correlates of Cognitive Functioning in Six-Year-Old Boys," ***Child Development,*** XXXIX (1968), 185–193.

EARLY EXPERIENCE AND THE SOCIALIZATION OF COGNITIVE MODES IN CHILDREN

Purpose: To investigate the effects of cultural deprivation on cognitive behavior and academic achievement

Review: The investigators noted that the basic emphasis today in the area of cultural deprivation is an attempt to understand how cultural experience is related to cognitive behavior and academic success. In light of today's emphasis on the behavioral concomitants of cultural deprivation, the investigators formulated three hypotheses:

1. **The behavior which leads to social, educational, and economic poverty is socialized in early childhood—that is, it is learned.**
2. **The central quality involved in the effects of cultural deprivation is a lack of cognitive meaning in the mother-child communication system.**
3. **The growth of cognitive processes in fostered in family control systems which offer predetermined solutions and few alternatives for consideration and choice.**

One hundred and sixty-three Negro mothers and their four-year-old children were selected from four different social status levels: (1) Level One—college-education professional, executive, and managerial occupations; (2) Level Two—skilled blue collar occupations; (3) Level Three—unskilled or semiskilled occupations; and (4) Level Four—unskilled or semiskilled occupations with support provided by public assistance.

After the mothers were interviewed twice in their homes, they were brought to the university for testing and an experimental session. During the experiment, the mothers were required to learn three tasks that they could later teach to their children. The first task was to group a number of toys by color and by function; the second task was to sort eight blocks by two characteristics simultaneously; and the third task required mother and child to work together in order to copy five designs.

An analysis of the tasks which had required a verbal response revealed that mothers from Level One gave consistently longer language statements (82 lines) than did mothers from the other three levels (average of 49 lines). In addition, an analysis of language used by mothers of Level One indicated a greater use of abstract words and a more complex sentence structure.

When explaining a new situation to their children, the mothers in Level One used person-oriented statements and thus established the following background for their children: (1) information, (2) reassurance, and (3) understanding of the new experience in terms of personal relationships. In contrast, the mothers in the other three levels were status-oriented. The latter groups characterized the role of their children in new situations as one of passive compliance with all personal relationships being defined in terms of status and role expectations.

Status differences in concept utilization were revealed by the analysis of the preferred method of grouping stimuli. Mothers in Level One scored higher on descriptive responses (grouping by direct reference to physical attributes) and categorical-inferential responses (grouping by unobserved characteristics). Both descriptive and categorical-inferential responses represented thought processes which were more orderly and complex. On the other hand, the mothers in Levels Two, Three, and Four used more relational categories (grouping

a stimulus according to the meaning derived from surrounding stimuli) which indicated thought processes that were less reflective and often subjective. There was a significant correlation between children's cognitive responses and those of their mothers on tasks requiring stimulus grouping. On the tasks that required a combined effort, the mothers and children in Level One performed better (14.6 points) than the mothers and children from the other levels.

There was no significant difference between the groups of mothers in the amount of affect shown to the child during interaction sessions. However, there were gross differences between the groups of mothers in the verbal and cognitive output. To a greater extent, Level One mothers encouraged their children to reflect on the consequences of their actions and to carry on more elaborate verbal communication.

Conclusion: Mothers who themselves had an orderly and reflective cognitive style produced children with orderly and reflective cognitive styles. The investigators viewed cultural deprivation as being ". . . a deprivation of meaning—a cognitive environment in which behavior is controlled by status rules rather than by attention to the individual characteristics of a specific situation . . . ." Frequently, the preferred mode of communication is characterized by the use of nonverbal cues. The investigator postulated that the disadvantaged environment often produces children who react to authority and not to rational and reflective thinking. Actions are motivated by immediate punishment or reward, not by future goals or effects.

Comment: The development of a reflective cognitive style may be facilitated by specific training for both mother and child in situations requiring reflective thinking, such as the performance of scientific experiments, the participation in social interaction experiments, the solution of mathematical problems, and even the solution of problems in everyday life.

Source: Hess, Robert D., and Shipman, Virginia C. "Early Experience and the Socialization of Cognitive Modes in Children," ***Child Development,*** XXXVI, No. 4 (1965), 869–886.

FAMILY ENVIRONMENT AND COGNITIVE STYLE: A STUDY OF THE SOURCES OF HIGHLY INTELLIGENT AND OF HIGHLY CREATIVE ADOLESCENTS

Purpose: To investigate the personal-social behavior concomitants and the family environments of highly intelligent and highly creative adolescents

Review: The investigators asserted that the use of an ubiquitous IQ measure often leads to several types of possible errors. First, the single measure itself limits the scope of the general phenomenon of intelligence and places on a single score a "... greater theoretical and predictive burden than it was [ever] intended to carry." Second, the IQ measure assumes that the intelligence test represents an adequate sampling of all functions. Third, attempts to quantify intelligence are overemphasized and an understanding of the different kinds of intellectual ability are minimized. Because of the restrictions imposed by the single IQ score, the investigators postulated that there are cognitive processes not now adequately measured by intelligence tests. From this postulation, the investigators posed three hypotheses: (1) There are "... two groups of subjects differing significantly in kind of intellectual functioning—in this case, 'intelligence' and 'creativity' "; (2) There are significant differences between the personal-social behavioral concomitants of the two groups of intellectual functioning; (3) There are significant differences in the family environments of the two groups.

Four hundred and forty-nine adolescents attending a private midwestern secondary school were administered a standard intelligence test (usually the ***Binet***) and the following tests of creativity:

1. ***Word Association Test***—The subject was asked to give as many definitions as possible for a common stimulus-word
2. ***Uses for Things***—The subject was required to give as many uses as possible for a familiar object
3. ***Hidden Shapes***—The subject was required to find a simple geometric shape hidden in a complex geometric design
4. ***Fables***—The subject provided an appropriate ending to each of four fables
5. ***Make-Up Problems***—The subject was asked to create as many mathematical problems as he could from four paragraphs which contained a number of numerical statements

On the basis of the IQ score and a summated score of the creative measures, two experimental groups were formed. The first group was identified as the High Creative group and consisted of subjects in the top 20 percent on the creative measure, but below the top 20 percent in IQ. The 15 boys and the 11 girls of the High Creative group had a mean IQ of 127. The second group was identified as the High Intelligence group and consisted of subjects in the top 20 percent in IQ, but below the top 20 percent on the creative measures. The 17 boys and the 11 girls of the High Intelligence group had a mean IQ of 150.

Personal-social variables were evaluated through an analysis of teacher ratings, creative writing, school achievement, and an indicated choice of career aspirations. In order to ascertain systematic differences in family environment and cognitive style, family

interviews and inventories were obtained for the following variables from mothers of the two experimental groups:

1. Education and occupation of the parents
2. Age of the parents
3. Mother's recollection of her own family situation when she was her child's age
4. Reading interests in the family, at least, as represented by the number and type of magazines found in the home
5. Parental satisfaction and dissatisfaction with the child and his school
6. Parental satisfaction and dissatisfaction with their own child-rearing practices
7. Mother's description of the kinds of friends she preferred for her child

Analysis of the data supported the hypothesis that there are " . . . two groups of subjects differing significantly in kind of intellectual functioning–in this case, 'intelligence' and 'creativity.'"

The second hypothesis, that there are significant differences in the personal-social behavior concomitants of the High Creative and the High Intelligence groups, was also supported. Differences were revealed on the following variables: (1) High IQ students were rated as preferred students; (2) Creative students made a significantly greater use of "stimulus-free themes," unexpected endings, humor, and playfulness in their fable stories; (3) Sixteen percent of the High Intelligence group and 62 percent of the High Creative group made "unconventional career choices (*e.g.,* adventurer, inventor)."

Also supported was the third hypothesis that there were significant differences in the family environments of the High IQ and High Creative groups. An analysis of the parental responses on the family inventories indicated that High IQ parents tended to: (1) have higher educational status and specialized training; (2) display greater age discrepancy between father and mother; (3) mention finances more often; (4) note more unfavorable qualities in their children; (5) express fewer misgivings concerning child-rearing practices; and (6) make decisions concerning other children on external basis–"good" family or manners.

Conclusion: The investigators concluded that children could be identified on the basis of their preferred intellectual functioning as either High Intelligence or High Creative groups. Both groups were found to differ not only in intellectual behaviors, but also in personal-social behavior and family environment. The distinctions between high intelligence and high creativity appeared to be analytic distinctions, not evaluative ones.

Comment: It is worth noting again the investigators' recognition of the necessity to avoid judging one cognitive style as superior to another. Rather, judgment should be based on the learning task in question. It is important for the teacher to be aware of the cognitive style preference of the student so that these individual differences can be taken into account when planning learning activities for the children.

The reader should also note that the intelligence level of both groups in this study was above average and the generalizability of the results is, therefore, limited.

Source: Getzels, Jacob W., and Jackson, Philip W. "Family Environment and Cognitive Style: A Study of the Sources of Highly Intelligent and of Highly Creative Adolescents," ***American Sociological Review,*** XXVI, No. 3 (June 1961), 351–359.

DIFFERENTIATION IN CHILDREN AND THEIR PARENTS

Purpose: To investigate the relationship between levels of psychological differentiation in children and their parents

Review: Thirty boys and thirty girls, ranging from eight to eleven years of age, voluntarily participated with their parents in this study. None of the children was adopted, and all families were from the middle and upper middle class.

During the home testing session, all family members were tested simultaneously in different rooms by different testers. The first measure of differentiation was obtained from scores on the following tests: (1) *The Children's Embedded Figures Test (CEFT)*; and (2) Witkin's *Embedded Figures Test (EFT)* for adults. Both embedded figures tests required subjects to differentiate an object from its background or field. The second measure of differentiation was obtained from human figure drawings (*FD*) which were rated by the "sophistication-of-body-concept scales" developed by Witkin. In order to control for the effects of verbal intelligence, Form A of the *Full Range Picture Vocabulary Test* was administered.

The effects of IQ and age on each of the measures of differentiation were partialled out of the embedded figures and figure drawing scores leaving residual scores. Correlations between children's and parents' residual scores on measures of differentiation indicated that: (1) boys' *CEFT* and *FD* scores were significantly related to the mothers' *FD* scores, whereas, only boys' *CEFT* scores were significantly related to fathers' *FD* scores; (2) girls' *FD* scores and fathers' *EFT* scores were significantly correlated, whereas, no significant correlation existed between girl's scores and those of their mothers.

