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ABSTRACT

A study is presented which concentrates on the development of a cognitive style assessment instrument for 3- to 8-year-olds and on a series of studies designed to evaluate the role of stylistic and attentional processes in the development of various competencies in young children. This report incorporates a manual for users, a technical report on the Kansas Reflection-Impulsivity Scale for Preschoolers (KRISP) for other researchers, including inter-form, test-retest, and intertester reliabilities, age and sex differences, a one-year stability study, and a study of retardate performance on the KRISP. The fifth section of this report contains two completed studies of attending behavior in young children. The sixth describes five studies concerned with elucidating the development of attention or observing strategies as preverbal aids to young children's learning. A seventh section describes four studies in the planning stages designed to extend the findings of this program. (Author/CK)

UNIVERSITY OF KANSAS

ATTENTION & COGNITIVE STYLE

FY 1972

John C. Wright

KANSAS CENTER FOR RESEARCH IN EARLY CHILDHOOD EDUCATION

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Project:	Attentional Processes and Cognitive Styles in Toddlers and Preschoolers
Project Code No.:	3HOK03
Principal Investigator:	John C. Wright
Contents of this report:	Overview of the Project

Note: Two additional sections, referred to in the Overview, are to be submitted as a progress report due February 28, 1973. They are:

1. Five experimental studies in progress.
2. Four studies in planning.

ATTENTION AND COGNITIVE STYLES

John C. Wright

Principal Investigator

I. Overview

The project on Attentional Processes and Cognitive Styles in Young Children's Learning has concentrated during the past year on the development of a cognitive style assessment instrument for three- to eight-year-olds and on a series of studies designed to evaluate the role of stylistic and attentional processes in the development of various cognitive competencies in young children.

The Kansas Reflection-Impulsivity Scale for Preschoolers, or "KRISP" (Wright, 1971) was initially developed as a research instrument for use with children younger than can be effectively tested by the matching Familiar Figures test (MFF) developed by Kagan (1966). In the past year some preliminary norms have been established, resulting in a manual for users which now makes the KRISP useable by untrained personnel. (Section 3, below). In addition to the manual, this report incorporates a technical report on the KRISP for other researchers, including inter-form, test-retest, and intertester reliabilities, age and sex differences, a one-year stability study, and a study of retardate performance on the KRISP. (Section 4, below).

The fifth section of this report contains two completed studies of attending behavior in young children. The first, on the role of salience and decentration in the development of color-form preferences (Wright, Embry, and Vlietstra) shows how the progressive decentration of attention with increasing age, combined with salience, locus, and sequence of cues,

accounts for what has been claimed to be a maturationally governed shift of preference from color cues in younger children to form cues in older one. The second completed study, habituation of concept stimuli in toddlers (Faulkender & Wright), demonstrated a new method for the assessment of "protoconcepts" in three-year-olds, children too young to perform effectively on the kinds of verbal-conceptual tasks customarily employed with preschoolers, but old enough to demonstrate not only their possession and use of simple preverbal concepts, but also differential patterns of individually characteristic observing behavior that may bridge the gap between the differential habituation observed in infants (Horowitz, 1972) and the reflection-impulsivity styles assessed by the KRISP in older preschoolers. Because the new Faulkender & Wright procedure is based on the "iconic" level of representation and the sensorimotor level of thinking, it promises to be generally useful for future research in the neglected age range of from eighteen months to four years.

The sixth section of this report describes five studies in progress, all aimed at elucidating the development of attention or observing strategies as preverbal aids to young children's learning. Four of these studies are concerned in part with the interaction of saliency of cues, observing response bias or strategy, and relevency or informativeness of cues with the subject variables of age and/or reflection-impulsivity as determinants of children's cognitive performance. Two of the studies are concerned with memory, one with habituation and dishabituation of looking behavior, one with homologous comparison strategies in a same-different task, and one with a more conventional discrimination, but in the haptic modality.

Finally a seventh section describes four studies in the planning stages all designed to extend the findings of this program in various ways. One will test the validity of the KRISP in relation to a number of free-play observation variables, scores on other standardized tests, and motor skills. Another will begin a three-year longitudinal study of cognitive style differences using a population of toddlers on which Horowitz has previously recorded infant attending data and Brazelton (Neonatal assessment scale) scores. A third study investigates the effects of relevance of salient cues on performance in an eye-hand coordination task. A final study attempts to relate the differing formal or structural properties of children's television programs (Sesame Street and Mister Rogers' Neighborhood) to reflective and impulsive children's attending behavior in the presence of these programs.

During the past year several changes in funding and administration have hampered progress to some extent, but the shift of administration from USOE and CEMREL to NIE, effective March 1, 1973, and the restructuring of long term funding under a new Basic Program Plan, effective December 1, 1973, promise to expedite our progress in the current and future years. The new BPP will combine this research project with the Infant project directed by Professor Horowitz into a single, integrated program; and this change also promises to facilitate operations next year.

Progress on this project would have been impossible without the skilled administrative assistance of Ann Branden. Non-student supporting personnel include Melody Johnson, Steve Whittenberger, and Judy Larson. Graduate assistants employed on the project include Alice Vlietstra, Kenneth Shirley, Pat (Faulkender) Keaton, and D.J. Gaughan. Other graduate students with major involvement in the program include Kathleen McCluskey, Russ McClanahan, and Joanne Ramberg. Among the many undergraduate students

who have assisted on this project during the past year, those taking major research responsibilities were Charles Herrick, Lynne Embry, Janet Winchester, Teddy Jackson, April Waldron, and Ted Schlechter. The Director records his appreciation of the contributions of all of these persons and the cooperation of numerous school, hospital, and daycare administrators, teachers, and parents. Perhaps the biggest debt is owed to the children who diligently, patiently, and cheerfully played our games with us.

Introduction

A critical gap in our knowledge base concerning the development of cognitive competence and learning abilities exists between the ages of about two and five years. In particular, theoretical conceptions and teaching methodologies for use in this age range have been inadequate for the needs of the toddler and younger preschooler. This program of research has identified a number of points of departure for planned intervention that are promising in terms of what is known about pre-operational thought (Piaget) and iconic representation (Bruner), but which require supplementation of the knowledge base, invention of new training procedures, and special attention to individual differences in styles of information processing.

Specifically this program has been developing, field-testing, and norming a cognitive style instrument, the Kansas Reflection-Impulsivity Scale for Preschoolers (KRISP) (Wright, 1971), together with a manual for teacher-users (Wright, in press) that will enable early childhood workers in various settings to identify outstandingly reflective or impulsive children and to make corresponding individual diagnoses of the kinds of learning situations and tasks in which future learning problems may be anticipated. The second body of work is basic research on information-intake processes and attentional skills needed for adequate learning and development of cognitive competence in toddlers and young preschoolers. Our studies of the relationship of attentional strategies to effective discrimination learning and matching performance utilize age, sex, and reflection-impulsivity as independent subject variables, together with modeling, fading, and shaping procedures as independent experimental variables designed to build those repertoires of attending, visual analysis, scanning strategies, and

the like that are needed for effective learning and memory. Thus both treatment and subject variables go into the experimental designs and are used to qualify the results. Furthermore, the dependent variables include effectiveness of observing and attending behaviors as well as rate and accuracy of correct responding. By the end of the program, some three or four years from now, we expect to have completed procedures for remediating extremes on the reflection-impulsivity dimension in those settings and tasks where difficulties may be confidently anticipated.

The outcomes programmed in order of their immediate availability for field testing and general use are thus: 1) the KRISP and associated user documents; 2) basic research on attentional processes in young children's learning to supplement the knowledge base selectively in those areas where it is both deficient and promising as a point of departure for intervention studies; and 3) training procedures for modification of style-related behaviors toward those demonstrated as being prerequisites for effective learning.

Children of equal intellectual ability often differ radically in the style with which they approach and solve problems. This is especially so in the many sorts of problems where early discrimination of relevant from irrelevant cues and consequent effective attention deployment are critical to solution. In particular, with tasks in which speed and accuracy (or attention to detail) are negatively related, about one-third of any sample of children are characteristically fast, but error-prone ("impulsive"), while another third are slower, but more accurate ("reflective") than the remaining average third of the group. Educators and psychologists have long been aware of these stable, generalized, and hard-to-modify individual differences among children, and recently a number of investigators have

demonstrated both the generality and the developmental primacy of such differences (Kagan, 1963, 1964a, 1964b, 1965a, 1965b, 1965c, 1966a, 1966b, 1966c; Messer, 1970; Harrison & Nadelman, 1972; Massari & Schack, 1972; Reali & Hall, 1970; White, 1971; Katz, 1971; Odom, McIntyre & Neale, 1971; Loo & Wenar, 1971; Eska & Black, 1971).

The first effort in this program has been concerned with the completion of the Kansas Reflection-Impulsivity Scale for Children (KRISP) (Wright, 1971), together with a testing and scoring manual (in press) that will enable teacher and child-care specialist users to assess reflection-impulsivity in young children simply, accurately and reliably. The KRISP is also being tried out on samples of retarded children of a mental age comparable to the normal toddlers and preschoolers in order to determine whether they too show cognitive style differences that might constitute a source of interference with effective learning. Preliminary data indicate that degree of retardation has smaller effects on KRISP scores than does institutionalization (Wright, Segler, & Ramberg, in preparation). Assessment of the long-term reliability of the KRISP over a one-year span has begun, and a series of validation studies are being planned to relate the KRISP to the Bender Gestalt Test, sensorimotor coordination, and attention span vs distractability in free play settings.

One key to the effects of reflection-impulsivity upon cognitive development appears to lie in the demonstrated importance of patterns of attending behavior as determinants of information processing, especially in young children. Prior to the age of six or seven years, when verbal and concrete operational skills begin to mediate learning and thinking effectively, recent evidence has shown that conditions favoring selective attention to relevant and informative features of a task are especially helpful (Gaines,

1970; Nodine & Lang, 1971; Odom & Mumbauer, 1971; Odom & Guzman, 1972; Witte & Grossman, 1971; Lehman, 1972; Yussen, 1972; Wright, Emby & Vlietstra, 1972; Wright, 1972a). At the same time it has begun to be apparent that reflection-impulsivity as a cognitive style is related to visual analysis skills, and especially to effectiveness of search strategies and patterns of attention deployment (Drake, 1970; Siegelman, 1969; Zelnicker, Jeffrey, Ault, & Parson, 1972; Adams, 1972; McCluskey & Wright, in preparation). Viewed developmentally it appears that the child between two and five years explores his environment at first as a function of what is novel, salient, inherently interesting, or associated with past rewards, but not in any task-relevant or systematic way. Later in this interval, however, if conditions are favorable, the control of the child's attending behavior begins to shift to the logical requirements of the task at hand. An exploratory pattern is eventually replaced by a deliberate search pattern. Curiosity is supplemented by relevance considerations. Play gives way to a work orientation when the task at hand is understood and within the child's competence. A consummatory orientation toward task stimuli begins to be displaced by an instrumental orientation as looking behavior comes under the control of somewhat longer range goals (Hutt, 1970; Ruble & Nakamura, 1972; Sellers, Klein, Kagan, & Minton, 1972; Turnure, 1971; Wright & Vlietstra, in preparation; Wright, Embry, Winchester & Jackson, in preparation; Wright, Embry & Vlietstra, 1972).

Moreover, both skills and strategies associated with selective attention and the stylistic preferences referred to as reflection-impulsivity appear to be at least partly and temporarily (and maybe selectively) modifiable under experimental conditions (Briggs, 1966; Nelson, 1968; Yando & Kagan, 1968; Kagan, 1966d; Debus, 1970, 1972; Denney, 1972a, 1972b; Heider, 1971; Ridberg, Parke, and Hetherington, 1971).

Our thinking and research to date has therefore been focused on the ways in which young children learn selectively to attend to different sources of stimulation in the environment, these sources being distinguished by sensory modality, physical locus, salience factors, and logical priority. Under this heading, "attentional processes in learning", previous research with school age and preschool age children is being extended downward to the preschool and toddler levels. Concurrently certain systematic findings on attention in infants have resulted from procedures that appear to be extendable upward for use with toddlers, such as habituation (or response decrement) and recovery (dishabituation). We have begun utilizing these procedures in studies designed to assess and modify toddlers' "protoconcepts" as manifested by selective generalization of induced habituation (Faulkender & Wright, 1972).

Under the heading, "attentional processes in learning", we have addressed ourselves to the following basic research questions, both because they appear to be important, promising points of departure for effective intervention to enhance the development of cognitive competence and because it appears from the existing knowledge base that they are now becoming answerable questions: a) How do children acquire and flexibly generalize routines for finding informative cues and for discriminating relevant from irrelevant information sources from visual, tactual, and auditory arrays of stimuli? b) What experiences contribute to a transition from primarily stimulus controlled, salience-oriented exploration to subject-controlled, task-oriented search? c) Can scanning strategies and search routines be specified in sufficient detail and generality so as to make them communicable to children as young as two to five years of age? d) As a function of age and cognitive style, what methods are most effective for this training?

e) Once acquired, whether by specific training or by unstructured experiences in a comparably enriched learning environment, h[illegible] readily can such routines be generalized? That is, can the child ap[illegible] and flexibly to entirely different problems that nevertheless [illegible] the same formal and logical properties as those on which the routines were originally established? And finally, (f) How enduring are such routines or strategies -- how long are they retained without further prompting or training?

The answers to the above questions should enable us to attack more directly the question of cognitive handicaps associated with extremes of reflection-impulsivity. That is, on the basis of an improved understanding of the age changes in attending and observing behaviors and their relation to children's learning, we propose that it should be possible to train impulsive children at an early age to use certain more reflective, careful, thoughtful, and deliberate methods of approaching learning and problem-solving tasks. Thus our long-range orientation is toward early identification of extreme impulsivity (and in some cases reflectivity) together with development of remediation techniques for training effective, task-oriented search routines in children whose lack of such skills promises subsequent learning difficulties in more formal educational settings.