An index score for parent and child on both measures of differentiation was obtained by converting residual embedded figure and figure drawing scores to standard scores. Intercorrelation of the index scores revealed two significant associations: (1) boys' scores were significantly related to those of their mothers; and (2) girls' scores were significantly related to those of their father.

Conclusion: The investigator concluded that the child's level of differentiation tended to be consistent with the level of differentiation of the opposite-sexed parent.

Comment: The findings suggest that it is important for children to relate effectively to the parent of the opposite sex in order to develop a preferred cognitive style. In a classroom setting, if an attempt is made to modify a child's cognitive style, the change may be more effectively fostered by placing the child with a teacher of the opposite sex.

Because the subjects used in this study were volunteers, generalizability of the results may be, of course, limited.

Source: Corah, Norman L. "Differentiation in Children and Their Parents," *Journal of Personality,* XXXIII, No. 11 (1965), 300–308.

CHILDREN'S DEPENDENT AND ACHIEVEMENT BEHAVIORS IN SOCIAL SITUATIONS AND THEIR PERCEPTUAL FIELD DEPENDENCE

Purpose: (1) To replicate Witkin's finding on the ". . . relations between children's perceptual field dependence and status variables (age, sex, intelligence. . .)"; and (2) to evaluate the relationship between children's achievement motivation, dependent behavior, and field dependence.

Review: The investigators postulated that there are associations between the following variables and children's perceptual field dependence: (1) status variables such as age, sex, and intelligence; (2) variables pertaining to children's dependent behavior in social situations; and (3) achievement behavior. The relationship of the above three variables to children's perceptual field dependence were hypothesized as follows:

1. **Children's perceptual field dependence is negatively correlated with age and intelligence.**
2. **Socially dependent children exhibit more perceptual dependence than do children who display less social dependence.**
3. **Children who are achievement-oriented in their social behaviors display more perceptual field independence than children who are less achievement-oriented.**

Twenty-eight boys and twenty-two girls ranging in age from six years and ten months to twelve years and five months participated in this study. The ten least difficult figures of Witkin's *Embedded Figure Test* (*EFT*) were selected and administered to each child as a measure of perceptual field dependence. The test required the child to locate a hidden figure which was embedded in a complex design. The child was first shown a figure card and then instructed to find the same figure in the complex design card. The figure card and its corresponding design card were never shown simultaneously. Perceptual field dependence was measured by the total number of seconds the subject used to locate the hidden figure.

Dependent social behavior and achievement behavior were evaluated according to observational ratings of the children during free play at a day camp. The social dependence variables rated were help seeking, affection seeking, and recognition-approval seeking behavior. The achievement variables rated were concerned with mastery of fine motor skills, task persistence, time child spent alone on tasks, and manifestation of independent achievement. Each child was also assigned an overall dependency score (the sum of observed ratings of the three social dependent behavior variables) and an overall achievement behavior score (total of the four achievement behavior ratings).

An analysis of the data by a series of intercorrelations revealed a negative relationship between field dependence, age, and intelligence; that is, older and more intelligent children exhibited more field independence than younger and less intelligent children. However, there was no significant difference between variables of social dependence and perceptual field dependence. In contrast to the limited association found between social dependence and perceptual field dependence, the children's achievement motivation variables significantly predicted performance on the *EFT*, even when age and intelligence were partialled out. Children who were field independent were rated as achievement-oriented in social situations.

Conclusion: The investigators concluded that status variables such as age, sex, and intelligence, and variables pertaining to achievement behavior were predictive of children's perceptual field dependence as measured by the *EFT*.

Comment: The significant correlation between achievement behavior and perceptual field dependence means that high achievement is related to field independence and low achievement is related to field dependence. One possible explanation of this relationship is that most school tasks require field independence and, therefore, the field dependent subject is at a disadvantage.

Source: Crandall, Vaughn J., and Sinkeldam, Carol. "Children's Dependent and Achievement Behaviors in Social Situations and Their Perceptual Field Dependence," *Journal of Personality,* XXXII (March 1964), 1–22.

ERROR, RESPONSE TIME, AND IQ: SEX DIFFERENCES IN COGNITIVE STYLE OF PRESCHOOL CHILDREN

Purpose: To investigate the relationship between the cognitive style of reflectivity–impulsivity and sex and IQ in the preschool-age child

Review: Kagan and his colleagues found that the cognitive style of reflectivity–impulsivity was an important dimension in problem-solving situations involving high task uncertainty for young school-age children. The reflective child was identified as one who exhibited long response times and made few errors on a matching-figures task in which he was required to select a standard familiar figure or geometric design from an array containing the standard and several variations of it. In contrast, the impulsive child exhibited shorter response times but made more errors on the task. In addition to finding that response time and errors are negatively correlated, Kagan asserted that response time was statistically independent of intelligence on the matching-figures task.

In the present study, 23 boys and 25 girls, aged 44 months, were used to determine whether the response to task uncertainty of preschool children would be the same as the response exhibited by school-age children. The investigators were also interested in determining the effects of sex and IQ on performance of the task.

The 48 subjects were participating in a longitudinal study in southwestern Ohio and comprised a heterogeneous sample. Each child was administered a matching-figures test and Form L-M of the *Stanford-Binet Intelligence Scale* which was given either two weeks before or two weeks after the *Matching Familiar Figures* test (*MFF*). Two classes of responses were recorded for the *MFF* test: (1) the first choice, and, if necessary, the second choice of the subject; and (2) response time, the amount of time between the presentation of the standard and the first choice response.

In the analysis of the three measures taken—errors, response time, and IQ—no significant differences were found between boys and girls on the number of errors or on response time. However, a two-tailed *Mann-Whitney U* test applied to the mean IQ scores for boys and girls yielded a difference significant at the .02 level of confidence, with the girls' mean higher than boys' (girls = 113.2, boys = 107.1).

When the relationship between the three measures were analyzed separately for boys and girls, the product-moment correlations revealed that for boys, errors were significantly correlated with response time but not with IQ; for girls, errors were significantly correlated with IQ but not with response time, and IQ and response time were significantly correlated.

Because the initial analysis of the data indicated that all three measures were correlated, the investigators performed a second analysis using a partialling procedure which enabled them to correlate two factors while holding the third factor constant. The second analysis produced two significant product-moment correlations. For boys, errors and response time were correlated (significant at the .02 level of confidence) while for girls, errors and IQ were correlated (significant at the .01 level of confidence).

Conclusion: The investigators concluded that the sex differences found in the present

study demonstrate that reflectivity-impulsivity is not the only determinant of performance in a problem-solving situation involving high task uncertainty. Since girls' errors were a function of IQ and not response time, the authors suggested that the assumption that cognitive style is manifested in the same way for the two sexes be reexamined and modified. In addition, since sex differences were demonstrated at the early age of two-and-a-half years, researchers should avoid pooling results for the sexes.

Comment: The finding that boys' errors are a function of response time may have implications for the classroom in learning situations where oral responses are being requested by the teacher. If a boy can be encouraged to take more time to think about his answers, he might reduce the number of errors he makes in front of the class. This problem of how to train children to minimize impulsivity has been investigated by Kagan, Pearson, and Welch. (See, "Modifiability of an Impulsive Tempo," abstracted in this issue.)

Source: Lewis, Michael; Rausch, Marilyn; and Goldberg, Susan. "Error, Response Time and IQ: Sex Differences in Cognitive Style of Preschool Children," *Perceptual and Motor Skills,* XXVI, No. 2 (1968), 563–568.

Section II

COGNITIVE STYLE AND INFORMATION PROCESSING

Of the many demands made on students during their school careers, those which require information processing are of critical importance to academic success. According to Kagan, information processing occurs in "... the following sequence: the initial categorization of information, storage of the encoded information, [and] the imposing of transformation or mediational elaborations upon the encoded material."[1] It is evident that students differ in their characteristic modes of processing information. Therefore, any attempts to individualize instruction should take into account how students differ in their styles of information processing.

In this section, the first four studies dealt with concept learning and information processing in the child. The next study related inductive reasoning to cognitive style. The last three studies investigated the interaction of cognitive style and information processing under conditions of distraction.

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[1] Jerome Kagan, ***et al.,*** "Information Processing in the Child: Significance of Analytic and Reflective Attitudes," ***Psychological Monographs: General and Applied,*** LXXVIII, No. 1 (1964), p. 3.

INFORMATION PROCESSING IN THE CHILD: SIGNIFICANCE OF ANALYTIC AND REFLECTIVE ATTITUDES

Purpose: To examine the " . . . immediate and historical determinants of a preference for analytic conceptual groupings"

Review: In order for an individual to solve a problem, the investigators noted that at least three distinct processes occur in the following sequence: (1) the initial categorization of information; (2) the storage of encoded information; and (3) the transformation of the encoded information. Early explanations of superior problem-solving ability usually ascribed such ability to superior knowledge, not to individual differences in the processing of information. However, research of Kagan and his associates has demonstrated that superior knowledge is not the sole explanation of problem-solving ability. They have found that children and adults have a definite preference with respect to initial information processing or categorization which affects problem-solving ability. The investigators identified one preferred mode of thinking in problem solving which they labeled conceptualization or the relatively stable ability to analyze a stimulus into its differentiated components.

In order to explore the antecedents and significant correlates of analytic conceptualization, eight studies were subsequently conducted using children in grades one through four. Results revealed that two basic cognitive dispositions contributed to the production of the more complex cognitive dimension of analytic conceptualization. The two fundamental cognitive dispositions were: (1) the tendency to reflect over alternative solution hypotheses in situations for which several responses were available simultaneously; and (2) the tendency to analyze visual arrays into their component parts. These two dispositions contributed considerable variance to the production of analytic concepts; and each influenced the frequency of recognition errors on tasks requiring complex perceptual discrimination. Results also revealed that an individual's degree of reflectivity was stable and generalizable across a variety of tasks over a one-year period. An inverse relation was shown between the production of analytic concepts, extreme degree of hyperactivity, and distractibility.

Conclusion: The findings suggested that reflection over alternative solution possibilities and visual analysis are fundamental cognitive dispositions that influence analytic conceptualization and perceptual recognition errors. The investigators concluded that the determinants of these two dispositions " . . . may be related to constitutional variables [such as gross motor control and respiration rate], degree of involvement in the task, and anxiety over task competence."

Comment: If, as the results suggest, analytic conceptualization does influence the categorization of information, the teacher should recognize that a child's achievement may be a product of both his cognitive style and his repertoire of knowledge.

It is interesting to note that the authors postulate the importance of constitutional variables as additional determinants of an analytic style.

Source: Kagan, Jerome; Rosman, Bernice L.; Day, Deborah; Albert, Joseph; and Phillips, William. "Information Processing in the Child: Significance of Analytic and Reflective Attitudes," ***Psychological Monographs: General and Applied,*** LXXVIII, 1, Whole Number 578, (1964), 2–36.

INFORMATION PROCESSING AND CONCEPT LEARNING AT GRADES 6, 8, AND 10 AS A FUNCTION OF COGNITIVE STYLE

Purpose: To determine the extent to which information processing and concept learning are a function of field articulation [1]

Review: One test of cognitive style and two tests of conceptual ability were administered to 128 boys and 128 girls from three Wisconsin public schools. Grade point averages and IQ scores were available for most of the subjects who were drawn from the sixth, eighth, and tenth grades in approximately equal numbers. The children, tested in groups, were paced for each item on every test and were instructed to answer every question.

The measure of field articulation was performance on the ***Hidden Figures Test*** (***HFT***) which required the subject to locate geometric figures in complex patterns. An individual's level of field articulation was considered a reflection of his ability to separate relevant from irrelevant information, and such an ability was considered important in information processing and concept learning. Subjects who were able to ignore irrelevant information were considered analytic while subjects who were distracted by irrelevant information were considered global.

Information processing ability was assessed by the 30-item ***Tagatz Information Processing Test.*** Each item consisted of a focus card made up of six properties and two additional cards which had the same six properties. No two cards were identical because each of the six properties had two possible values (***e.g.***, the figure on the card was either round or square) and these values were combined in different ways to make the cards. One of the additional cards was always marked by a "Yes" or a "No" to indicate whether it was to be considered an example of the rule contained in the focus card. The third card was always marked with a question mark and the subject's task was to decide whether the "?" card was a "Yes" card, a "No" card, or a "Can't Tell" card. The "Can't Tell" response was to be given if the subject decided that he didn't have sufficient information to make a decision.

The test of concept learning consisted of two stories, each designed to teach a single concept. From the first story, the subject could learn "which plants would be good to eat" and from the second story, he could learn "which animals would bite." Both stories began with an explanatory paragraph and, depending on the story, the paragraph was followed by several pictures of plants or animals. Each picture was marked "Yes" or "No" to indicate whether it was a positive or negative instance of the plants good to eat or animals which bite. By studying the "Yes" and "No" examples provided, the subjects could learn which dimensions were relevant and his task was to categorize a new set of plant and animal pictures as "Yes" or "No" examples.

The analysis of variance revealed that the subjects who scored significantly higher on the ***HFT*** also had significantly higher IQ scores and grade point averages in the subjects of English, social studies, and mathematics. The high scorers on the ***HFT*** also made

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[1]The cognitive style dimension of field articulation has also been called global-analytical and field dependent-independent.

significantly fewer errors on both the *Tagatz Information Processing Test* and the concept learning task. The data analysis also revealed that as grade level increased, performance on the *HFT* improved.

Conclusion: The investigator concluded that " . . . significant differences between analytic and global *S*s [subjects] exist in intelligence, achievement, and in information processing and concept learning abilities."

Comment: Further evidence that cognitive style pervades several spheres of behavior is provided by the findings of this study. The correlation between IQ, grades, and an analytic style should not, however, be viewed as a cause and effect relationship. Success in school is usually gauged by performance on tests, and both the teaching methods and test requirements in the school environment are generally geared to the analytic mode of thinking. Thus, the conventional school requirements may not elicit or reflect the ability of nonanalytic thinkers.

Source: Frederick, Wayne C. "Information Processing and Concept Learning at Grades 6, 8, and 10 as a Function of Cognitive Style," ***Technical Report No. 44: The Research and Development Center for Cognitive Learning,*** Madison, Wisconsin: University of Wisconsin, 1968.

CONCEPT IDENTIFICATION AS A FUNCTION OF COGNITIVE STYLE, COMPLEXITY, AND TRAINING PROCEDURES

Purpose: (1) To determine whether individuals with a high analytic cognitive style would perform better on a standard concept identification task than low analytic individuals, and (2) to investigate the effect of two training procedures on concept indentification

Review: The subjects in the first experiment of this two-part study were selected on the basis of their performance on the *Hidden Figures Test* (*HFT*) which required the testee to locate a simple figure in a complex pattern. Of the 310 senior high school boys tested, 90 were selected to participate in the experiment and were divided into three equal groups:

1. High analytic group—members experienced little difficulty on the *HFT*
2. Medium analytic group—members were intermediate in their performance
3. Low analytic group—members experienced great difficulty on the task

One-half of the 30 subjects in each major group was randomly assigned to one of two concept identification problems. The subjects' task for both problems was to discover by trial and error the rule for classifying a series of figural patterns into four categories. The patterns were constructed so that they could vary along as many as seven dimensions. The two problems differed only in the two relevant dimensions which the subjects had to identify in order to classify successfully the patterns. Both problems had three comparable levels of complexity associated with them. Level of complexity was defined by the number of dimensions allowed to vary within a given set of patterns. A set of patterns in which more dimensions were allowed to vary was considered more complex than a set in which fewer dimensions varied because the latter set contained less irrelevant information. Each subject was randomly assigned to one of the levels of complexity for his problem and was tested individually to a criterion of 16 correct responses.

The analysis of variance applied to the errors-to-criterion scores revealed that high analytic subjects made significantly fewer errors than did middle analytic subjects who in turn made fewer errors than low analytic subjects. The main effect of the complexity variable was also significant—the subjects who had been assigned to the more complex problems made more errors. However, the interaction between cognitive style and complexity was not significant.

The second experiment of the study was conducted " . . . to determine whether the deficit in concept identification by the low analytic ***S***s [subjects] in Experiment I could be overcome by the use of two training procedures, ***verbalization*** and ***prompting.***" A new group of senior high school boys was administered the ***HFT*** and, on the basis of their scores, 40 analytic and 40 nonanalytic boys were selected to participate in the experiment. Although different boys were used in the two experiments, their scores on the ***HFT*** were comparable.

The concept identification task remained essentially the same for the second experiment. There were again two problems which differed only in terms of their relevant dimensions, but the level of complexity was not varied. One-half of the boys in both of the cognitive style groups was randomly assigned to one of the two problems. Then, maintaining an equal number

of analytic and nonanalytic subjects in each group, the boys were further randomly assigned to one of the following training conditions:

1. Verbal only condition--The subject was required to describe all of the values in each pattern presented before he was allowed to respond. The verbalization requirement was continued until the criterion of 16 consecutive correct responses was given.
2. Prompted only condition--For the first 24 trials, the subject was given the correct answer before he responded and was allowed to examine each pattern for as long as he wished. After the twenty-fourth trial, the subject continued the task by trial and error until criterion was reached.
3. Verbal-prompted condition--In this interaction condition, subjects received both types of training. On each of the first 24 trials, the subject verbalized the values of the patterns after the correct response was shown to him. Beginning with the twenty-fifth trial, he verbalized the values without prompting.
4. Control condition--Subjects in this nontraining group received no verbalization and no prompting.

Application of the analysis of variance to the errors-to-criterion scores revealed a significant main effect for cognitive style. High analytic subjects made fewer errors than nonanalytic subjects, regardless of the type of training and problem. The subjects in the "Prompted only" and "Verbalization only" conditions both made significantly fewer errors than the subjects in the "Control" condition. However, subjects in the "Verbal-prompted" condition made significantly more errors than the control group.

Conclusion: The author concluded" . . . that cognitive style is an important individual difference variable which exerts a marked degree of influence in concept identification." The study also demonstrated that training procedures such as prompting and verbalization can facilitate the learning of concepts for both high and low analytic individuals.

Comment: In the author's view, the findings of this study are pertinent to the field of education because of the current emphasis placed on the need for individualized instruction. He notes that " . . . non-analytic students would require assistance in differentiating a stimulus complex to a greater extent than would high analytic children." The ability to distinguish between analytic and nonanalytic children would help the teacher to develop instructional sequences tailored to the needs and learning styles along this dimension of individual differentiation.

Source: Davis, Kent J. "Concept Identification as a Function of Cognitive Style, Complexity, and Training Procedures, " ***Technical Report No. 32: The Research and Development Center for Cognitive Learning,*** Madison, Wisconsin: University of Wisconsin, 1967.

INFLUENCE OF A PREFERENCE FOR ANALYTIC CATEGORIZATION UPON CONCEPT ACQUISITION

Purpose: To investigate if a preference for analytic groupings would be associated with differential rates of learning various concepts–analytic, relational, or inferential–in a standard concept formation task

Review: According to the number of analytic responses given on the *Conceptual Style Test* (*CST*) (a set of 30 cards, each with three black and white drawings of familiar objects), 30 third grade boys were selected from a larger sample and divided into analytic and nonanalytic subgroups. A response was considered analytic if the grouping of objects was based on the similarity of an objective attribute which was a differentiated part within the total pattern–that is, "objects with a leg missing." Nonanalytic responses were classified as relational or inferential. Relational responses were characterized by the grouping of objects by some functional relationship between them such as "the dog goes in the doghouse." Inferential responses were characterized by the grouping of objects on some inferred quality or language convention such as "animals" or "furniture."

All students were asked to learn two analytic, two relational, and two inferential concepts. Each concept contained nine different picture stimulus cards sharing a corresponding nonsense syllable concept label. Following the paired presentation of the picture stimuli with the proper nonsense syllable, students were presented only the picture stimuli. They were then required to recall the correct nonsense syllable for each picture by identifying how the concept stimuli were related. Students were only shown the nonsense syllable label if, after five seconds, there was no verbal response or the response was incorrect. After students could correctly identify each picture for three errorless trials, they were asked to verbalize the concepts appropriate to each nonsense syllable.

Correlations indicated that analytic boys learned the analytic concepts at rates comparable to one another; however, their rates of learning relational concepts showed greater variance. The nonanalytic boys exhibited the reverse pattern by learning the relational concepts at comparable rates, and the rate of learning analytic concepts showed greater variance. The investigators noted that " . . . the interaction between a preference for analytic categorization and concept acquisition was highly significant ($p < .001$), indicating that the differential ease of attainment of the three concepts was intimately related to the tendency to be analytic in grouping the stimuli on the *Conceptual Style Test.*" Analytic boys mastered the analytic concepts faster than they mastered the other two concept classes; whereas, the reverse pattern was displayed for the nonanalytic boys.