Objectives of Program

The long range objective is to be able to put into the hands of teachers and child-care workers a set of assessment instruments, training procedures, and facts about the development of attending skills in children of different ages and cognitive styles that will enable them to identify potential attentionally based learning problems early and to begin remediation of them differentially as a function of age and style.

In order to achieve this objective, it is necessary to complete norming of the KRISP on a large population of toddlers and preschoolers. First-generation norms are now in hand. The second generation will be based on considerably larger numbers of children, and may need to be stratified in terms such as urban vs. non-urban, socioeconomic status, as well as age, sex, and number of previous administrations of the scale. Inter-form, scorer, and test-retest reliability figures need again to be assessed with each new contributing population.

A second intermediate goal is to determine the accuracy and utility of our current theoretical model describing the processes involved in the developmental transition of observing behavior determinants that allegedly takes place in the years from age two to five. This is being accomplished by a series of experiments designed to compare trained vs. untrained, younger vs. older and reflective vs. impulsive children, on indices of systematic stimulus scanning and effective discrimination learning and memory. Among the training variables are included modeling and fading techniques, stimulus class habituation and dishabituation procedures, and the systematic manipulation of the salience of relevant and irrelevant stimulus features.

The third intermediate goal corresponds to the third research effort and forms a bridge between the first two. It is the modification of extreme and maladaptive cognitive styles in selected tasks by means of training in those attention deployment skills that appear from the studies described in the preceding paragraph to be both trainable and important for learning and memory tasks. This style training will be aimed not at reducing the range of reflection-impulsivity in any group of children, but rather at teaching children to discriminate those tasks requiring a more reflective approach from those that benefit from a more impulsive orientation, and to adopt the

appropriate style for the task at hand. It is obvious that impulsive children have difficulties with tasks requiring careful analysis and convergent thinking directed toward a single "right" answer. Not so obvious is the possibility that reflective children are conversely handicapped when it comes to free expression i[illegible] art, body-movement, story-telling, and other learning situations [illegible]ing divergent thinking and a high rate of relatively uncritical behavioral output.

These basic questions in a context of current research on attentional and stylistic differences in cognitive development serve to focus our concerns on the more applied issues of how to identify stable individual differences early and how to develop both stimulus materials and training programs that will demonstrably, reliably, and economically facilitate effective attending and learning for unique children in the stylistically and developmentally heterogeneous target population. We cannot expect what is most effective for three-year-old impulsive children to work as well with five-year-old reflectives. But we can expect this program of research to lead to the specification of the minimum necessary differentiation of training techniques and materials required for such a variable population. More ambitiously, we expect that tailoring search and scanning strategy training to categories of children that can be confidently identified in terms of developmental status and cognitive style will be more generally effective than using traditional variables like intelligence and social class for the same purpose.

Research Strategy

Younger toddlers, especially impulsive ones on the KRISP are more attentive to stimuli or stimulus features that are salient because of physical features (brightness, contrast, location, size, change or movement,

complexity, novelty, etc.), while older preschoolers, especially reflective ones on the KRISP, have begun to respond under favorable conditions by analyzing, discovering, or at least looking for, relevant and informative features as defined by organization of materials and task requirements. Consequently the former tend [illegible] explore passively and erratically, while the latter tend to [illegible]y and more systematically. Facilitation of this transition can be accomplished best in children who are ready to make it, and they, in turn should be identifiable by their pattern of time and errors on the KRISP.

The basic studies thus begin by identifying reflective, impulsive and intermediate children at the three-, four- and five-year-old levels. Typically these scores are coded so that all the staff are "blind" as to any child's KRISP scores until all the data are in. In most of the studies, a task, such as matching to sample, matching from memory, classifying, or simply discriminating compound stimuli, is devised which permits reliable recording of both attending behavior (eye movements, hand movements in a haptic task, or task, or slide changes under the child's control) and solution behavior (correct discrimination, matching, or classifying), which is usually directly reinforced. Then two or more groups of subjects, stratified on age and KRISP classification, are selected. One group receives attentional training on practice items by means of modeling, direct shaping of observing responses, or fading from stimuli that by design attract attention to relevant features, toward stimuli that contain the relevant cues imbedded in a distracting complex of irrelevant cues. At least one group receives equivalent practice and exposure without systematic training as a placebo. Results are analyzed using subject-type by treatment anova models, with particular attention to the interactions between subject variables on

which the groups were stratified (age and style) and the various training vs. control manipulations employed.

What is uncommonly done in the literature, but is especially useful in these designs, is to analyze observing responses (attention and scanning) both as a dependent variable and as a co-determinant of the correctness of the child's final choice or decision. Thus we can establish when attention is indeed the intervening variable that determines the effects of subjects and treatments on learning, because when it so functions, the observing behavior we attempt to teach both improves and is correlated with terminal accuracy of response. If the training facilitates learning by some other means than improving observing behavior, that fact shows up in this design. Correspondingly, if the subject variables affect learning, either mediated by attending behaviors or not, but the treatments are not effective, that too is manifest in the results. Finally, the differential effectiveness of various training techniques for improvement of both search strategies and terminal decision making by the child can be assessed for each age and style group studied. Such treatments can thus be differentially prescribed for other children.

Children are typically studied one at a time in an experimental room or mobile laboratory set up typically with back-projection slide displays or haptic stimuli. Their eye movements or hand movements are recorded on, and scored from, video tapes. Their choice behavior consists usually of pointing to the required stimulus, rather than any verbal response. The child changes his own slides when he is ready in most experiments. Reinforcement consists of praise or tokens that may be exchanged for a prize. Many variations have already been wrung on this basic technique, and its most innovative features are simply the recording of visual scanning without physical constraints and the systematic design and careful production of differentially

interesting stimuli.

For KRISP development, as many subjects as can be secured nationally from age two to eight are being tested. Age and sex are the norming criteria, and most of the data have come from middle-class suburban and small-town populations. Smaller poverty, inner-city, and minority samples are being collected as well, together with trainable and educable retardates between ages of five and thirteen, both institutionalized and living at home.

Standard preschool, kindergarten, and daycare populations of children from the Lawrence community are involved in the basic research program, together with older comparison groups from public school classes at the second- to fourth-grade levels when needed.

The ages most appropriate for style-modification and style-task differentiation training have yet to be determined precisely, but lie within the range currently under study as described above.

Summary

In the individual reports that follow, we believe are the seeds of an emergent model for new ways of matching the deliberately arranged features of early childhood learning environments, including home, day-care, and preschool, to the most important parameters of individual children: their level of information processing competence and the cognitive styles with which they typically approach new learning situations. Such a model will, we believe, eventually be able to make a series of periodic assessments of the child's status, not so much in terms of achievement as in terms of attentional sophistication and readiness for well defined types of tasks, and in terms of how best to present such tasks to children of a particular cognitive style and level of readiness.

If the first part of such a model is designed to match the educational environment to the particular child, it follows that a similar effort may also be needed to match the readiness of the child to the particular educational demands that are about to be made upon him, especially in those settings that are not equipped to adjust so readily to the unique individual child. Thus we stress the development of intervention procedures, eventually designed to help atypical children make the minimum necessary accomodation to an educational system that is increasingly less tuned to their unique needs and more to general standards of cognitive competence. Both kinds of matching efforts are required, and although we are farther advanced on the first, we are hopeful that the two-faceted approach our research has followed will continue to feed both kinds of efforts.

REFERENCES

Adams, W.V. Strategy differences between reflective and impulsive children. Child Development, 1972, 43, 1076-1080.

Briggs, C.H. An experimental study of reflection-impulsivity in children. Unpublished doctoral dissertation, University of Minnesota, 1966.

Debus, R.L. Effect of brief observation of model behavior on conceptual tempo of impulsive children. Developmental Psychology, 1970, 2, 22-32.

Debus, R. A comparison of fading, modeling, and strategy-training techniques for modifying conceptual tempo of impulsive children. Unpublished research summary presented at University of Kansas, September, 1972.

Denney, D.R. Modeling effects upon conceptual style and cognitive tempo. Child Development, 1972a, 43, 105-120.

Denney, D.R. Modeling and eliciting effects upon conceptual strategies. Child Development, 1972b, 43, 810-823.

Drake, D.M. Perceptual correlates of impulsive and reflective behavior. Developmental Psychology, 1970, 2, 202-214.

Eska, B. and Black, K.N. Conceptual tempo in young, grade-school children. Child Development, 1971, 42, 505-516.

Faulkender, P. & Wright, J.C. Generalization of habituation of concept stimuli in toddlers. Annual Report, Kansas Center for Research in Early Childhood Education, 1972.

Gaines, R. Children's selective attention to stimuli: stage or set? Child Development, 1970, 41, 979-992.

Harrison, A. and Nadelman, L. Conceptual tempo and inhibition of movement in black preschool children. Child Development, 1972, 43, 657-668.

Heider, E.R. Information processing and the modification of an "impulsive conceptual tempo". Child Development, 1971, 42, 1276-1281.

Hutt, C. Specific and diversive exploration. In H.W. Reese and L.P. Lipsitt (Eds.) Advances in Child Development and Behavior, 1970, 5, 120-180.

Kagan, J., Moss, H.A., and Sigel, I. Psychological significance of styles of conceptualization. In J.C. Wright and J. Kagan (Eds.), Basic Cognitive Processes in Children. Monographs of the Society for Research in Child Development, 1963, 28, No. 2 (serial No. 86), 73-112.

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

Kagan, J. and Rossman, B. Cardiac and respiratory correlates of attention and an analytic attitude. Journal of Experimental Child Psychology, 1964b, 1, 50-63.

Kagan, J. Individual differences in the resolution of response uncertainty. Journal of Personality and Social Psychology, 1965a, 2, 154-160.

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

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

Kagan, J. Body build and conceptual impulsivity in children. Journal of Personality, 1966a, 34, 118-128.

Kagan, J. Developmental studies in reflection and analysis. In A.H. Kidd and J.H. Rivoire (Eds.), Perceptual development in children. New York: International Universities Press, 1966b, 587-522.

Kagan, J. Reflection-Impulsivity: The generality and dynamics of conceptual tempo. Journal of Abnormal Psychology, 1966c, 71, 17-24.

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

Katz, J.M. Reflection-impulsivity and color-form sorting. Child Development, 1971, 42, 745-754.

Lehman, E.B. Selective strategies in children's attention to task relevant information. Child Development, 1972, 43, 197-210.

Loo, C. and Wenar, C. Activity level and motor inhibition: Their relationship to intelligence test performance in normal children. Child Development, 1971, 42, 967-971.

Massari, D.J. and Schack, M.L. Discrimination learning by reflective and inpulsive children as a function of reinforcement schedule. Developmental Psychology, 1972, 6, 183.

McCluskey, K. and Wright J.C. Observing behavior strategies and matching accuracy of reflective and impulsive preschoolers. (in preparation)

Messer, S. The effect of anxiety over intellectual performance on reflection-impulsivity in children. Child Development, 1970, 41, 723-736.

Nelson, T.F. The effects of training in attention deployment on observing behavior in reflective and impulsive children. Unpublished doctoral dissertation, University of Minnesota, 1968.

Nodine, C.F. and Lang, N.J. Development of visual scanning strategies for differentiating words. Developmental Psychology, 1971, 5, 221-232.

Odom, R.D. and Guzman, R.D. Development of hierarchies of dimensional salience. Developmental Psychology, 1972, 6, 271-287.

Odom, R.D., McIntyre, C.W., and Neale, G.S. The influence of cognitive style on perceptual learning. Child Development, 1971, 42, 883-892.

Odom, R.D. & Mumbauer, C.C. Dimensional salience and identification of the relevant dimension in problem solving: A developmental study. Developmental Psychology, 1971, 4, 135-140.

Reali, N. & Hall, V. Effect of success and failure on the reflective and impulsive child. Developmental Psychology, 1970, 3, 392-402.

Ridberg, E.H., Parke, R.D., & Hetherington, E.M. Modification of impulsive and reflective cognitive styles through observation of film-mediated models. Developmental Psychology, 1971, 5, 369-377.

Ruble, D.N. & Nakamura, C.Y. Task orientation vs. social orientation in young children and their attention to relevant social cues. Child Development, 1972, 43, 471-480.

Sellers, M.J., Klein, R.E., Kagan, J., & Minton, C. Developmental determinants of attention: A cross-cultural replication. Developmental Psychology, 1972, 6, 185.

Siegelman, E.Y. Reflective and impulsive observing behavior. Child Development, 1969, 40, 1213-1223.

Turnure, J.E. Control of orienting behavior in children under five years of age. Developmental Psychology, 1971, 4, 16-24.

Vlietstra, A.G. & Wright, J.C. Sensory modality and transmodal stimulus properties in discrimination learning and transfer. Lawrence, Kansas: Annual Report, Kansas Center for Research in Early Childhood Education, 1971.

White, K.M. Conceptual style and conceptual ability in kindergarten through the eighth grade. Child Development, 1971, 42, 1652-1656.

Witte, K.L. & Grossman, E.E. The effects of reward and punishment upon children's attention, motivation, and discrimination learning. Child Development, 1971, 42, 537-542.

Wright, J.C. The Kansas Reflection-Impulsivity Scale for Preschoolers (KRISP). St. Louis: CEMREL, Inc., 1971.

Wright, J. C. Decentration of attention and the shift from exploratory to search orientation in young children. Paper presented at S. E. Regional Meeting, Society for Research in Child Development, Williamsburg, Va., 1972a.

Wright, J. C. Technical report on the Kansas Reflection-Impulsivity Scale for Preschoolers (KRISP). Lawrence, Kansas: Kansas Center for Research in Early Childhood Education, Annual Report, 1972b.

Wright, J. C. Users' Manual for the KRISP. St. Louis: CEMREL, Inc. (in press). Lawrence, Kansas: Kansas Center for Research in Early Childhood Education, Annual Report.