Conclusion: The investigators concluded that some boys showed a predisposition toward an analytic approach when solving a conceptual problem, while others showed a predisposition toward a nonanalytic approach. Children of equal ability may arrive at " . . . different end states in a problem situation because of differences in the initial processing of stimuli."

Comment: Teachers should be made aware of the fact that most conceptual problems may be solved in many ways and the correct way for a child may depend upon his specific cognitive

categorization preference (analytic or nonanalytic). Consequently, the teacher who is presenting a lesson involving analytic concepts should realize that her analytic students will learn the concepts at comparable rates while the nonanalytic students will show a greater variance. Of course, the reverse pattern should hold true when nonanalytic problems are being presented. This greater spread should not be interpreted as a superiority of ability, but as a cognitive style difference.

Source: Lee, Lee C.; Kagan, Jerome; and Rabson, Alice. "Influence of a Preference for Analytic Categorization Upon Concept Acquisition," *Child Development,* XXXIV (1963), 433–442.

CONCEPTUAL IMPULSIVITY AND INDUCTIVE REASONING

Purpose: To determine whether impulsive children make more errors than reflective children on inductive-reasoning problems

Review: Seventy-nine boys and seventy-six girls, all first-graders in Newton, Massachusetts, met individually for two test sessions with one of three female investigators. The first test session included two measures of reflectivity-impulsivity, one inductive-reasoning test, and the vocabulary scale from the *Wechsler Intelligence Scale for Children* (*WISC*). Reflectivity-impulsivity was measured by the *Matching Familiar Figures* test (*MFF*) in which the child was required to select the one variant in a group of six that was identical to the standard being shown to him. Variables scored on the *MFF* included the number of errors, the response times, and the number and duration of times the subject's eyes oriented to the standard. In the second test of reflectivity-impulsivity, the *Haptic Visual Matching* test, the subject was again required to select a standard from a group of variants in a visual array. In this case, however, the standard was a geometric form or familiar object which the subject was allowed to touch for as long as he wished, but was not able to see. The major variables scored were exploration time of the standard, response time, and the number of errors. The measure of inductive reasoning in the first test session was performance on the *Picture Completion Reasoning Test* in which the subject was required to select from a group of four pictures the one which logically completed a set of pictures which told the beginning of a story. The variables scored were the response time to the first selection and whether that selection was correct.

The second testing session included the information scale from the *WISC*, a self-evaluation instrument, and two tests of inductive reasoning. In the *Extrapolation Reasoning Test*, the subject was shown a series of stimuli that were linked by a principle; the subject was then required to select from a set of alternatives the stimulus which best completed the series according to the principle. In the final test in inductive reasoning, the child was told three characteristics of a common object and was asked to guess the identity of the object. Then, after completing the *WISC* information scale, each subject was asked to evaluate his performance on all of the tests. He was shown a ten-inch line and was told that one end represented the children who did best, that the other end represented the children who did poorly, and that the middle represented the children who "did medium." The child was told to make a mark at the point on the line corresponding to the quality of his own performance. Using the same procedure, the child was asked to evaluate his own speed of thinking as well as his anxiety about making mistakes.

An intercorrelational analysis was performed on the 24 major variables derived from both testing sessions. Correlations of response times and errors on the test of reflectivity-impulsivity and of the reasoning tests for both sexes revealed that girls' correlations were higher than boys'. As expected, response times and number of errors on each reflectivity-impulsivity test were negatively correlated, but the effect was stronger for the girls. Errors on the reflectivity-impulsivity measures were also negatively correlated with the verbal-scale scores, but response time was independent of verbal ability. Reflective children took longer to make decisions on the self-evaluation task than did the impulsive children, and the reflective children were

generally more accurate. Finally, eye scanning data revealed that reflective children took longer to look at all stimuli that the impulsive children.

Conclusion: The authors suggested that children as young as six years of age exhibit a preferred mode of responding on inductive-reasoning problems which can be identified as either reflective or impulsive. They concluded that impulsive children make more errors on inductive-reasoning tasks because they do not pause to evaluate the quality of their inferences. The failure of the impulsive child to reflect may be due to his difficulty in placing effective inhibitions on tendencies toward action and his apparent lack of anxiety about making mistakes.

Comment: The authors note that the findings have implications for the teaching of subjects such as arithmetic, science, and social studies in which a high premium is placed on reflective thinking and making inferences. Teachers usually interpret an incorrect inference " . . . as [being] indicative of insufficient knowledge and usually do not appreciate the role of an impulsive attitude in determining the quality of the inferential process." The authors further suggest that the efficacy of training children to be more reflective be investigated. (See, for example, "The Modifiability of an Impulsive Tempo," by Kagan ***et. al.*** abstracted in this issue.)

Source: Kagan, Jerome; Pearson, Leslie; and Welch, Lois. "Conceptual Impulsivity and Inductive Reasoning," ***Child Development,*** XXXVII, No. 3 (September 1966), 583–594.

COGNITIVE STYLE AND PERFORMANCE UNDER DISTRACTION: A PARTIAL REPLICATION

Purpose: To investigate the effect of distraction on the performance of conceptual tasks for the perceptual-motor dominant subject and for the conceptual dominant subject

Review: The investigator attempted to test Broverman's premise that " . . . performance under distraction is a function of the degree of match between the requirement of the task and the cognitive style of *S*s [subjects]." Twenty-seven male and thirty-four female undergraduate students were administered the ***Stroop Word Color Interference Test*** and then categorized as either perceptual-motor or conceptual dominant. The test required subjects to read the printed names for colors (Card A) and then to give the names for patches of color (Card B). Subjects who named colors (Card B) faster than they read color names (Card A) were classified as perceptual-motor dominant, while subjects who named colors (Card B) slower than they read color names (Card A) were classified as conceptual dominant.

During the second test session, subjects were given a series of four matched anagram problems, each of which consisted of the sequential presentation of seven letters. Subjects were required to construct words as rapidly as possible with and without distraction (e.g., electronic music, sound effects).

Mathematics problems were given in the last test session. Each subject was required to solve four matched sets of sixteen mathematics problems (***e.g.,*** addition, subtraction, multiplication, division).

An analysis of variance revealed that perceptual-motor dominant subjects constructed more correct words on the anagram task without distraction than did the conceptual dominant subjects. Under distraction conditions, the perceptual motor subjects showed poorer performance than the conceptual dominant subjects, although the results were not significant. Also, no significant differences were obtained on the mathematics problems with or without distraction.

Conclusion: The results only partially supported Broverman's hypothesis. "It is true that perceptual-motor dominant subjects were somewhat more disrupted by distraction when working on a conceptual problem, but the relationship held only for the anagram problems."

Comment: The investigator noted that from an individual's cognitive style, only limited predictability exists for his performance on a conceptual task under conditions of distraction. "Further research is needed to clarify the conditions under which the relationship between cognitive style and task is of major importance or, alternatively, the conditions under which some possibly more general 'trait' of distractability determines performance under distraction."

Source: Bee, Helen L. "Cognitive Style and Performance Under Distraction: A Partial Replication," ***Perceptual and Motor Skills,*** XXVI (1968), 863–867.

FIELD-ARTICULATION AS A FACTOR IN VERBAL LEARNING AND RECALL

Purpose: To determine whether high field-articulation subjects perform better than low field-articulation subjects on a rote-learning task under interference conditions

Review: In order to select a sample for this study, 125 women were administered the *Concealed Figures Test* (*CFT*) which requires the individual to locate a simple figure embedded in a complex design. The investigator viewed the ability to articulate a complex field or design as a reflection of the capacity to direct attention to relevant stimuli while ignoring irrelevant or distracting stimuli. Thus, on the basis of scores on the *CFT*, 26 women identified as high field-articulation (Hi-FA) individuals and 26 women identified as low field-articulation (Lo-FA) individuals were selected to constitute the two experimental groups. The 52 women included housewives, secretaries, and business college students who ranged in age from 18 to 45 years.

A rote-learning task was individually administered to each subject in the two experimental groups. The subject was required to learn two lists, each of which consisted of ten meaningful words beginning with the letter "p" and ending with the suffix "ed"– for example, "PAINTED" and "POSTED." The same instructions were given to all subjects; however, before the presentation of the first word list, one-half of the subjects in both Hi-FA and Lo-FA groups was administered a warm-up task similar to the actual rote-learning task.

Immediately after the subject learned the first word list (List A), to the criterion of one correct trial, the second word list (List B) was presented, and the number of trials taken to learn both lists was recorded. Subsequently, each subject was tested for recall of words in Lists A and B. Only the words written in the correct position and list were scored as correct responses. Following the test of recall, each subject relearned List A to the criterion of one correct trial.

The analysis of variance for the original learning of List A revealed that the Hi-FA subjects learned the list significantly faster than the Lo-FA group. In addition, it was found that the Lo-FA subjects who were administered the warm-up task learned List A in significantly fewer trials than the Lo-FA subjects who had no warm-up activity. The warm-up activity did not, however, facilitate learning for the Hi-FA subjects.

Analysis of covariance of the recall test scores for List A revealed that the Hi-FA subjects recalled significantly more words than the Lo-FA subjects. In order to determine the extent to which the two lists of words interfered with correct recall, the Wilcoxon t-test was applied to the total number of transpositions between the two lists. A difference significant at the .001 level of confidence was found with the Lo-FA group averaging four times as many transpositions as the Hi-FA group. Finally, the analysis of the data pertaining to the relearning of List A revealed that the Hi-FA subjects relearned the list significantly faster.

Conclusion: The investigator concluded that " . . . the Field-articulation control principle is an important determinant of learning and recall in an interference situation." He suggested that the high field-articulators performed better because they are more capable of directing attention only to the relevant items in a complex stimulus field which contains irrelevant or distracting elements.

Comment: It is worth noting that the warm-up activity task facilitated learning only for the women who were rated low on the field-articulation dimension. If the warm-up task in this study is similar in function to motivational or readiness activities which are often used as introductions to lessons, students who can be characterized as field articulators may not benefit from such activities.

Source: Long, Robert I. "Field-Articulation as a Factor in Verbal Learning and Recall," ***Perceptual and Motor Skill,*** XV (1962), 151–158.