Wright, J. C., Embry, L.A., & Vlietstra, A.G. Color-form perception: A question of centration of attention or developmental stage? Lawrence, Kansas: Kansas Center for Research in Early Childhood Education, Annual Report, 1972.

Wright, J.C., Embry, L.A., Winchester, J., & Jackson, T. Relevance of observing response set, distinctiveness of cues, and age as determinants of haptic discrimination learning. (in preparation).

Wright, J.C., Segler, D., & Ramberg, J. KRISP performance of institutionalized and non-institutionalized, trainable and educable retardates. (in preparation).

Wright, J.C. & Vlietstra, A.G. Attentional processes in children's learning. (in preparation for Advances in Child Behavior and Development).

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

Yussen, S.R. The effects of verbal and visual highlighting of dimensions on discrimination learning by preschoolers and second graders. Child Development, 1972, 43, 921-929.

Zelniker, T., Jeffrey, W.E., Ault, R., & Parson, J. Analysis and modification of search strategies of impulsive and reflective children on the Matching Familiar Figures Test. Child Development, 1972, 43, 321-336.

USER'S MANUAL FOR

THE KANSAS REFLECTION-IMPULSIVITY SCALE FOR PRESCHOOLERS

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THE KANSAS REFLECTION-IMPULSIVITY SCALE FOR PRESCHOOLERS

(KRISP)

The KRISP (Wright, 1971) is an individually administered test designed to identify those children between the ages of about 3 and 5 1/2 years who are unusually reflective or impulsive in their cognitive style or tempo (Kagan, 1966). It has been developed initially as a research instrument, but is eventually intended for use by teachers of preschoolers and other child care specialists, without extensive formal training in mental tests and measurements, as well as by psychologists. There are two comparable forms of the KRISP, each consisting of five practice items followed by ten test items. (The practice items for the two forms are the same). Each item is a match-to-sample problem requiring the child to find in an array of similar figures that one which is an exact copy of the standard stimulus appearing above the array. The child's total errors and mean time to first response on the ten test items are recorded as his scores. Figure A. is a KRISP item.

Insert Figure A. about here

Cognitive style (or tempo) is conceptualized as a dimension along which individuals differ in their typical speed and accuracy of performing tasks on which speed and accuracy are negatively related. The match-to-sample task has this property. That is, those who respond most rapidly tend to make the most errors, and those who respond most slowly tend to make the least errors. Fundamentally reflection-impulsivity is an individual characteristic somewhere between an intellectual ability, such as might be measured by an intelligence or aptitude test, and a personality trait such as might be measured on a personality inventory. It is a measure of a person's performance for, or tendency toward approaching information-processing tasks

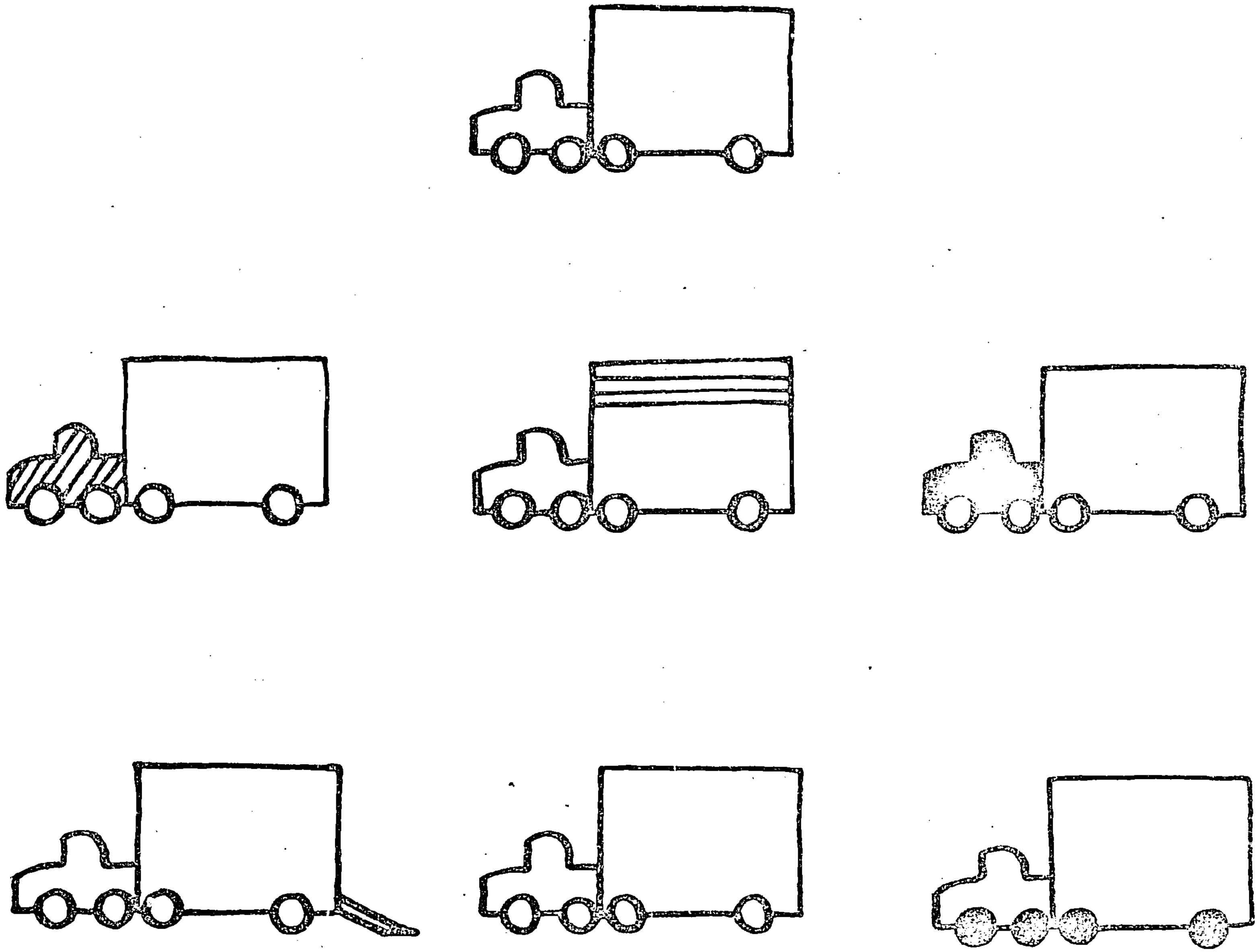

Figure A. Sample KRISP Item

in a generally rapid, fluent, but imprecise way (impulsive) versus the opposing tendency to approach such tasks with caution, deliberation, and great concern for accuracy (reflective).

Although research has only begun on the generality of cognitive styles in young children, KRISP scores are likely to predict certain habits of thinking in a variety of situations even though the particular demands of the task and situation will, of course, play an important role in how a child performs. Children of these ages are much less fully developed in either intellectual abilities or personality characteristics, and users of the KRISP are cautioned that the stability of reflection-impulsivity, while fairly we established for older populations, has NOT been proved for children at the preschool level. It would therefore be risky to try to predict from KRISP scores at age four the cognitive style expected of a child at, say, age 8 or 10. Many experiences in the growth and development of the child after the preschool years are important and formative for the cognitive style that may become a more lasting characteristic of the individual in his more mature years.

Nevertheless, it appears useful to attempt to identify those preschoolers who are exceptionally impulsive or reflective now, because armed with that information, preschool teachers and others can select appropriate learning materials and settings for such children. Such choices then might both capitalize on children's natural tendencies, and help them prepare to deal with tasks on which their present cognitive style places them at a disadvantage compared with their less exceptional peers. For it seems that neither reflectivity nor impulsivity alone are always helpful or harmful to the child. While it is true that the reflective in general appears more intellectually mature and resembles children older than he, there are

important areas in early education where the impulsive may enjoy a compensating advantage. For example, reflectives are typically better at "convergent thinking", that is thinking that requires careful analysis, accurate comparison, and the like in order to arrive at the single "correct" answer. But impulsives may have an edge when it comes to "divergent thinking" as exemplified in fluent expression in art and design, in expressive rhythm and body movement, or in story telling and creative imagination. If the impulsive child is sloppy, error-prone, and careless, he is also relatively free of compulsive worry about whether or not he is doing something "right." Conversely if the reflective is agonizingly slow and hypercritical of his own work, he may also be a very effective information-processor, with analytic skills unusual for one his age.

Ideally, of course, one might hope that most children are neither reflective nor impulsive across the board. A better goal might be for a child to discriminate those tasks and settings requiring a reflective approach from those benefitting from a more impulsive style, and to adjust his own behavior accordingly. At the very least we usually hope to develop in preschoolers a long enough attention span for them to be able to comprehend and carry out simple instructions accurately, together with freedom of self expression which permits them to use words, movements, musical sounds, and graphic materials with some fluency, if not artistry. Therefore the KRISP is intended to be useful not to diagnose some permanent incapacity or hidden talent, but to give the user a confirmation or disconfirmation of what may appear rather obvious to her, namely that a particular child seems unusually impulsive or reflective as compared with his peers.

Administration and Scoring

The KRISP is published with a set of instructions for administration to the child. The procedure is very simple, and requires only the use of a stopwatch and the appropriate score sheet. Figure B. shows a typical testing arrangement using a foot-actuated electric timer in place of a

Insert Figure B. about here

stopwatch, but the latter refinement is unnecessary in most applications. Basically the child is simply asked to find that member of the lower array which exactly matches the standard above. He is timed in seconds from the first exposure of an item until his first response (pointing to an alternative), whether correct or wrong. If he is correct, the tester simply goes on to the next item. If he makes an error on his first response, the tester gently informs him of that fact and invites him to try again. If his second response is also incorrect, he is permitted a third guess. But if he has still not pointed at the correct alternative after three errors, the tester goes on to the next item anyway. Thus the total errors in 10 items is a number ranging from zero to a hypothetical maximum of thirty. The mean response time for ten items is obtained by summing the individual times for the ten items, and then moving the decimal one place to the left (dividing by ten). Typical times to first response have ranged from two or three seconds up to fifteen or more. Figure (C) is a sample score sheet containing fictitious data on a fictitious child, and properly scored.

Insert Figure C. about here

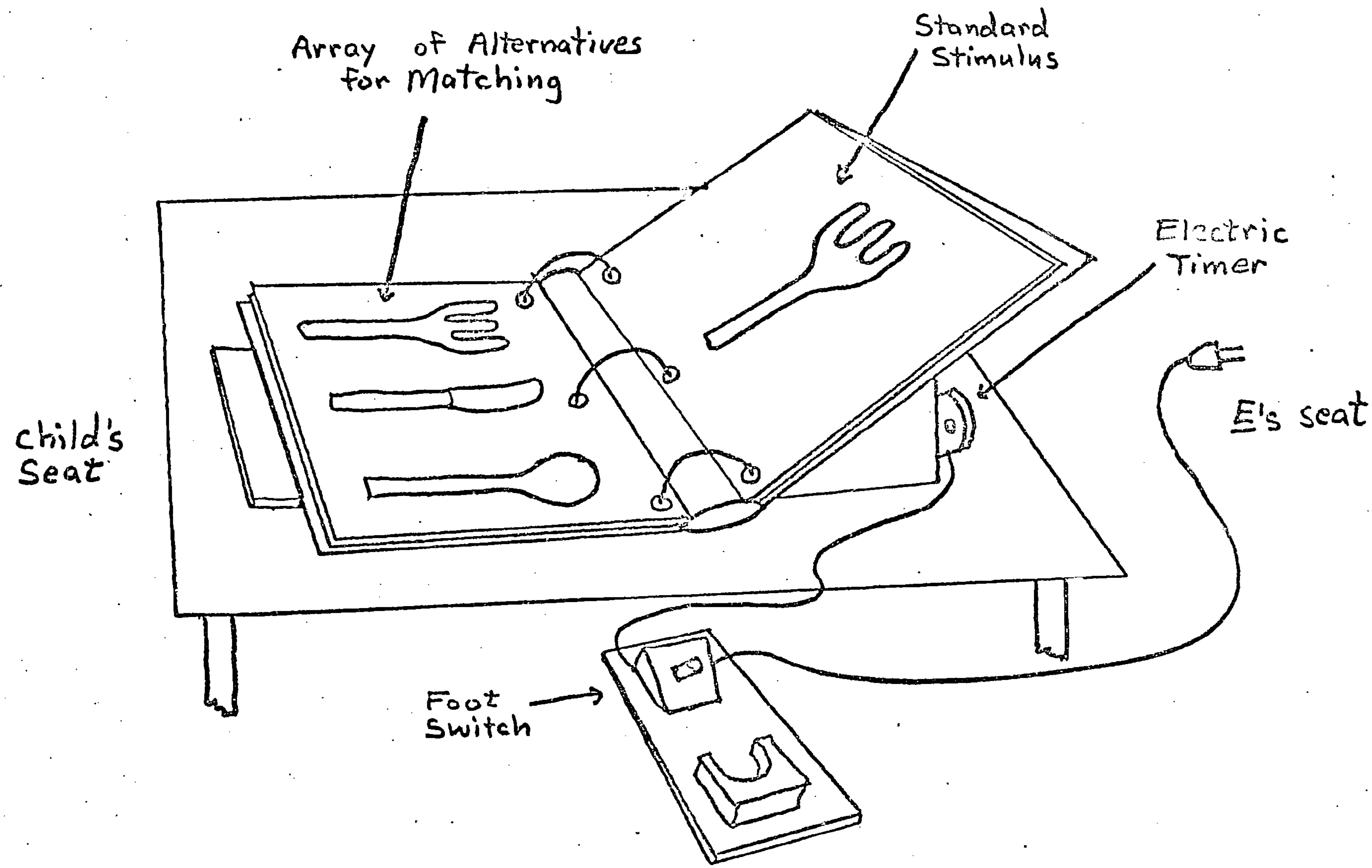

Figure B. KRISP Testing Apparatus

SCORING SHEET KRISP FORM A

Number 021

Subject F. R. Date of birth 1/17/69 Date 1/15/73

Experimenter P. F. K. Reliability not checked Sex M

Stimulus	Correct Answer Seen by E	Response Time	Number of Errors	Comments
P-1 Circle	X 1	2.0 sec.	0	
P-2 Ice Cream	X	3.5	0	
P-3 Silverware	X 2 1	2.5	0	
P-4 Hat	3 X 1	3.0	0	
P-5 Umbrella	4 X 2 1	5.5	0	(hesitant)
A-1 Ball	4 X 2 1	6.5	0	
A-2 Candle	X 3 2 1	4.0	0	
A-3 Coat	4 3 X 1	7.5	0	
A-4 Pail	5 X 4 2 1	8.5	1	looked at me for answer
A-5 Wagon	5 3 4 2 X	4.0	1	
A-6 Pan	4 3 2 X	6.0	0	
A-7 Kite	5 3 X 2 1	3.5	0	much more confident
A-8 Truck	6 X 4 3 2 1	2.5	1	
A-9 Mouse	6 5 4 X 2 1	2.5	2	
A-10 Kitten	5 3 4 2 X	3.0	0	
		48.0	5	

Figure C. Sample Score Sheet

The remainder of this manual contains charts by which a preschooler can be compared with others of the same sex and approximate age. In these charts no percentile norms are provided, since we believe that the norms are not based on a large enough sample (305 youngsters in this edition) and also because cognitive styles, themselves, as stressed above, are not sufficiently stable or well defined at this age to warrant such precision. Therefore the charts are only designed to give a general indication of the direction and degree of impulsivity or reflectivity.