FIELD DEPENDENCE AND MEMORY FOR INCIDENTAL MATERIAL

Purpose: To investigate the relationship between field dependence, recall, and recognition of incidentally presented neutral and social materials

Review: Twenty-seven undergraduate and three female graduate students participated in this study. Subjects were brought to an experimental room where they were led to believe that another experiment (Experiment 2) was being conducted with the use of a tape recorder. The subject heard a brief discussion between the two experimenters during which it was decided to use a plastic curtain to divide the room. This procedure was designed to convince the subject that any sounds she heard would have no connection with her own experiment (Experiment 1).

The subject was then administered the Digit Symbol subtest of the ***Wechsler Adult Intelligence Scale*** (***WAIS***) under two conditions: (1) with no stimuli being presented on the tape recorder; and (2) with an incidental word list being presented on the tape recorder which was clearly audible to the subject. The incidental word list consisted of 15 neutral and 15 social words presented three times, resulting in a total presentation time of eight minutes. The social words were selected by three raters who agreed that the words were relevant to social interaction. In addition to the aural incidental word list, the physical characteristics of the room and eight objects, such as pictures and an ash tray, were defined as neutral visual stimuli. The constellation of the physical and personal traits of Experimenter 2 were defined as social visual incidental stimuli.

After the subject completed the Digit Symbol task under both conditions, she was asked to recall as many words as she could from the tape recorder word list. Next, subjects were presented with a recognition sheet and asked to choose from each group of six words the two which they had heard.

A questionnaire concerning the possible impact of Experimenter 2 (social visual incidental stimuli) and the physical characteristics of the experimental room (neutral visual incidental stimuli) was completed by each subject. Finally, a group form of the ***Embedded Figures Test*** (***EFT***) and the ***Hidden Figures III*** test were administered to the subjects.

The significantly negative correlation between the ***EFT*** and the recall of social incidental words indicated that the more field dependent a subject was, the more social words she recalled. Correlations of the recognition data revealed that while ***EFT*** and recognition of neutral words were not significantly related, recognition of social words was significantly related to ***EFT*** performance. In addition, the correlation between ***EFT*** and the difference scores between social and neutral recall of incidental visual stimuli revealed a significant negative correlation. That is, field dependent subjects were more likely to show superior incidental learning of social visual material.

Conclusion: The investigators suggested that " . . . field dependence is related specifically to memory for incidental socially relevant material rather than incidental material as such."

Comment: Because of the nature of this experiment, the findings have limited application to the classroom setting. The finding that field dependent subjects are able to learn incidental social material merits further exploration. It may be advantageous to explore whether the

positive learning of social incidental material by field dependent subjects could be extended to the positive learning of subject matter in a social context. Will field dependent children learn material presented in a social context better than material presented in neutral contexts?

Source: Fitzgibbons, David; Goldberger, Leo; and Eagle, Morris. "Field Dependence and Memory for Incidental Material, "***Perceptual and Motor Skills***, XXI (1965), 743-749.

Section III

COGNITVE STYLE AND ACADEMIC PERFORMANCE

Although the effects of cognitive style on academic performance have not been extensively investigated, the studies available indicate a positive relationship between the two variables. The findings of the studies also suggest that different academic content areas present different task requirements for the student. Because of the nature of many school task requirements, students who manifest the cognitive styles variously defined as reflective, analytic, and field independent are at an advantage. For example, when learning how to read reflective students appear to master the skill of word recognition more accurately than impulsive students. On the other hand, it is inappropriate to assert that one cognitive style is superior to another.

In this section, the first study related cognitive style to classroom expressiveness. In studies two and three, the effects of cognitive style on reading achievement were examined. The next study investigated the cognitive style differences between students of comparable intelligence who differed in achievement levels. The final study reported the relation between academic performance, content requirements, and cognitive style.

THE RELATIONSHIP OF COGNITIVE STYLE TO CLASSROOM EXPRESSIVENESS AND ASSOCIATED VARIABLES

Purpose: To investigate two dimensions of cognitive style—intelligence as measured by IQ tests and creativity or divergent thinking as they are related to classroom cognitive expression

Review: One hundred seventy-six academically talented junior and senior high school students in ten classes were administered tests of divergent thinking and a semantic differential test which measured self-concept and attitudes. Sixty-eight students were drawn from the larger sample and assigned to one of three main groups as follows:

1. High IQ-Low Divergent—Students who fell in the top third on IQ scores but in the bottom third group on divergence scores
2. Low IQ-High Divergent—Students who fell in the top third on divergence scores but in the bottom third on IQ scores
3. High IQ-High Divergent—Students who fell in the top third on both measures

Each of the main groups was divided by sex into smaller unequal groups resulting in six subgroups. "High" and "low" IQ were relative terms in this study, for all groups had high ability with the low IQ group having a mean near 120.

The three groups were compared on classroom expressiveness through analyses of transcripts of five consecutive one-hour class sessions. Student and teacher questions and answers were rated according to Guilford's theoretical model of intellectual functioning. "Four major dimensions of intellectual operations were identified through the system: Cognitive-Memory, Divergent Thinking, Convergent Thinking and Evaluative Thinking." Student class scores were adjusted on each intellectual function by dividing the student score for five days by the total class score in each area.

Teacher ratings were obtained on student ability and sociability. A questionnaire, designed to measure parental attitudes and parent-child relationships, was completed by the parents of each student.

The data were analyzed by the Mann-Whitney U test which made allowance for the small number of subjects and the wide variance of each group. Each of the following results was significant at least to the .05 level of confidence:

I. Results pertaining to classroom expressiveness
   - A. The boys showed no significant difference between cognitive styles and classroom performance.
   - B. High IQ-High Divergent girls were significantly more expressive than the High IQ-Low Divergent girls in the dimensions of Divergent Thinking, Convergent Thinking, and Evaluative Thinking.
   - C. The Low IQ-High Divergent girls were significantly more expressive in Convergent Thinking than High IQ-Low Divergent girls.

II. Results pertaining to teacher ratings
   - A. The High IQ-High Divergent girls were rated significantly higher in cognitive ability than the Low IQ-High Divergent girls.
   - B. The High IQ-Low Divergent boys were rated significantly higher on cognitive ability than Low IQ-High Divergent boys.

C. The High IQ-High Divergent girls were rated significantly higher on the characteristic of sociability than High IQ-High Divergent boys.

III. Results pertaining to a semantic differential scale
   A. The concept of "work" was rated significantly lower by the High IQ-Low Divergent boys than the other High Divergent groups.
   B. The concept of "mother" was rated significantly higher by the High IQ-Low Divergent girls than by the High IQ-High Divergent girls.

IV. Results pertaining to parental attitude
   A. The fathers of the High IQ-Low Divergent boys were rated significantly lower on achievement inducing than the fathers of the Low IQ-High Divergent boys.
   B. The mothers of Low IQ-High Divergent girls were rated as granting significantly more independence than mothers of the other two style groups.

Conclusion: The investigators concluded that there were significant differences in classroom expressiveness, teacher ratings, and parental child rearing practices between the three cognitive style groups of academically talented secondary students. The different patterns of results obtained for each sex within a specific cognitive style group may indicate that investigators should be wary of combining the results of girls and boys in the analysis of their data.

Comment: The findings of this study suggest that the teaching methods needed to obtain maximum performance from children may differ not only for various cognitive style groups, but may differ for sexes within a specific cognitive style group.

Source: Gallagher, James J., and Jenné, William C. "The Relationship of Cognitive Style to Classroom Expressiveness and Associated Variables," ***The Journal of Educational Research,*** LX, No. 6 (February 1967), 273–279.

REFLECTION–IMPULSIVITY[1] AND READING ABILITY IN PRIMARY GRADE CHILDREN

Purpose: To " . . . determine if measures of reflection-impulsivity gathered in the first grade would be prognostic of reading performance one year later."

Review: The investigator defined a disposition labeled "reflection-impulsivity" as the tendency to reflect over alternative-solution possibilities in contrast with the tendency to make an impulsive selection of a solution in problems with high response uncertainty." Children classified as impulsive made faster decisions and more errors than reflective children who exhibited longer decision times. The investigators wished to ascertain whether first-graders learning to read would be affected by the reflection-impulsivity dimension. They hypothesized that reflective children would commit fewer word recognition errors than impulsive children.

Sixty-five boys and sixty-five girls in the first grade of three middle-class public schools were tested individually by two adult females during two test sessions. Descriptions of the tests in their order of administration follow:

I. First Session Tests

A. ***Design Recall Test*** **(*DRT*)**—After children were shown a simple geometric design for five seconds, the design was removed and children were than shown eight, nine, or ten similar designs from which they were to select the one identical to the standard. The number of errors made and response latencies were recorded.

B. ***Haptic Visual Matching*** **(*HVM*)**—Following the presentation of a wooden form which children were allowed to explore only by touch, a visual array of five stimuli was then presented. The children were to choose the visual stimulus which was identical to the standard. Total number of errors, response time to selection of the visual array stimuli, and exploration time (i.e., the time children devoted to exploration by touch) were recorded for each child.

C. ***Matching Familiar Figures*** **(*MFF*)**—Children were shown a picture of a familiar object and were then shown six similar picture variations, only one of which was identical to the standard. During the selection of the matching picture, both the standard and the variations were always available to the child. Total number of errors and average response time to the matching of the familiar figures were recorded.

D. ***Wechsler Intelligence Scale for Children*** **(*WISC*)**—The average scaled score of the information and vocabulary scales of the ***WISC*** were recorded for each child.

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[1] Kagan uses the terms "reflection-impulsivity" and "reflectivity-impulsivity" interchangeably.

II. Second Session Tests

A. Visual analysis—Children were required to associate correctly one of four colors (yellow, blue, red, or green) with four different complex designs. Each design contained three distinct components—background, element, and figural forms. After the criterion of eight consecutive correct trials was reached, children were given a response-transfer task in which the three design components were shown separately. The children were required to associate correctly the isolated component to the correct color. The numbers of ground, figural, and element components labeled correctly were scored.

B. Reading ability—Children were tested for letter and visual word recognition; response time and total number of errors were recorded.