Figure I is a sample illustration of a plot of 12 widely scattered

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Insert Figure I about here

---

children's KRISP scores. They are of course hypothetical cases. Each child's time and error scores serve to locate him at their intersect. Thus child number 6 made 9 errors and took about 4 1/2 seconds per item on the average. The box in the upper right-hand corner of the chart serves to identify the sex and age-range of children to whom that figures applies. Therefore the first step in evaluating a child is to locate the correct chart for his age and sex, and then to plot his point on the chart.

The final step involves a judgement as to whether the label for the graphic region into which a child falls is an appropriate label for the child in question. Again considerable caution should be employed. Firm conclusions require consistent supporting data, such as observation of the child, parental reports, and the like, and should not be drawn from KRISP data alone. A cautious interpretation of the hypothetical children plotted in Figure I might be as follows:

Children 1, 2, 3, and 4 are very close to the average for their age and sex, and consequently we surmise that they are neither unusually

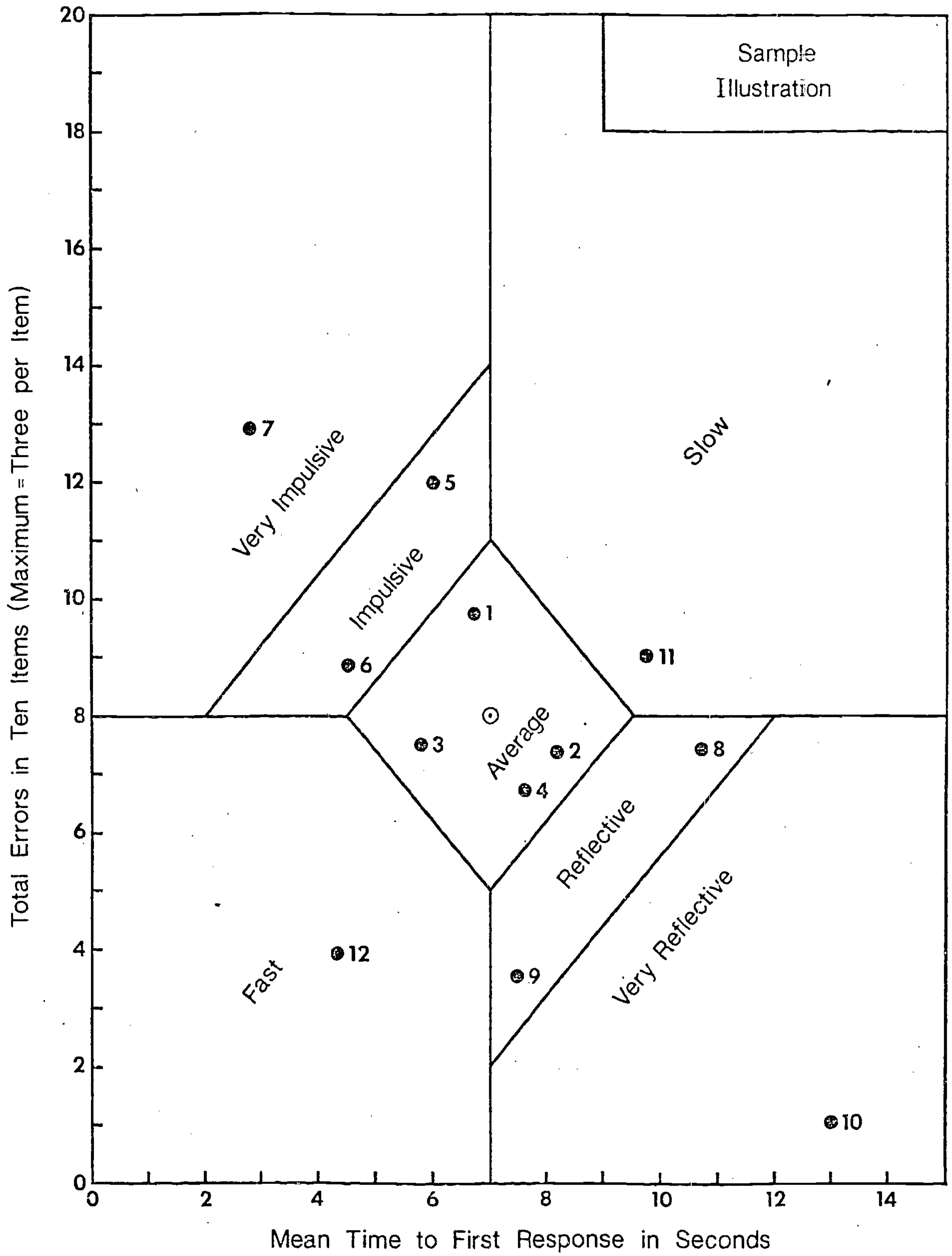

Sample Illustration
Very Impulsive
Impulsive
Slow
Average
Reflective
Very Reflective
Fast
1
2
3
4
5
6
7
8
9
10
11
12
Total Errors in Ten Items (Maximum = Three per Item)
Mean Time to First Response in Seconds
0
2
4
6
8
10
12
14
16
18
20

Fig. 1

impulsive or reflective. Children 5 and 6 are probably somewhat impulsive relative to their peers. For child 5 this appears more as a high error rate, and for child 6 it appears more as a fast response rate. Because child 7 is nearly two steps (technically these are standard deviations) above the mean in errors and below it in time, we would feel more confident in concluding that he is impulsive.

Correspondingly, children 8 and 9 score on the reflective side, but in different ways. Child 8 is very slow, but near average in errors, while child 9 is very accurate, but only a little slower than average. Child 10, however, clearly appears to be reflective by both criteria.

While most of the children tested will distribute themselves on such a chart in an elliptical scatter from the upper left corner (impulsive) to the lower right corner (reflective), a few children will always fall in the less populated lower right and upper left quadrants. Children 11 and 12 are examples, and would be labelled "slow" and "fast", respectively. Clearly they are neither reflective nor impulsive on the KRISP, but they do differ. Some studies have indicated that children who, like child 11 are slow and make more errors than average differ from children like child 12, who is fast and makes few errors, in their general intelligence rather than in their cognitive style. One should be very cautious about drawing such conclusions from KRISP plots, however. More justifiable would be that although child 12 is faster and more accurate than the average by a good margin, and is therefore probably unusually skilled at rapid visual analysis (and perhaps quite bright), no opposite conclusion can be validly drawn about child 11. This is not only because he differs only slightly from children 1 to 4, who are "average", but also because a wide

variety of unknown factors could have caused him to be somewhat slower and less accurate then we would expected. We should therefore consider child II also as being average in the absence of any other indications.

It is acknowledged that these categories are rather imprecise, but the current state of development of this test, together with the inherent stability of any scores on children of these ages, has prompted a corresponding coarseness of classification as a cautionary measure. Those using the KRISP for research purposes should use mean time and total errors to compare their results to the research findings of others. An interim technical report on the KRISP is available (Wright, 1972). The tentative norming sample for this edition is comprised of suburban and small town, mostly caucasian, children who attended a university preschool or a public kindergarten.

The author would greatly appreciate receiving data from KRISP administrations to normal samples of children. Such data will be incorporated in future norms if they are identified as to a) testing conditions and procedural anomolies, if any; b) exact age at time of testing; c) sex of child; d) setting from which the child came (e.g., daycare, private preschool, Head Start, etc.); and e) the general composition of the sample (e.g., community size, general socio-economic level, racial/ethnic composition, etc.)

Insert Figures 2, 3, 4, 5, 6, & 7 about here

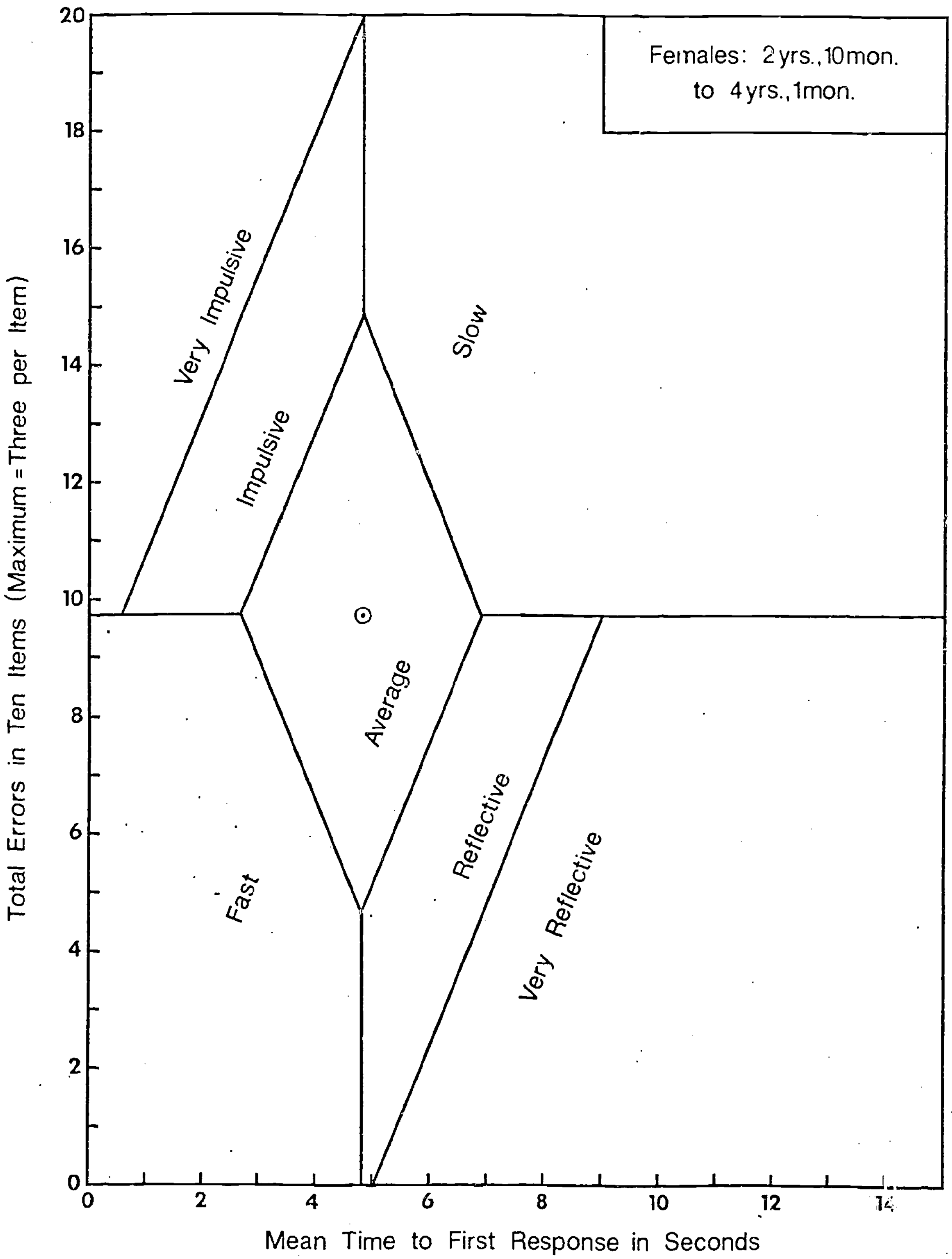

Females: 2 yrs., 10 mon. to 4 yrs., 1 mon.
Total Errors in Ten Items (Maximum = Three per Item)
Mean Time to First Response in Seconds
0
2
4
6
8
10
12
14
16
18
20
Very Impulsive
Impulsive
Slow
Average
Fast
Reflective
Very Reflective

Fig. 2

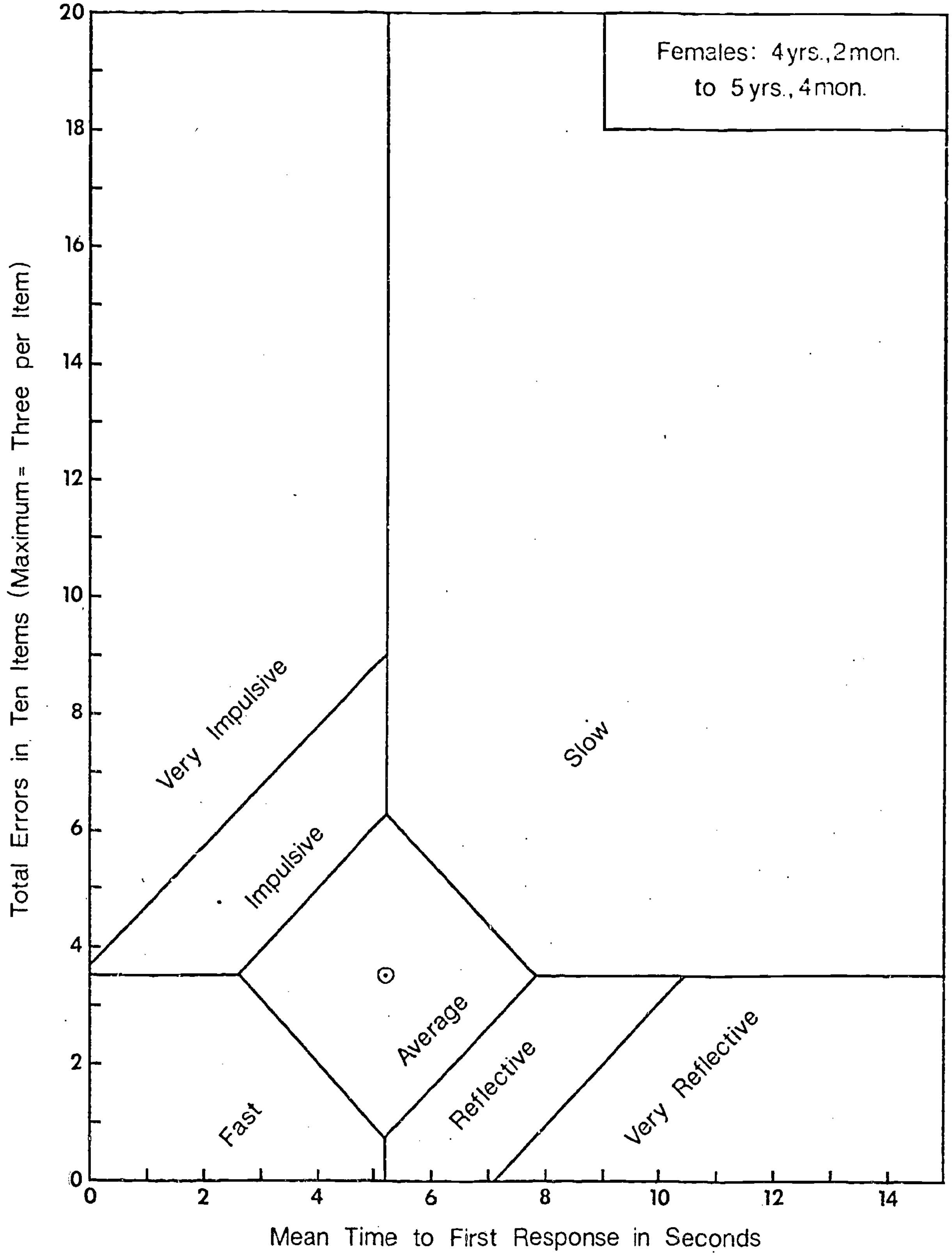

Females: 4 yrs., 2 mon. to 5 yrs., 4 mon.
Very Impulsive
Impulsive
Slow
Average
Fast
Reflective
Very Reflective
Total Errors in Ten Items (Maximum = Three per Item)
0
2
4
6
8
10
12
14
16
18
20
Mean Time to First Response in Seconds

Fig. 3

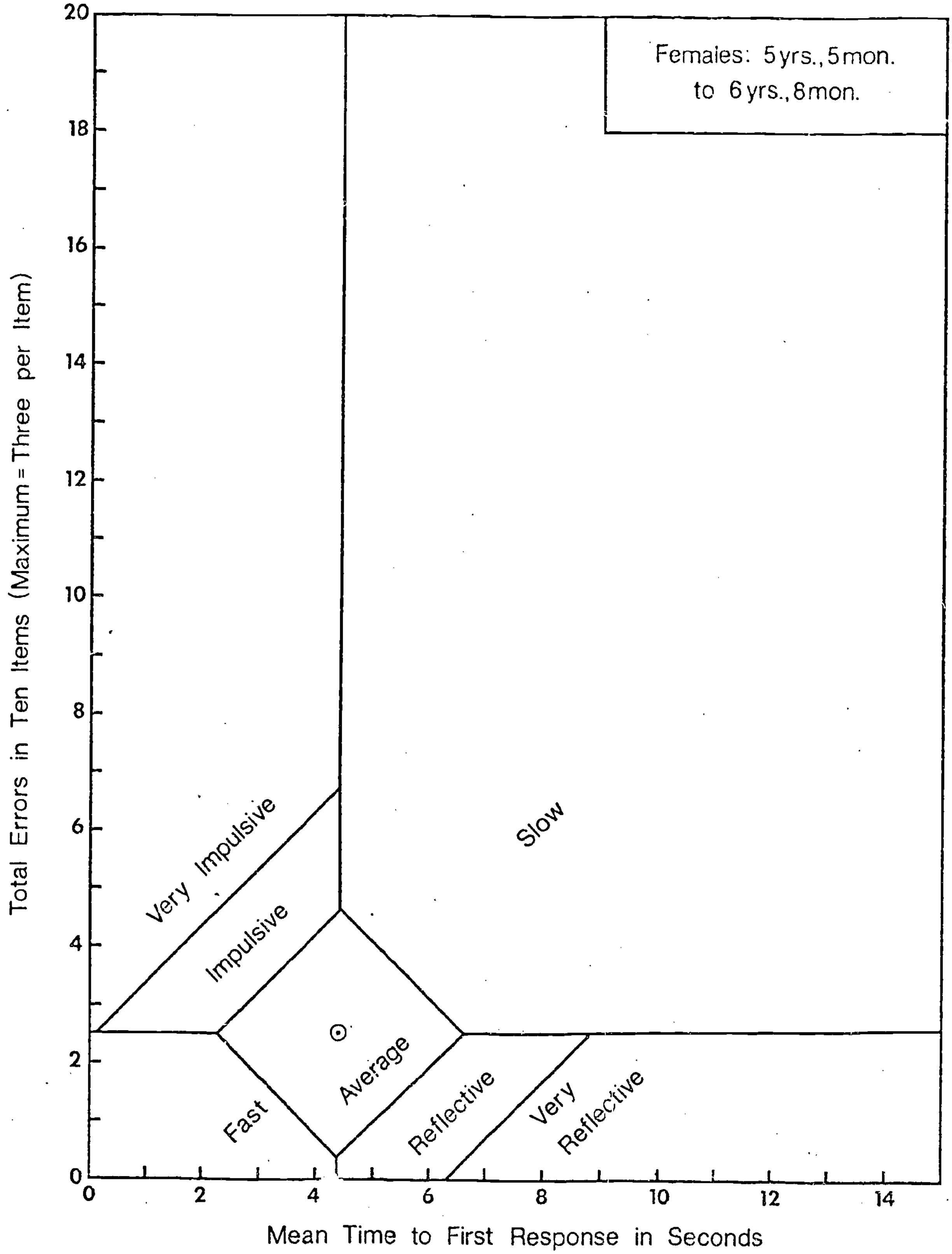

Females: 5 yrs., 5 mon.
to 6 yrs., 8 mon.
Total Errors in Ten Items (Maximum = Three per Item)
Mean Time to First Response in Seconds
Very Impulsive
Impulsive
Slow
Average
Fast
Reflective
Very Reflective
0
2
4
6
8
10
12
14
16
18
20

Fig. 4

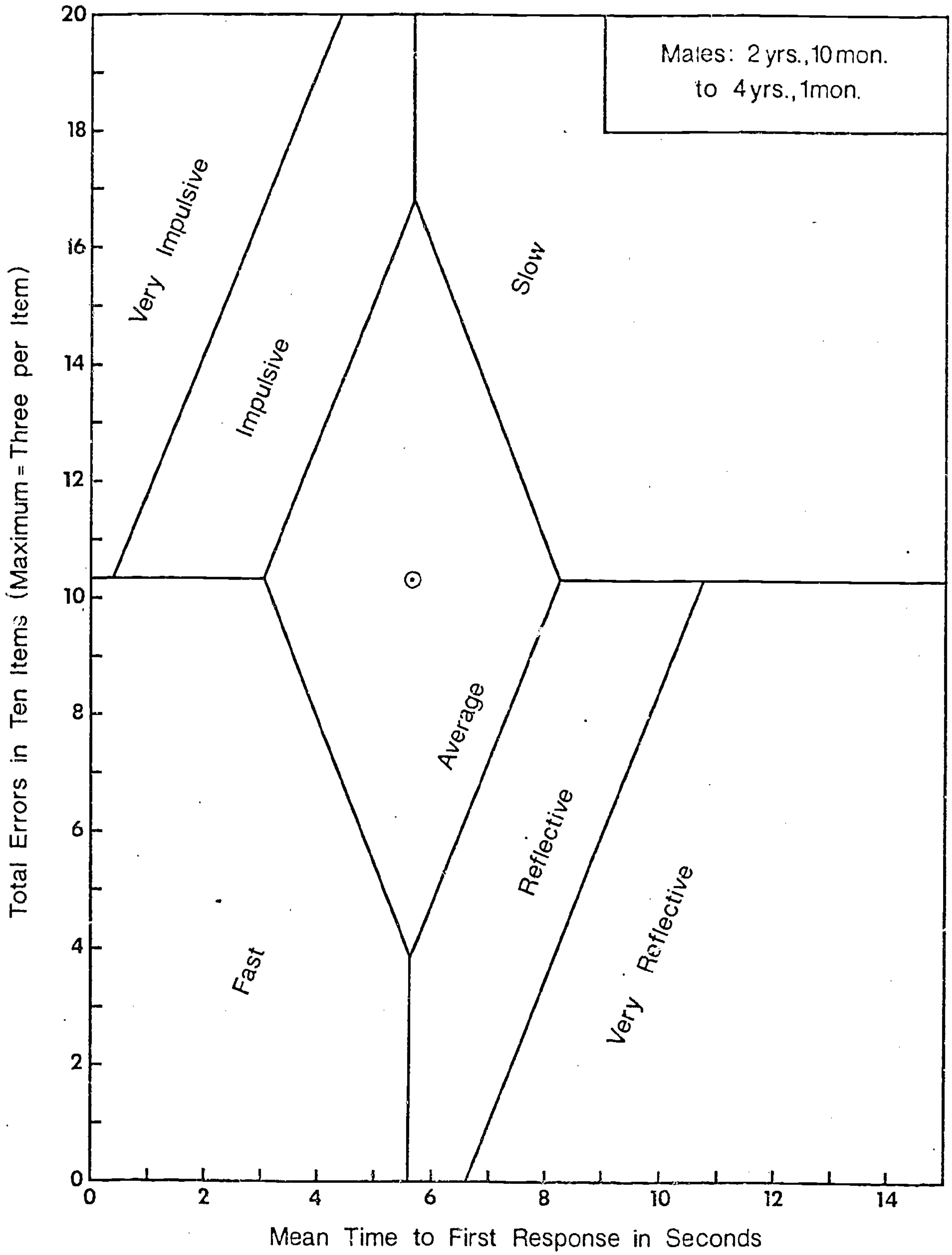
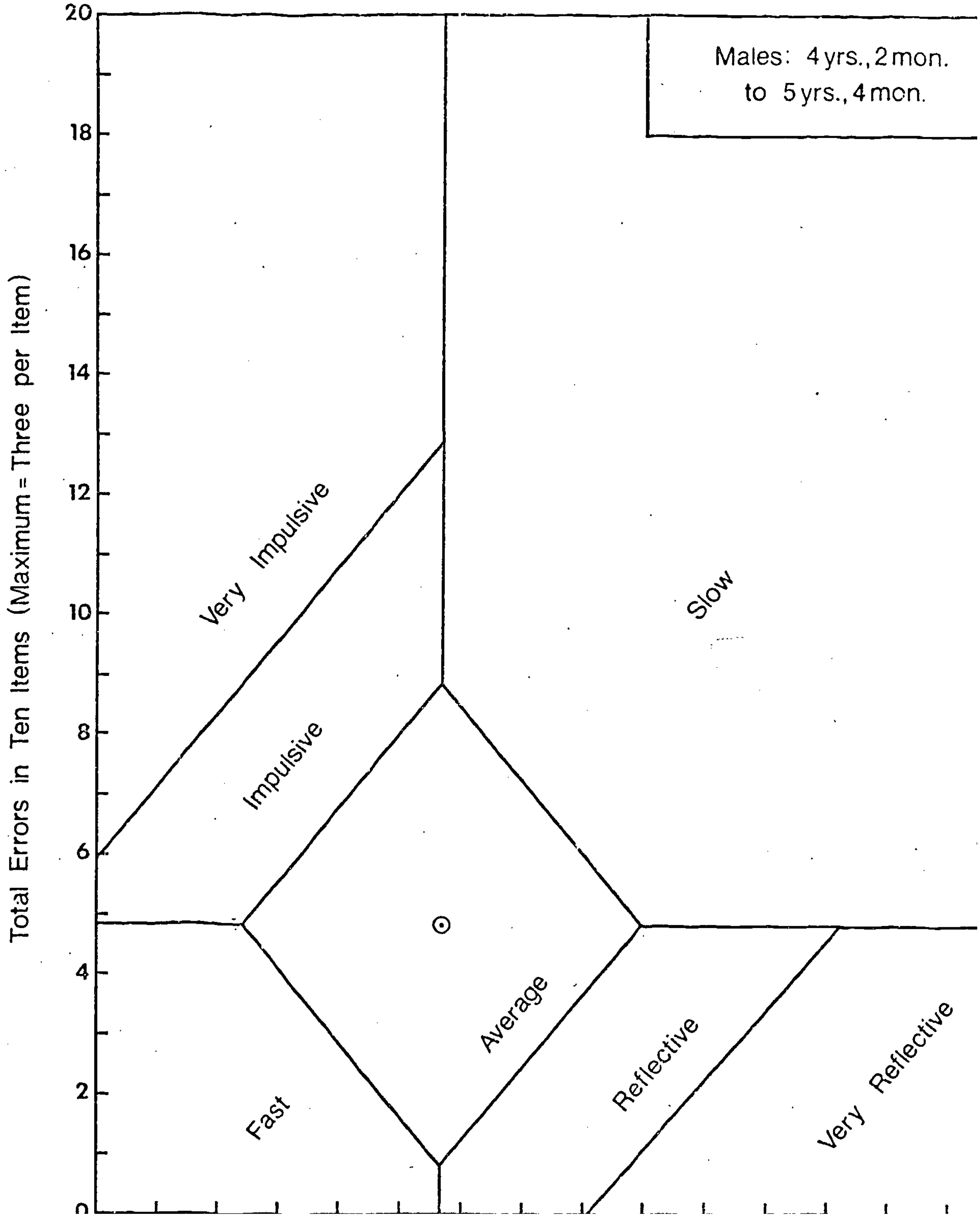
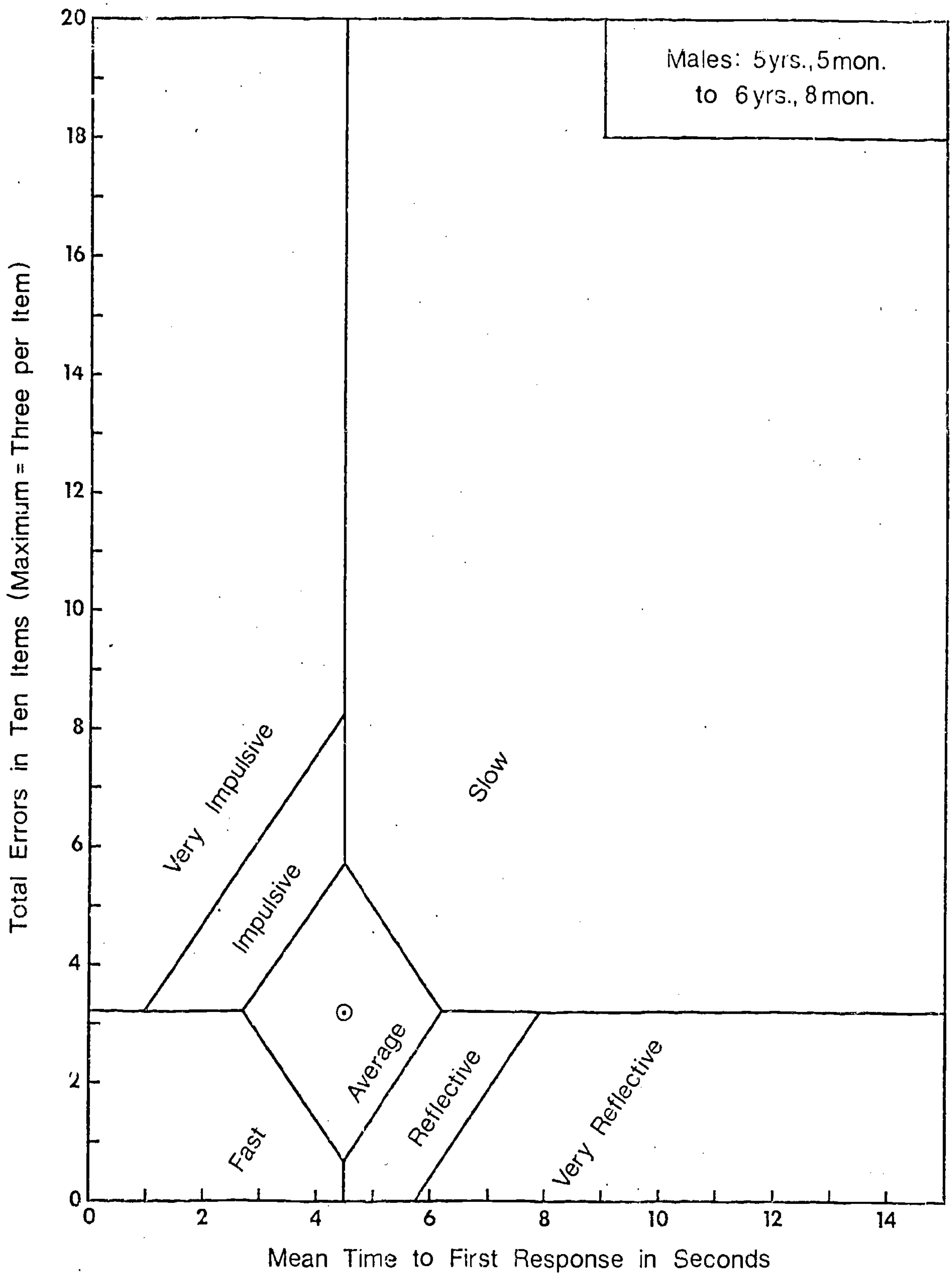