Word recognition errors were negatively correlated with response time on the ***MFF*** for both sexes. Also, high error scores on the ***MFF*** and the ***HVM*** were predictive of high word error scores. Greater accuracy in word recognition was exhibited by children having longer decision times and lower error scores on the ***MFF***. Even after the effect of verbal ability was partialled out, long response time on the ***MFF*** was still significantly correlated with reading errors. This relationship was more clearly demonstrated by the highly verbal children since the low-verbal children had acquired minimal reading skill; it was believed that this lack of basic ability to read rather than a preferred conceptual strategy was the primary determinant of reading errors.

Of the original group, 54 boys and 59 girls were retested approximately six months later in the fall of their second year in school. In groups of 15, the children were tested for their ability to recognize orally presented words. Test items consisted of a set of three printed words, and the children were to underline the word that was read by the instructor.

Correlations between measures of reflection-impulsivity and reading scores in grade one and word-recognition scores in grade two revealed that high error scores on the ***MFF*** and the ***HVM*** significantly predicted word recognition errors.

Of the 130 children tested in grade one, 46 boys and 56 girls were observed in the spring of the second grade. Each child was tested individually with the same version of the ***MFF*** which had been administered in grade one and was then given four paragraphs to be read aloud.

Children who had been classified as impulsive in the first grade had the highest reading error scores at the end of the second grade. For boys, the level of reading performance was best predicted by the response time variable on the ***MFF*** while for girls, the best predictor was number of errors on the ***MFF***.

Conclusion: The hypothesis that primary grade children who had been identified as reflective thinkers would be more accurate in recognizing words than children who had been identified as impulsive thinkers was confirmed. The investigators noted that an assessment of reflection-impulsivity should be included in the diagnostic evaluation of children with reading difficulties. Training in reflection could also prove to be profitable in reading readiness programs.

Comment: The investigator's suggestion for training in reflection may be extended to other academic subjects such as mathematics and spelling.

Source: Kagan, Jerome. "Reflection-Impulsivity and Reading Ability in Primary Grade Children," *Child Development,* XXXVI (1965), 609–628.

COGNITIVE STYLES AND READING DISABILITY

Purpose: To determine whether poor readers can be differentiated from adequate readers (i.e., those reading on grade level) in terms of their cognitive styles

Review: Twenty-four boys were selected by a remedial reading teacher in a Colorado school system to form the experimental group used in this study. Their ages ranged from eight to thirteen years and their grade levels ranged from the third to the sixth grade. Scores on the *Botel Reading Inventory* established that each boy was reading on a level at least one year below his actual grade placement, and scores on the *IPAT* test (an intelligence test which estimates IQ relatively independent of language skills) ranged from 65 to 116 (mean = 92.7).

The control group consisted of 23 boys who were selected from the same school system in such a way that their age, IQ, and grade level profiles closely approximated those of the experimental group. However, the reading achievement levels of the control subjects were equal to, or slightly better than, their actual grade placement.

Following the formation of the experimental and control groups, three different cognitive styles were investigated in three different, but interdependent studies. The same boys participated in all three studies, and each boy was tested individually in a room in his own school.

Study 1 investigated the cognitive style of focusing-scanning which " . . . concerns the manner in which an individual distributes attention between objects which he is comparing." Individuals who distribute attention equally and systematically between objects were defined as focusers while persons who appear to attend to the objects in an unsystematic manner were called scanners. Each subject was adminstered *The Circles Test* which consisted of 27 pairs of circles in both illusion and nonillusion conditions. Each pair was printed on a separate card and the subject's task was to judge which circle on each card seemed larger or whether the circles seemed equal in size.

The investigators reasoned that poor readers were scanners and would therefore produce fewer accurate size estimations on the nonillusion condition, but would produce more accurate size estimations on the illusion conditions because their scattered, unequal attention would not allow the illusions to operate. The analysis of variance, however, revealed no significant differences in judgment between the poor readers and the controls in any of the conditions.

Study 2 investigated the cognitive principle of level-sharpening which " . . . concerns the manner in which an individual processes ongoing, changing stimuli." Levelers were described as perceivers who tend to merge new experiences with memories of earlier ones and who " . . . therefore construct relatively undifferentiated impressions of ongoing experiences." Sharpeners, however, tend to maintain discrete impresstions and thus, for them, the elements of stimuli do not lost their individuality. The subjects were administered Santostefano's *Leveling-Sharpening House Test,* which consisted of 60 lined, acromatic pictures of a house scene. Every fouth picture shown to the subject contained a change in the scene in the form of an omission and 19 elements were omitted cumulatively. The subject viewed each picture for five seconds and was instructed to tell

the experimenter if he noticed that something had changed in terms of the picture just shown and those preceding it. Three scores were assigned to each subject: a first-stop score, the number of correct changes reported, and the leveling-sharpening ratio. The analysis of variance performed on the mean scores yielded no significant differences between the poor and adequate readers.

Study 3 investigated the constricted-flexible cognitive style which characterizes " . . . the manner in which an individual deals with a stimulus field containing a background of information which is intrusive or contradictory in terms of the central task." The flexible individual is able to ignore such irrelevant data while the constricted individual cannot. In this study, the two-part ***Fruit Distraction Test*** was administered to each boy to determine his position on the dimension of constricted-flexible cognitive style. In ***Fruit Distraction Test I,*** each subject was given a control card which contained 50 drawings of properly colored apples, bananas, lettuce, and grapes randomly distributed in rows. The subject was required to read aloud as fast as he could the colors of the fruit. Upon the completion of that task, the subject was handed the first distraction card which contained exactly the same fruit as the control card, but the fruit was now surrounded by acromatic line drawings of various common objects (e.g., a chair, a car). Again, the subject was asked to read the color of the fruit and, at the completion of the task, was requested to name as many of the background pictures as he could remember. Reading errors and time were recorded for both cards.

In ***Fruit Distraction Test II,*** a second distraction card was used which contained the same kinds of fruit as the control card, but each fruit was colored incorrectly. Each subject was required to read the correct color that should have been on each fruit.

Reading time differences and error differences between the control card and each distraction card were tested for significance on the assumption that subjects who took longer to read and made more errors on the distraction cards were governed by the constricted principle. On ***Fruit Distraction Test I,*** the poor readers did take longer than the adequate readers to read the distraction card, but the difference failed to reach an acceptable level of confidence. The difference between the two groups on the number of errors made on the control and distraction cards was also not significant. However, there was a significant difference between the poor readers and controls in the number of background pictures recalled (significant beyond the .05 level of confidence) with the poor readers recalling more than the controls.

On ***Fruit Distraction Test II,*** the poor readers took a significantly longer time to read the incorrectly colored distraction card than the controls (significant beyond the .05 level of confidence), but the difference in the number of errors was not statistically significant.

Conclusion: Of the three cognitive principles studied, only the constricted-flexible dimension seemed to have implications for reading disability. Poor readers appeared to have difficulty processing information in the context of distractions or irrelevant information.

Comment: The authors note that if particular cognitive styles can be identified as being critical to the reading process, and if the developmental acquisition of these styles

comes to be understood, then a better understanding of reading disabilities would follow. Moreover, the better understanding of how cognitive styles function in the reading process would aid in the development of effective reading programs in general.

Source: Santostefano, Sebastiano; Rutledge, Louis; and Randall, David. "Cognitive Styles and Reading Disability," *Psychology in the School*, II (1965), 57–62

COGNITIVE STYLES IN POTENTIAL SCIENTISTS AND IN UNDERACHIEVING HIGH SCHOOL STUDENTS

Purpose: To determine whether bright high school students identified as underachievers and high achievers identified as potential scientists differ in their cognitive styles of impulsivity, tolerance for ambiguity, and rigidity

Review: Ten boys (mean age, 16.4; mean IQ, 130) enrolled in a summer science program for bright high school students with outstanding grades in science and mathematics courses comprised one of the two groups studied. The second group consisted of 20 boys (mean age, 15.6; mean IQ, 128) enrolled in a summer remedial program for bright students who were failing academically.

Two experimental procedures were used to evaluate the cognitive styles of the 30 boys. During the first procedure, designed to measure the rigidity-flexibility dimension, each boy was shown a series of eight pictures which represented a continuum that began with a clear picture of a boy in Card 1 and changed to a clear picture of a girl in Card 8. Each picture contained a slight change from boy to girl and the subjects were instructed to tell the experimenter "what the picture is" as each was presented to him. Several variables were scored:

1. The first indicated change in concept (a noun such as "person," "man," or "teenager"
2. The first stable concept that did not change again
3. The number of changes in concept
4. The number of elaborations or modifiers and details, e.g., "farm boy," "girl with long hair"
5. The response latency between the presentation of the picture and the child's comment

In the second experimental procedure, designed to measure tolerance for ambiguity, each subject was shown a series of 15 pictures which began with an ambiguous picture showing isolated parts, and ended with a complex picture showing a man digging with a shovel. The subject was told that he would be shown a series of cards, each containing a few more hints or clues as to what the final picture would be, and that he should try to determine the nature of the final picture as soon as he could. No restriction was put on the length of time the subject viewed each card and, again, response latencies were recorded.

Several significant differences were found between the two groups of boys on both tasks. On the first task, the high achievers changed their concept from boy to girl earlier in the series and also changed their concepts a greater number of times than the underachievers (significant beyond the .05 level of confidence). Moreover, the high achievers offered a significantly greater number of concepts and elaborations and exhibited significantly longer response latencies.

Analysis of the data for the second procedure, the ambiguous picture series, revealed that the high achievers offered their first response earlier in the series, gave a correct response (human or person) earlier, took fewer trials to arrive at an unchanging correct response, took fewer trials to give the response "person digging or shoveling,"

and again volunteered a greater variety of concepts and elaborations. All of these differences were statistically significant. In addition, the underachievers responded significantly more rapidly than the high achievers.

Conclusion: Noting that his results are in agreement with findings of earlier studies, the investigator stated that "... underachievers tend to be rapid and impulsive in their approach to experimental tasks, and show greater rigidity and intolerance of ambiguity in their cognitive processes." In contrast, the potential scientists (or high achievers) exhibited significantly more flexibility and tolerance for ambiguity. Since cognitive styles are established early in the child's life and would appear to be important in determining how effectively the individual utilizes his capabilities, the author recommended that large-scale research be undertaken to investigate the development and possible modification of the cognitive process in the young child.