Males: 2 yrs., 10 mon. to 4 yrs., 1 mon.
Very Impulsive
Impulsive
Slow
Average
Reflective
Very Reflective
Fast
Total Errors in Ten Items (Maximum = Three per Item)
Mean Time to First Response in Seconds
0
2
4
6
8
10
12
14
16
18
20

Fig. 5



Males: 4 yrs., 2 mon.
to 5 yrs., 4 mon.
Total Errors in Ten Items (Maximum = Three per Item)
20
18
16
14
12
10
8
6
4
2
0
Very Impulsive
Impulsive
Slow
Average
Fast
Reflective
Very Reflective



Males: 5yrs.,5mon. to 6yrs., 8mon.
Total Errors in Ten Items (Maximum = Three per Item)
Mean Time to First Response in Seconds
Very Impulsive
Impulsive
Slow
Average
Fast
Reflective
Very Reflective

Fig. 7

References

Kagan, J. Developmental studies in reflection and analysis. In A.H. Kidd and J. H. Rivoire (Eds.), _Perceptual Development in Children_. New York: International Universities Press, 1966, pp. 487-522.

Wright, J. C. _The Kansas Reflection - Impulsivity Scale for Preschoolers (KRISP)_. St. Louis: CEMREL, Inc., 1971.

Wright, J. C. Technical report on the KRISP. In _Annual Report_, Kansas Center for Research in Early Childhood Education, University of Kansas, 1972.

The KRISP*: A Technical Report

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Director

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KANSAS CENTER FOR RESEARCH IN EARLY CHILDHOOD EDUCATION

University of Kansas

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3HOK03-7
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*The Kansas Reflection-Impulsivity Scale for Preschoolers (Wright, 1971) and a User's Manual for the KRISP (Wright, 1973) have been published elsewhere. This report supplies supplementary technical data on the KRISP and assumes the reader's familiarity with the test.

Introduction

The Kansas Reflection-Impulsivity Scale for Preschoolers (KRISP), initially developed as a research instrument (Wright, 1971) is now being normed and prepared for wider, though still experimental, use under ordinary user conditions by personnel without specialized training. For this purpose a user's manual (Wright, 1973) has been written in non-technical language and format, containing preliminary norms in the form of comparison charts based on the 307 children tested by the Kansas Center for Research in Early Childhood Education, University of Kansas, during the past two years. While a much larger number of cases is being tested for inclusion in subsequent norms, it appears useful to analyse the data in hand for a preliminary report to accompany the interim norms now being distributed. The present report is based on 307 children tested in the Lawrence and Kansas City, Kansas areas in 1971 and 1972. They come from a generally middle class population and are otherwise unselected. The greatly enlarged norming population now being studied will include a number of different regions in the United States, more varied populations (urban, inner city, suburban, and small town), together with sample data from Canada, Great Britain, West Germany, Belgium, and Australia. Doubtless it will prove necessary and desirable to replicate the analyses reported here on the larger sample, and to extend them to include regional and international comparisons as well as demographic contrasts not yet possible with existing data.

Results

Table I shows the basic KRISP data (mean time to first response and total errors in 10 items) averaged separately by age and sex and combined in various ways. The findings are based only on the first

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Insert Table I
about here

---

administration of the KRISP to each child, and a random half of the Ss in each age x sex cell were tested with Form A, the rest on Form B. (See below for interform comparisons).

Sex Differences in speed and accuracy.

The overall sex difference in time indicates that females respond slightly faster than males, but the difference is not significant [$F(1,299) = 2.18$, n.s.]. That females make fewer errors, however, is a significant finding [$F(1,299) = 4.28$, $p < .05$]. The sex-by-age interactions are not significant, yielding F-ratios of less than 1.0 for both time and errors.

Age Differences in speed and accuracy

The effect of age was analysed by comparing the three age levels used in norming: "young" (2 yrs., 10 mon. to 4 yrs., 1 mon.); "middle" (4 yrs., 2 mon. to 5 yrs., 4 mon.); and "old" (5 yrs., 5 mon. to 6 yrs., 8 mon.). Time scores yield a hump-shaped function with age, with the middle group responding slowest and the old group responding fastest. This rather small effect is nonetheless significant [$F(2,299) = 4.52$, $p < .05$]. For errors, however, there is a large, decelerated improvement with age that is highly significant [$F(2,299) = 79.98$, $p < .001$]. No age by sex interactions were significant. Figure I shows these results.

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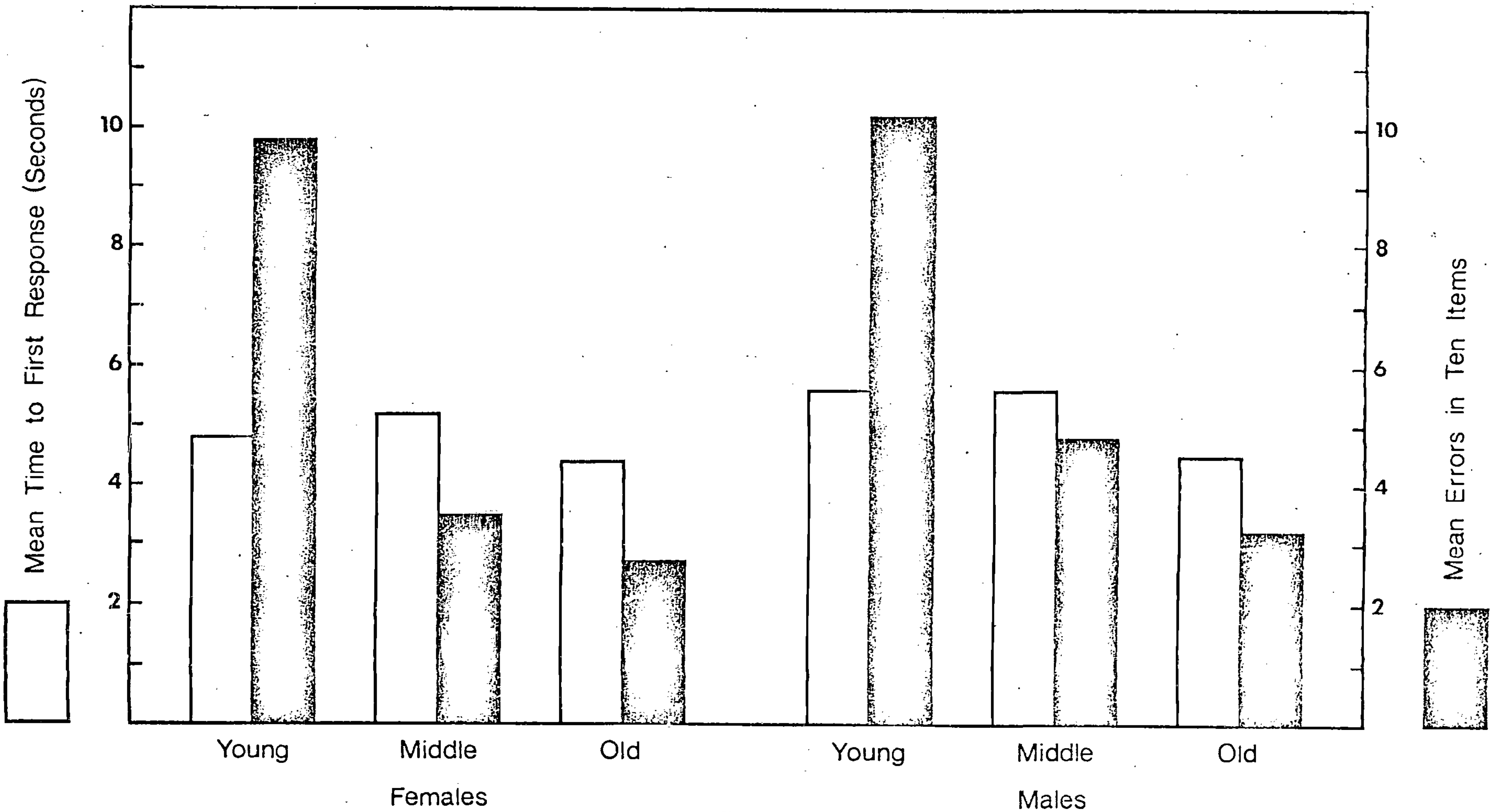
insert Figure I about here

Table I. Interim norms for KRISP time and errors as a function of age and sex.

Age Range	Sex	N	Mean Time to First Response (sec.)		Total Errors in Ten Items	
			Sample mean	S.D.	Sample mean	S.D.
Young[1]	Female	51	4.72	2.06	9.80	5.14
Middle[1]	Female	26	5.23	2.63	3.48	2.76
Old[1]	Female	69	4.44	2.14	2.50	2.07
Combined	Female	146	4.68	2.22	5.20	4.89
Young	Male	51	5.59	2.39	10.35	6.04
Middle	Male	32	5.65	3.25	5.28	4.15
Old	Male	78	4.41	1.77	3.20	2.49
Combined	Male	161	5.03	2.41	5.88	5.28
Young	Combined	102	5.16	2.27	10.08	5.62
Middle	Combined	58	5.47	3.00	4.49	3.71
Old	Combined	147	4.43	1.95	2.87	2.33
All Subjects		307	4.87	2.31	5.56	5.11

[1] Note: "Young" subjects defined as 2 yrs., 10 mon. to 4 yrs., 1 mon.
"Middle" subjects: 4 yrs., 2 mon. to 5 yrs., 4 mon.
"Old" subjects: 5 yrs., 5 mon. to 5 yrs., 8 mon.


Mean Time to First Response (Seconds)
10
8
6
4
2
Mean Errors in Ten Items
10
8
6
4
2
Young
Middle
Old
Females
Young
Middle
Old
Males
Fig. 1

Relationship between speed and accuracy

Pearson product moment correlations between mean times and total errors are reported in Table 2. Others, e.g., Kagan (1966), have

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Insert Table 2 about here

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generally found with older children on their MFF test that speed and accuracy are negatively related, with correlations running between -.40 and -.60. As can be seen, the same correlations on our present KRISP data yield uniformly negative, but substantially smaller correlations, perhaps due to the restriction of range, especially of time scores, or perhaps due to the fact that a larger number of experiential variables appear to influence younger children's scores, especially their accuracy scores. In any case the pattern of a generally negative relationship between time and errors appears to be established in Table 2, and it is stronger for males than for females.

Interform reliability.

Most of the Ss for whom the first administration of the KRISP yielded the data analysed above were also given a second administration less than ten days later using the other form of the test. By the use of t-tests for correlated samples, the data from Form A (half first session, half second session, same Ss) were compared with those from Form B in each of the six age-by-sex cells. None of the t-tests yielded values approaching significance (all t-values less than 1.0) for either time or errors. Correlations between Form A and Form B on various combinations of 188 Ss are given in Table 3. In general it appears that satisfactory inter-form reliability has been demonstrated.

Insert Table 3 about here

Table 2. Pearson correlations between mean time to first response and total errors on ten KRISP items by age and sex.

	Male Ss		Female Ss		Sexes Combined	
	N	r	N	r	N	r
Young Ss (2 yrs., 10 mon. to 4 yrs., 1 mon.)	51	-.44[e]	51	-.08	102	-.28[d]
Middle Ss (4 yrs., 2 mon. to 5 yrs., 4 mon.)	32	-.36[a]	26	-.11	58	-.25[a]
Old Ss (5 yrs., 5 mon. to 6 yrs., 8 mon.)	78	-.27[c]	69	-.22[a]	147	-.16[a]
Ages Combined	161	-.17[b]	146	-.06	307	-.11[a]

Significance code:

a: $p < .05$; b: $p < .02$; c: $p < .01$; d: $p < .005$; e: $p < .001$.

Table 3 Pearson correlations between Form A and Form B

	Young Ss		Middle Ss		Old Ss		Ages Combined	
	N	r	N	r	N	r	N	r
Male Ss								
Time	51	+.59	32	+.75	13	+.33	96	+.61
Errors	51	+.72	32	+.72	13	+.77	96	+.77
Female Ss								
Time	51	+.60	26	+.83	15	+.74	92	+.70
Errors	51	+.71	26	+.51	15	+.53	92	+.80
Sexes Combined								
Time	102	+.60	58	+.78	28	+.60	188	+.72
Errors	102	+.72	58	+.66	28	+.74	188	+.78

Test-retest reliability

Session I scores were compared with Session 2 scores to determine whether on a second administration of the KRISP, using the other form, a practice or warm-up effect can be expected. For time scores, the answer is clearly no, since none of the t-tests yielded significant changes for any age x sex cell or combination of cells. For errors, however, there appears to be a definite practice effect leading to error reduction on the second administration. Table 4 summarizes these changes and their significance.

Insert Table 4 about here

The data reported in Table 3 were arranged to correlate Form A (regardless of which session it was given in) with Form B (also regardless of session). A rearrangement of the same data permits the correlation of Session I data (regardless of Form) with Session 2 data (regardless of form). The resulting correlations are given in Table 5. Again

Insert Table 5 about here

satisfactory reliability appears to have been established despite the practice effects that differentiate Session I from Session 2 scores. However, separate norms will probably be needed for "second administrations" of the KRISP.

One-year Stability

Since the KRISP measures variables of unknown stability, especially at the younger end of its range, it was decided to study stability of KRISP performance over a one-year period, beginning with three-year-olds. Unfortunately, at this stage, the only Ss that could be easily

Table 4. One-week (other form) retest changes for KRISP time and errors.

		Time (sec.)				Errors			
	N	Change (±)	t	d.f.	p*	Change (±)	t	d.f.	p*
Young Males	51	+.02	0.05	50	n.s.	-3.10	6.33	50	.001
Young Females	51	+.17	0.53	50	n.s.	-0.92	1.61	50	n.s.
All Young	102	+.09	0.35	101	n.s.	-2.01	5.15	101	.001
Middle Males	32	+.36	1.13	31	n.s.	-1.25	2.55	31	.02
Middle Females	26	+.29	0.76	25	n.s.	-1.19	2.25	25	.05
All Middle	58	+.33	1.38	57	n.s.	-1.22	3.99	57	.001
Old Males	13	+.39	0.76	12	n.s.	-1.62	2.25	12	.05
Old Females	15	+.73	1.87	14	(.10)	-0.33	0.85	14	n.s.
All Old	28	+.57	1.84	27	(.10)	-0.96	2.40	27	.05
All Males	96	+.06	0.24	95	n.s.	-2.28	6.91	95	.001
All Females	92	+.13	0.59	91	n.s.	-0.90	2.57	91	.02
All Ss	188	+.04	0.25	187	n.s.	-1.61	6.44	187	.001

* The probabilities reported are two-tailed. The t is for correlated samples.

Table 5 Pearson correlations between Session 1 and Session 2

	Young *Ss*		Middle *Ss*		Old *Ss*		Ages Combined	
	N	r	*N*	r	*N*	r	*N*	r
Male *Ss*								
Time	51	+.62	32	+.73	13	+.34	96	+.62
Errors	51	+.84	32	+.77	13	+.76	96	+.84
Female *Ss*								
Time	51	+.62	26	+.81	15	+.84	92	+.71
Errors	51	+.73	26	+.50	15	+.49	92	+.82
Sexes Combined								
Time	102	+.63	58	+.77	28	+.60	188	+.67
Errors	102	+.78	58	+.70	28	+.75	188	+.82

retested one year later were children in the University of Kansas Preschool who were still enrolled one year after their initial KRISP administration. Also awkward is the fact that they were some of the same Ss who contributed to the interform and one-week retest data described above, and had already had two KRISP administrations, a week apart, in the first year. Moreover, only 19 males and 21 females were available one year later.

Nevertheless it appears useful to analyse the effects of one year's growth and experience (including classroom training in preacademic skills and intensive participation as Ss in learning and cognitive research studies over that interval). Therefore within 10 days of the exact anniversary of their first KRISP, these Ss were given a third and fourth administration of the KRISP. Again half got Form A and then Form B, the other half got B then A this time. By t-test for correlated means (changes), time scores for males, females, and all Ss combined showed about a half-second decline over the year, a nonsignificant change. This finding is corroborated by the cross-sectional data in Table I, where young and middle Ss differed by about the same small amount in time scores. Errors, however, declined significantly, as they did in the cross-sectional study. For males the decline in errors was 3.68 [$t\ (18) = 3.61$; $p < .002$]. Again similar to the cross-sectional findings, the females' errors declined still more than the males: a decrease of 5.19 errors [$t\ (20) = 4.36$; $p < .001$]. Combining the sexes yields a mean change of -4.48 errors, which is also significant [$t\ (39) = 5.67$; $p < .001$].

Pearson correlations were calculated between year 1 and year 2 for both time and errors by using the average of the two administrations in the first year for the year I scores and the average of the second year

administrations for the year 2 scores. This pooling of the two administrations separated by one week in each year was done a) because we were more interested in trait stability over a year than in test stability and therefore sought the best possible estimates of the child's "true" scores; and b) because by this method Form A and Form B contribute equally to the first year and the second year means for each dhild. Table 6 gives the anniversary correlations. As can be seen, they are not

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Insert Table 6 about here

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impressively strong for either time or errors, but in general females appear to be much more stable than males, judging from this small sample.

Special Populations

As has been mentioned, efforts are under way to obtain KRISP normative data stratified by population density (urban, suburban, small town, and rural); by socioeconomic status; and by nation and language groups. No results are yet analysed from these efforts. However one study, now three-fourths completed, is providing interesting data on the KRISP performances of retarded children. With the collaboration of Delores Segler and Jo Ramberg, we have administered the KRISP to 99 retarded children drawn from two residential institutions for retardates and special classrooms in two school districts where the children live at home. Groups of institutionalized trainables and educables have been run, as well as home-living trainables. Fifty-three home-living educables, to complete the design, have been contacted, but not yet tested. Nevertheless some preliminary analyses can be reported.

Table 6. Pearson correlations between the 3-year-old and the 4-year-old KRISP performances of the anniversary sample.

	N	Time	Errors
Males	19	-.16	+.09
Females	21	+.67[d]	+.42[b]
Sexes Combined	40	+.21[a]	+.33[c]

Significance code:

a: $p < .10$; b: $p < .03$; c: $p < .02$; d: $p < .001$

The institutionalized children were patients at the Parsons State Hospital and Training Center in Parsons, Kansas or the Kansas Neurological Institute in Topeka. Their stay at the time of testing averaged more than a year at Parsons, and more than six months at KNI. The non-institutionalized sample is drawn from the special classes for retardates at Grandview School, and from similar classes at Wellbourne School, both in Kansas City, Kansas. The comparison normals are from the University of Kansas Preschool. Table 7 shows the composition of the samples by age range and estimated I. Q. range and estimated mental age range. The

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Insert Table 7 about here

IQs are approximations based on varying estimates available on the preschool population as a whole, and in the folders of the retarded children. Often only one or two estimates were available per child, and the instruments used included the PPVT, WISC, Leighter, and Stanford-Binet. The PPVT scores were all discrepantly high, and were not used if another score was available. The educable-trainable distinction was routinely made as a classification by the Parsons' staff, and the other retardates were selected so as to approximate the Parsons' groups.

The KRISP was administered by a procedure as close as possible to the standard one. The only modification was occasional simplification and repetition of both instructions and the five practice items, as needed, with the retardate groups. No guidance or prompting was given once the test proper had begun. If a retarded child did not finish in ten minutes, he was re-tested, beginning all over with the practice items a day or so later. At the end of each session each retarded child received a small toy or a piece of candy.

Table 7. Characteristics of samples used in KRISP study of retardates.

Type of Child	N	C.A. Range	Approximate M.A. Range	Approximate I.Q. Range
Normal Preschoolers				
Younger	33	4 to 5 yrs.	4 to 6 years	100 to 120
Older	25	5 to 6 yrs.	5 to 7 years	100 to 120
Retardates*				
Trainables	70	8 to 14 yrs.	3 to 6 years	30 to 50
Educables	82	6 to 12 yrs.	4 to 7 years	50 to 70

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* Approximately the same for institutionalized as for home-living. For sample sizes of each, see Table 8.

Table 8 gives the preliminary results. A formal analysis of variance awaits the testing of the 53 home-living educables, but preliminary

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Insert Table 8 about here

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t-tests indicate that retardates respond faster than normals ($p < .05$), and make more errors ($p < .01$). Trainables and educables respond about equally fast, but trainables make significantly more errors ($p < .01$). Institutionalized trainables are somewhat slower than home-living trainables ($p < .05$) and make many fewer errors ($p < .01$). In general, among the retardates, institutionalization appears to make for more reflective responding, while degree of retardation so far does not appear to have as strong effects as institutionalization. The main effect of retardation *per se* is that retardates have higher error rates than normals, as expected.

Summary and Conclusions

Initial norms on the KRISP indicate that females make slightly, but significantly fewer errors than males and are probably more stable over a one-year interval. Males show a stronger negative relation between speed and accuracy, but otherwise there are no marked sex differences. The effects of age (cross-sectionally and longitudinally) and practice are readily seen in the form of error reduction, but not as a systematic change in the speed of responding. The efficiency trade-off that with older school-age children on the MFF creates a sizeable negative correlation between speed and accuracy appears present, but much weaker, in KRISP data from preschoolers. All comparisons support the high agreement between Form A and Form B of the KRISP.

Table 8. KRISP Scores of Normal and Retardate Children.

		Time (sec.)		Errors	
	N	$\overline{X}$	S.D.	$\overline{X}$	S.D.
Younger Preschoolers	33	5.60	2.58	3.89	3.67
Older Preschoolers	25	4.83	2.01	2.12	2.35
All Preschoolers	58	5.23	2.34	3.12	2.54
Trainable Inst. Retard.	33	5.12	1.89	5.59	3.40
Trainable Home Retard.	37	3.88	1.12	10.73	4.48
All Trainable Retard.	70	4.46	2.45	8.31	4.83
Educable Inst. Retard.	29	4.11	1.81	5.31	2.89
Educable Home Retard.	53	incomplete data			
All Educable Retard.	82	incomplete data			
All Inst. Retardates	62	4.64	2.54	5.46	4.65
All Home Retardates	90	incomplete data			
All Retardate Ss	152	incomplete data			

Retardates of the same mental age as the norming population respond more impulsively than normals, but degree of retardation appears to make less difference than institutionalization. Perhaps because they are not as protected as institutionalized children from tasks too difficult for them, the home-living retardates appear to develop an especially rapid and error-prone style. Conversely the children living in institutions either have stronger expectation of success, or perhaps a stronger, deprivation produced motivation to please adults who work individually with them, for they take longer and do better than their home-living peers.

So far the KRISP appears to be a reliable instrument, with face validity related to the MFF (Kagan, 1966), after which it was patterned. Its predictive validity has not been adequately tested as yet, but studies are under way (Wright, 1972) to assess its relationship to individual differences in infant attention as well as to the MFF performances of children as they reach school age. KRISP scores at age three may not predict KRISP scores at age four for boys, but they do for girls. The ability of the KRISP to predict other performances in other situations is being assessed in three experiments and one observational/correlational study in this laboratory (Wright, 1972), and it is hoped that by the time enlarged norms become available, a clearer picture of its ultimate practical usefulness will emerge. In the interim it appears to be a useful research instrument.