Comment: This study may indicate that a major determinant of the differences in achievement levels between two groups of comparable intelligence may be attributed to differences in cognitive style—specifically impulsivity, tolerance for ambiguity, and rigidity. The findings suggest that a reexamination of some common approaches used in attacking the problem of underachievement may be necessary. Typically, underachievers have been exposed to programs which emphasize content enrichment or enhancement of their apparent lack of motivation. It is possible that efforts may be channeled more productively into attempts to modify the cognitive style of underachievers. The development of a diversity of response sets should encourage flexibility and divergent thinking.

Source: Davids, Anthony. "Cognitive Styles in Potential Scientists and in Underachieving High School Students," *The Journal of Special Education*, II, No. 2 (1968), 197–201.

ACADEMIC PERFORMANCE AS A FUNCTION OF TASK REQUIREMENTS AND COGNITIVE STYLE

Purpose: To examine the relationship between an individual's cognitive style and academic performance in the areas of engineering, humanities, natural science, and social sciences

Review: One hundred and fifty Princeton male upperclass undergraduates voluntarily participated in this study. Cognitive style was defined in terms of performance on the Schroder *Paragraph Completion Test (PCT)*. Scores derived from this test fell along a continuum, with high scores representing persons who are congitively abstract and low scores representing persons who are cognitively concrete. The student grade point average of courses in his major was computed and used as a measure of performance. In order to control for the effects of aptitude upon performance, scores on the *Scholastic Aptitude Test Verbal (SAT–V)* and *Math (SAT–M)* were obtained for each student.

An analysis of the data by t-tests revealed that: (1) Humanities students had significantly lower *SAT–M* scores than did students in engineering and natural science; and (2) Humanities students were significantly more conceptually abstract than engineering students. Pearson product-moment correlations were then run between Schroder *PCT* scores and departmental averages for students. High scores on the *PCT* (cognitively abstract) correlated positively with good grades in the social sciences and humanities, but negatively with good grades in engineering. Finally, multiple and partial correlations between the scores on *SAT–V, SAT–M,* and *PCT* and scores on departmental averages revealed that cognitively concrete students performed better in engineering than did those who were cognitively abstract. The reverse relationship held for students in the humanities and social sciences.

Conclusion: The investigators concluded that students with a cognitively concrete style tend to show better performance in engineering, and students with a cognitively abstract style tend to show better performance in the social sciences and humanities.

Comment: The findings suggest that different academic disciplines present different task requirements. However, it is inappropriate to assert that one cognitive style is superior for academic performance, " . . . but rather that it is necessary to consider performance as a function of the interaction between cognitive style and task requirements."

Source: Pohl, Richard L., and Pervin, Lawrence A. "Academic Performance as a Function of Task Requirements and Cognitive Style," *Psychological Reports*, XXII (1968), 1017–1020.

Section IV

COGNITIVE MAPPING

The American practice of using the IQ score as a single index of children's ability is often misleading in that it masks the true complexity of intellectual processes. Very often pupils are evaluated and labeled on the basis of a composite score (IQ) representing their performance on intelligence tests. Widespread criticism of the practice has lead investigators to seek additional means for classifying children's intellectual processes. For example, Getzells and Jackson have suggested that not all intellectual processes relevant to school achievement are being tapped by the IQ test and perhaps cognitive style measures could be more profitably used on supplement the single IQ metric. (See, "Family Environment and Cognitive Style: A Study of the Sources of Highly Intelligent and of Highly Creative Adolescents," abstracted in this issue.) Witkin even recommends the use of cognitive mapping which " . . . will in time be able to establish . . . a rich, sensitive, complex and comprehensive way of characterizing children both in their cognitive functioning as persons."[1]

Although cognitive mapping appears to hold great promise as a measurement tool, there are, at present, too few studies which explore the relationship between the concepts of cognitive mapping and intelligence testing.

In this section, the first study investigated the relationship between children's intellectual functioning and the cognitive style dimension of field dependence. The second study examined adult concept formation and field independence.

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[1] Herman A. Witkin, "Some Implications of Research on Cognitive Style for Problems of Education." *Archivio di psicologia neurologia e psichiatria,* XXVI (1965), 49.

FIELD DEPENDENCE AND INTELLECTUAL FUNCTIONING

Purpose: To examine the nature of the relationship between the dimension of field dependence and IQ scores

Review: The investigators defined the dimension of field dependence as the relative ability to differentiate embedded figures from their field or background. Subjects who have difficulty in separating a figure from its field are called field dependent; subjects who easily analyze an organized perceptual field or readily separate a figure from its background are called field independent. The investigators noted that previous research has revealed that field independent subjects will generally achieve higher scores on intelligence tests than field dependent subjects. Witkin has postulated that certain intellectual tasks may require the ability to separate an item from its context—the dimension of field independence. On the basis of Witkin's postulation, the investigators asserted that some subtests of the ***Wechsler Intelligence Scale for Children*** **(*WISC*)** would reflect an individual's capacity for overcoming embeddedness.

Factor analyses of the ***WISC*** subtests have revealed the following three factors:

1. Verbal Comprehension—defined by the Information, Comprehension, Similarities, and Vocabulary subtests
2. Memory or Concentration-speed—defined by the Arithmetic and Digit Span subtests
3. Closure or Nonverbal Organization—defined by the Block Design, Picture Completion, and Object Assembly subtests

The investigators hypothesized that the factor identified as Closure or Nonverbal Organization on the ***WISC*** appears to involve the capacity to overcome embeddedness. They further hypothesized that if the analysis " . . . of the subtests defining the Closure factor is correct, and if the relationship between field dependence and IQ is a function of cognitive style, i. e., the capacity to overcome embeddedness, it should be possible to demonstrate that tests of field dependence and ***WISC*** Closure subtests define a single, common factor."

Two groups of children, Group A (consisting of 25 boys between the ages of 11.5 and 12.5 years); and Group B (consisting of 30 boys between the ages of 9.5 and 10.5 years) were administered the ***WISC*** battery. Measures of field dependence were obtained from Group A and Group B by administering the following tests:

1. *The Embedded Figures Test* (*EFT*)—consisted of 24 test items which required subjects to locate a simple figure embedded in a complex geometric design
2. *The Rod-and-Frame Test* (*RFT*)—required the subject to be brought into a darkened room where he was told to manipulate a luminous rod within a frame until the rod was set to the objective vertical standard
3. *The Room Adjustment Test* (*RAT*)—utilized the "tilting-room-tilting-chair" situation which required the subject, who is seated in the tilted chair, to adjust the tilted room to the upright standard

4. *The Body Adjustment Test* (*BAT*)—required the subject to adjust the tilted chair to the upright while the room remained tilted

The following additional cognitive tests were administered only to subjects in Group B:

1. *The Children's Embedded Figure Test* (*CEFT*)—required the subject to locate a simple figure in a complex design
2. *The Recognition-efficiency test* (nonserial version)—consisted of a series of out-of-focus pictures which subjects were asked to identify
3. *The Recognition-efficiency test* (serial version)—consisted of a series of out-of-focus pictures; however, each picture was presentec in increasingly sharper focus until identified correctly by the subject
4. *The Hidden Picture Test*—consisted of a series of pictures which required subjects to identify faces hidden in a complex scene
5. *The Incidental Learning Test*—consisted of the presentation of eight common three-letter words, each of which was printed in one of four colors. Following a single exposure to the series of words in which the subject was instructed to name the color of each word, the subject was tested on the recall of the words
6. *The Intentional Learning Test*—utilized the same type of material and a similar procedure as the *Incidental Learning Test*. However, prior to the presentation of the list of words, the subject was instructed to name and try to remember each word
7. *The Reconciliation of Opposites* test—required subjects to explain how a pair of opposites (e.g., high-low) are similar
8. *The Cancellation Test*—required the subject to cross out all the "t's" on a page as quickly as possible

For each experimental group, a factor analysis was performed on the matrices of correlations which consisted of the cognitive style tests (particularly field dependence) and the subtest of the *WISC*. Eight factors were extracted from the Group A correlation matrix and nine factors were extracted from the Group B matrix. The first three factors of each analysis corresponded closely to the factors of the *WISC* scales.

The first factor, verbal comprehension, was isolated by loadings on the Vocabulary, Information, Similarities, Arithmetic, and Comprehension subtests of the *WISC*. Among the variables included in the Group B study, reconciliation of opposites and intentional learning were loaded on Factor One.

The second factor, attention-concentration or memory, was isolated by loadings on the Digit Span, Arithmetic, and Coding subtests of the *WISC*. Group B's *CEFT* results were also loaded on this factor.

The third factor, closure, was isolated by loadings on the Block Design, Picture Completion, and Object Assembly subtests of the *WISC*. The five tests of perceptual field dependence—*RFT, EFT, CEFT, BAT,* and *Hidden Pictures* were loaded on Factor Three. All tests had one common requirement, the overcoming of an embedded context.

Conclusion: "The hypothesis that there was a factor [Factor Three], common to

intellectual and perceptual tests and involving the capacity to overcome an embedding context, receives some support from the results of these studies." This result tends to support Witkin's hypothesis that a relationship exists between tests of field dependence and some subtests of standard intelligence tests.

Comment: The findings of this study may indicate that intelligence tests currently in use tap the dimension of field dependence. An individual's IQ score involves not only a fund of knowledge, but also the ability to overcome embeddedness. Because successful performance on intelligence tests may call for the ability to overcome embeddedness, field independent individuals could have a distinct advantage when taking such tests.

Source: Goodenough, Donald R., and Karp, Stephen A. "Field Dependence and I' tellectual Functioning," *Journal of Abnormal and Social Psychology,* LXIII, No. 2 (1961), 241–246.

FIELD INDEPENDENCE AND CONCEPT FORMATION

Purpose: To determine whether field independent subjects exhibit superior performance on a test that requires perceptual concept formation

Review: Thirty army reservists and twenty-six female nurses (median age=22) were administered the following tests:

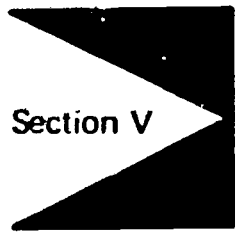
1. *The Gottschaldt Embedded Figures Test* (*EFT*)—measured field dependence and subjects were required to locate a simple figure in a complex geometric design
2. *The Shipley Hartford Abstraction* test (*SHA*)—measured perceptual concept formation (i.e., the abstraction of elements and relations from things) and required subjects to complete an open-ended relational problem
3. *The Shipley Hartford Vocabulary Test* (*SHV*)—required subjects to choose the correct synonyms for test items

Subjects were characterized as field dependent or field independent on the basis of the median split of the *EFT* scores. An analysis of the scores on the *SHA* and *SHV* revealed that field independent subjects scored significantly higher than field dependent subjects on the *SHA*, but did not score significantly higher on the *SHV*.

Conclusion: The investigators concluded that field independent subjects were more proficient than field dependent subjects on a test requiring perceptual concept formation.

Comment: The investigators suggest that in order to interpret test results more adequately, a distinction should be made between " . . . concept formation tests which require abstraction from words and those which require abstraction from things." It is not only important to delineate perceptual and cognitive styles, but also to delineate the modes of approaches required by tests. Biased interpretation of results may occur if concept formation is not considered as a multidimensional process in which at least verbal and perceptual modes of responses are possible.

Source: Elkind, David; Koegler, Ronald R., and Go, Elsie. "Field Independence and Concept Formation," *Perceptual and Motor Skills*, XVII (1963), 383–386.



MODIFIABILITY OF A CONCEPTUAL TEMPO

Although cognitive style has been characterized as a relatively stable psychological construct, investigators have shown that certain dimensions of cognitive style can be modified through stystematic attempts. For example, Yando and Kagan demonstrated that children characterized as impulsive became more reflective after being taught by experienced reflective teachers. However, the investigators also stated that further research needs to be undertaken since it was not possible to " . . . specify the exact behaviors in the teacher that may have caused this change."[1] In addition, Yando and Kagan suggested that it may be possible to alter teacher tempo in order to modify the conceptual tempo of children.

In this section, the two studies found that under certain conditions, a child's impulsive tempo may be modified.

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[1] Regina M. Yando and Jerome Kagan, "The Effect of Teacher Tempo On the Child," *Child Development*, XXXIX (1968), 34.

MODIFIABILITY OF AN IMPULSIVE TEMPO

Purposes: (1) To determine whether the impulsive child can be taught to increase his reflectivity, and (2) to determine whether training in reflectivity is influenced if the child initially perceives some basis of similarity to the tutor

Review: In order to select a sample for the study, 155 first-graders were administered the ***Matching Familiar Figures*** test (***MFF***), two verbal scales from the ***Wechsler Intelligence Scale for Children (WISC),*** and the ***Picture Completion Reasoning Test.*** The children were classified as reflective or impulsive on the basis of performance on the ***MFF***—a visual discrimination task in which the testee is required to select a standard familiar figure from an array of six variations of the standard. Impulsive children were identified as those who scored above the median for their sex on the number of errors and below the median for their sex on average response times; the reflective children scored above the median for their sex on average response times but below the median on number of errors.

Eighty of the 155 children tested in the fall were assigned to one of four experimental groups so that verbal ability profiles of the groups (as measured by the ***WISC***) were almost identical, each group consisting of ten boys and ten girls. Sixty of the children selected were impulsive and each was assigned to one of the following training groups: (1) Group I-Id—to be trained under high perceived similarity to the tutor; (2) Group I-non Id—to be trained under low perceived similarity to the tutor; or (3) Group I-C—to receive no training. The 20 reflective children constituted a fourth group which, like Group I-C, received no training.

The 40 impulsive children in the two groups which received training in reflectivity met individually with a tutor of the same sex for three brief training sessions held several days apart. For Group I-Id, actual training in delay of response (reflectivity) was preceded by an interview designed to persuade the child that he shared interests and attributes with the tutor. In this pretraining interview, the tutor asked the child a set of standard questions and, regardless of the response, answered in a similar manner and commented on the similarity between tutor and child. A sample dialogue in pretraining session 1 with a Group I-Id child follows:

> "How many brothers and sisters do you have? (After the child answers, E answers in a way consonant with the child and adds:)"
>
> "Gee, we are the same, we both have a (brother, sister). Let's see if we are the same in other ways. What are your favorite foods to eat?"

The children in Group I-non Id were administered the same pretraining interview but the tutor never indicated that he shared interests with the child and merely commented positively on the child's choice.

After the pretraining interview, the direct training in delay of response was conducted in exactly the same manner for both training groups. Descriptions of the three tasks used in the training procedure follow:

1. Design matching task—subject was required to select a standard geometric design from an array which contained that design and several variations of it

2 Haptic-visual matching task—subject explored only by touch a letter of the alphabet made from discrete tacks and was then required to select that letter from a visual array of several letters

3 Inductive-reasoning task—subject was told three characteristics of an object and was required to identify the object. A sample item was, "What is cold, white, and round?"

The child was told not to give an answer until the tutor told him it was time to do so, and that he should think about his answer. The period of delay was ten seconds for all items on the inductive-reasoning task and fifteen seconds for all items on the design matching and haptic-visual tasks. Only one answer was allowed and the child was not told whether it was correct.

Although the second training session was conducted in the same manner as the first, new questions were used in the interview and six new items were used. In the third and final training session, the interviews were shorter and, again, new items were used for each task.

During the evaluation session, held six to eight weeks after the final training session, all 80 children (40 in the training groups and 40 in the impulsive and reflective no-training groups) were administered new versions of the ***MFF*** and the ***Picture Completion Reasoning Test.*** The two women who administered the tests in the evaluation session were strangers to the children and were unaware of whether a particular child was reflective or impulsive.

The two major variables analyzed were (1) the average response time and error scores of the evaluation session, and (2) the change scores for response times between pre- and posttraining. The test of differences between means revealed that response times on the ***MFF*** were significantly longer on the second administration for both training groups, but the difference between the training groups (i.e., trained under high or low perceived similarity to the tutor) were not significantly different. A two-tailed test for each training group showed that both groups had longer response times on the second administration of the ***MFF*** than the impulsive group which received no training (significant at the .05 level of confidence). In addition, the mean response times of the training groups matched that of the normal reflective group on the ***MFF.*** However, no difference was found for any of the four groups on error scores for either test and none of the variables tested for the ***Picture Completion Reasoning Test*** was significantly different.

Conclusion: The authors concluded that "'. . . impulsive children can be taught to modify their behavior and the effect can last a few weeks." Although the hypothesis that perceived high similarity to the tutor would facilitate learning was not supported, the authors suggested that further research on that variable is warranted because a few of the girls did seem to manifest the effect.

Comment: Commenting on the fact that longer response latencies were not accompanied by a corresponding reduction in the number of errors made by impulsive children, the authors point out that the children were not given specific training for improving strategies on the tasks. This finding seems to indicate that the teacher who would like to help an impulsive child reduce the number of errors he makes in front of the class will not be successful if

she only forces him to take more time. The child also needs to be taught how to use such time effectively by being encouraged to develop a variety of strategies to solve problems.

The finding that the child's perceived similarity to the tutor does not facilitate learning may not necessarily apply to the classroom teacher since the effect she has on the pupils could be manifested in a different way from that of a tutor with a child in the one-to-one situation.

Source: Kagan, Jerome; Pearson, Leslie; and Welch, Lois. "Modifiability of an Impulsive Tempo," ***Journal of Educational Psychology,*** LVII, No. 6 (1966), 359–365.

THE EFFECT OF TEACHER TEMPO ON THE CHILD

Purpose: To investigate whether a teacher's conceptual tempo influences a first grade child's response-time in problem situations

Review: Reflection-impulsivity was defined by the investigators as a stable psychological dimension which describes an individual's conceptual tempo or the "... tendency to display slow or fast decision times in problem situations with high response uncertainty (i.e., where S [subject] must select one hypothesis from among several possibilities)." The investigators postulated that although reflection-impulsivity is a relatively stable dimension, its modifiability may be possible.

After 43 first-grade teachers had been individually interviewed, they were administered an adult version of the ***Matching Familiar Figures*** test (***MFF***)–a visual discrimination task in which the subject task in which the subject was required to select a standard familiar figure from an array of eight variations of the standard. The mean response time and the total number of errors recorded for the ***MFF*** were used in order to select reflective and impulsive subjects. Reflective teachers were identified as those who scored an average response time above the median and error scores below the median; the impulsive teachers scored an average response time below the median and error scores above the median. Ten reflective and ten impulsive teachers were chosen for the sample. There ages ranged from 22 to 63 years, and their years of experience ranged from under one to as many as thirty-two years. The 20 teachers were then classified as experienced or inexperienced by dividing the group into two subgroups based on the median value of eight years of teaching experience.

Six boys and six girls were randomly selected from each of the 20 classes and administered the children's version of the ***MFF*** during the fall of the school year and a parallel form of the test in the spring. Additional data collected for each child included a score on an occupational scale for social class membership, the grade equivalents on the ***Metropolitan Reading Readiness Test***, and the final grade evaluation for each child made by his teacher. Because of loss of subjects, data were reported only for 80 boys and 80 girls. Of these, half came from classrooms of reflective teachers and half from classrooms of impulsive teachers.

The first analysis of variance performed on the data revealed no significant decreases in the number of errors made by the children of the ***MFF*** over the course of the year. However, a second analysis of variance revealed that the main effect of teacher tempo on children's response time was significant at the.01 level of confidence and the interaction effect of teacher experience and tempo on children's response time was significant at the .001 level of confidence.

The t-tests used to measure the differences in conceptual tempo between boys and girls revealed that boys in the classrooms of experienced reflective teachers increased their response time more than boys in classrooms of inexperienced reflective teachers or impulsive teachers. Girls with experienced reflective teachers also showed sizeable, but insignificant increases in response time.

Conclusion: The investigators concluded that first-grade children placed in classrooms with experienced reflective teachers became more reflective over the school year than

children placed in classrooms of impulsive teachers. The exact behavior exhibited by the teachers which may have caused the change in the conceptual tempo of the children was not identified by the investigators. The investigators suggested that modeling effects, as well as direct reinforcement, may act to mediate the response time of the child.

Comment: The finding of the study led the investigators to recommend that extremely impulsive boys be placed with experienced reflective teachers in an attempt to modify the pupils' impulsive tempo. Since the experienced reflective teacher seems to play a critical role in the modification of her impulsive pupils' conceptual tempo, it may be profitable to conduct further research in order to determine the specific ways in which the teacher influences the child. Knowledge and training in these specific mechanisms would contribute to the enhancement of the teacher's role as the environmental manager of learning.

It should also be noted that the interaction of sex and conceptual style of the teacher may very likely function as an important variable in children's conceptual tempo.

Source: Yando, Regina M., and Kagan, Jerome. "The Effect of Teacher Tempo on the Child," *Child Development*, XXXIX (1968), 27–34.

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