We may speculate that the error scores reflect an acquired ability to visual analysis, since they appear so much more susceptible to systematic changes than are time scores. The latter, on the other hand, are

probably more stable indicators of a lasting cognitive style. It therefore appears to be appropriate to use them in conjunction to make predictions of children's differential functional effectiveness in different types of tasks. Impulsive children do appear to get more reflective as they get older, and after all this is what most formal teaching is directed toward. But a second educational goal might well be to preserve the impulsive child's fluency and expressiveness, while enhancing that of the rather cautious reflective child.

References

Kagan, J. Developmental studies in reflection and analysis. In: A.H. Kidd and J.L. Rivoire (Eds.), Perceptual development in children. New York: International Universities Press, 1966.

Wright, J.C. The Kansas Reflection Impulsivity Scale for Preschoolers (KRISP). St. Louis: CEMREL, Inc., 1971.

Wright, J.C. (Studies in progress and development) Annual report of the Kansas Center for Research in Early Childhood Education. Department of Human Development, University of Kansas, Lawrence, 1972.

Wright, J.C. A Users' Manual for the KRISP. St. Louis: CEMREL, Inc., 1973.

Salience of Dimensional Cues and Attentional Set in Children's Color-Form Matching

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KANSAS CENTER FOR RESEARCH IN EARLY CHILDHOOD EDUCATION

University of Kansas

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Introduction

ls a part of a continuing research program on attention
sses and cognitive styles in early learning the presen
ndertaken to elucidate a developmental shift in determi
tion that we have hypothesized (Wright, 1972). Simply
er preschoolers and toddlers are more likely to respond
of physically salient portions of stimuli, regardless
older children are more likely to "decenter" their att
so as to take into account less obvious, but logically
es of the task.

Many investigators have noted that younger preschoolers
nd more to color than to form, while older ones appear
dominant. Gaines (1970) has suggested that while this
opmental phenomenon due to the maturation of the organi
ences with form and color cues, it could also be based
In support of the latter, she demonstrated that an ext
on-dominant dimension relevant, once completed, had a s
subsequent optional color-form task, producing a prefer
ously relevant dimension. Tighe, Tighe, Waterhouse & V
hile, demonstrated the same phenomenon as a methodologi
udies which had first assessed dominance and then exper
ed discrimination on the dominant vs. nondominant dimen
tional reversal (e.g., Smiley & Weir, 1966). Tighe, et
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a forced choice. Once made and followed consistently for a few trials, such choices (i.e., whether to match on color or form when it is impossible to do both) have a setting effect on the following task.

Corah and Gospodinoff (1966) reasoned that the younger children's initial preference for responding to color cues was a function of the ease of locating these cues in conventional stimuli. That is, ordinarily color inheres in every part of a stimulus, while form cues are found only in specific locations (e.g., on the perimeter of planometric forms). Therefore more selective optical scanning is required for form responding than for color responding with ordinary stimuli, such as those conventionally used to assess color-form preferences. Since it takes less time to locate color cues, and since younger children respond rapidly to those cues that first attract attention, their general color-dominant responding is explained on that basis.

Where Gaines (1970) and Tighe, et al. (1970) established setting effects by the sequencing of experiences over time, Corah (1966;1967) and Katz (1971) have done so by manipulating the immediate salience and locus of cues in each single stimulus. Instead of establishing set <u>qua</u> habit or expectation, they established it by the attention-getting properties of the stimuli themselves. Color cues can be made more immediately potent either by increasing the saturation of the colors used (Corah, 1967), or conversely by making the form cues more difficult to locate and identify. The latter can be accomplished by making the forms more complex (Corah, 1966; Katz, 1971). Correspondingly form cues can be made more immediately salient by repetition of concentric contours within simple shapes (Katz, 1971). This serves to distribute form cues more completely throughout the figure as color cues are ordinarily distributed. Finally, form cues can

be made more salient by making color cues less so. This was done by Katz (1971) and in part by Corah (1966) by locating color cues on the periphery of the figure, where ordinarily form cues are found. The effectiveness of these four kinds of salience manipulations has been demonstrated in the studies cited.

Consonant with the hypothesis that immediate salience plays a setting role is the finding by Katz (1971) that impulsive Ss on the Kagan MFF test of conceptual tempo respond in general more to color and reflectives more to form. But when the stimuli were so constructed as to make form the immediately salient cue, impulsive Ss chose it almost as often as reflectives. We thus have two phenomena, not one. The rapid responding of impulsives and younger children generally makes them more responsive to color cues, and it also makes them more susceptible to short-term sets, whether produced by differential salience built into the stimuli or established through sequence. One might therefore predict the same differences between, say four-year-olds and five-year-olds as Katz found between impulsive children and reflective ones. In either case there should be two differences: 1) younger or impulsive children should in general respond more to color and older or reflective children should respond more to form, especially with neutral stimuli, and 2) younger and impulsive children should more closely resemble older or reflective children when a set is established (either by sequence or by salience) toward either strong color or form responding.

Method

Design

This experiment was designed to study color-form preferences in a forced-choice matching task as a function of age, dimensional salience of

stimuli, and temporal sequence of experiences with them, together with the interactions among these variables. Salience was manipulated by extensions of the stimulus construction methods summarized above for all Ss. Age and sequence are within-subject variables. Given six sets of stimulus items ranging from highly form-dominant to highly color dominant, half the Ss received the stimuli in order with the most color dominant first and the most form dominant last. The other half received the same stimuli in scrambled (random) order.

Subjects

Twenty-eight preschool children, selected only by parental consent, served as Ss in the experiment. They sere divided into four groups in a two-ages by two-treatments factorial design, with seven Ss per cell. The younger Ss' mean chronological age was 48 months; the older groups averaged 66 months of age. Half of each group was assigned to the "ordered" treatment, and half to the "scrambled" treatment. The two treatment groups were approximately equated for age, and all groups contained approximately equal numbers of each sex.

Apparatus

Sixty stimulus cards were prepared in which a standard figure appeared in the top half and two variants were located side by side in the bottom half. One of the variants matched the standard in form, but not color; the other matched it in color but not form. Six sets of ten cards each were constructed so as to be homogeneous within sets and to range between sets from strong color dominance (Set A) to strong form dominance (Set F). Set D in the series was designed to be the same as the neutral sets used for assessing color-form dominance by others, such as Katz's (1971)

Series I. Sets F and B resemble Katz's form-dominant Series II and color-dominant Series I, respectively. A general description of each set follows, including specification of how mismatches of color and form were accomplished.

Set A: Highly saturated "da-glo" colors of widely differing hues were used. The background was black. The forms were complex, random shapes differing in only one small feature.

Set B: Colors still bright "da-glo", background black. Forms simple, familiar, differing only slightly.

Set C: Bright tempora colors on gray background. Figures still more simple and familiar. Forms differ in several respects.

Set D: Typical of stimuli used to test color-form dominance. Primary colors on a white background. Shapes simple familiar geometric cut-outs. Form differences probably nameable (e.g., circle vs. triangle). This set intended to be neutral (neither color- nor form-dominant.)

Set E: Color contained only in broad-band outer contour line defining the figure. Markedly different geometric shapes, with two successively smaller identical forms outlined in black within the larger color outline, on a white background.

Set F: Markedly form dominant. Form contours repeated concentrically five times by black lines effectively filling the figure with form cues. Simple, widely differing geometric shapes. Color in the form of short, thin line segments at the apexes of the outermost contour. These line segments were extensions of the black lines forming the sides of these polygons and replaced them at outer corners wherever the angle was less than 180 degrees.

Four warm-up cards were prepared for use with all Ss, to establish a pointing response on the basis of match to the standard. Two were colored animal pictures and two were colored abstract figures. One animal item and one abstract form required a color match because the forms for all three stimuli on the cards were identical. The other animal and the other abstract item forced form matching because all

three stimuli were of the same color. The order of administration of this warm-up series was: a) forced color animal; b) forced form abstract; c) forced form animal; d) forced color abstract.

The sixty test cards were placed in clear acetate folders and bound in a large ring binder. In the scrambled treatment the order of the sixty items was randomized with the constraint that no more than two in sequence could come from the same set, and that exactly two from each set must appear in each block of 12 items. In the ordered treatment all ten items in Set A were presented first, Set B second and so on with Set F last.

Procedure

Each S was brought to the experimental room by E and seated facing E across a table. The E then presented the warm-up series, prompting and correcting S as needed to elicit a proper pointing response, defined as touching the correct response choice with a finger. The E then presented each of the stimulus cards saying, "Point to the one that looks the most like this one." (E pointed to the standard stimulus). If S asked questions or pointed out that none of the stimuli were exact matches, E responded only by repeating the initial instruction. Each S had unlimited time in which to make his choice. When the S had completed the series, he was given a graham cracker and returned to his classroom by E.

Results

Mean per cent form choices for each stimulus set (regardless of order) were calculated for each _S_. Figure I shows the results for each group. A mixed-design analysis

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Figure I about here

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of variance was performed on these scores, using one within-_S_s and two between-_S_s variables. As indicated in the anova summary in Table I, age had a significant effect upon the rate of form responding, with older children

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Table I about here

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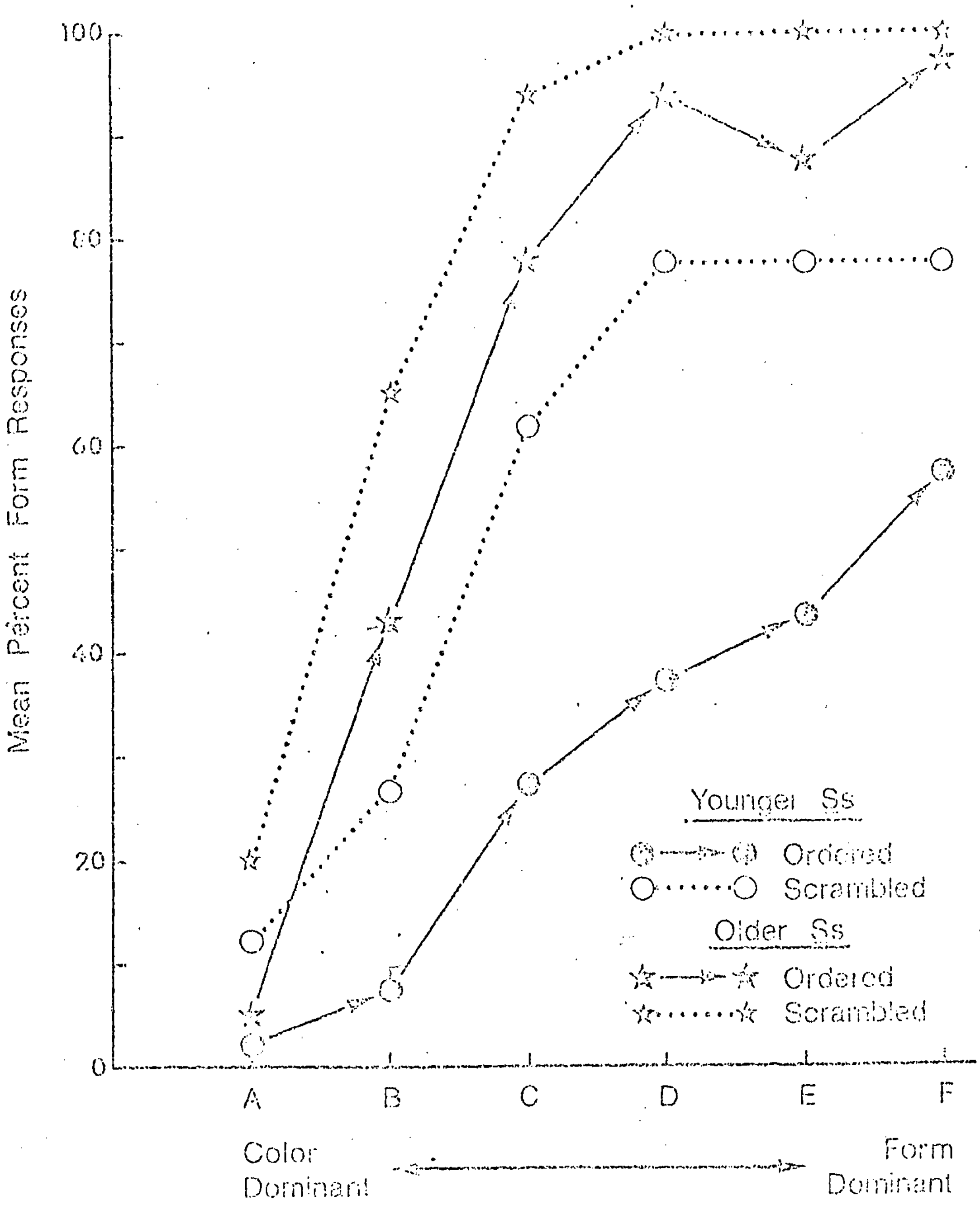
responding more to form ($F(1,144)=414.86$, $p<.005$). The ordered (form-to-color) sequence produced less form responding than the scrambled sequence ($F(1,144)=5.22$, $p<.02$). The largest main effect, however, was that of stimulus set. With but one reversal in twenty adjacent comparisons, each successively less color-dominant and more form-dominant set produced no change or an increase in form responding over its predecessor, regardless of presentation order. This main effect was highly significant ($F(5,5)=56.74, p<.001$). The difference between the age groups was greater for neutral and form-dominant sets than for color-dominant sets, and this interaction was significant ($F(5,5)=2.78$, $p<.05$). The remaining interactions were non-significant, though in Figure I it appears that younger _S_s were more influenced by sequence than were older _S_s.



100
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Mean Percent Form Responses
Younger Ss
Ordered
Scrambled
Older Ss
Ordered
Scrambled
A
B
C
D
E
F
Color Dominant
Form Dominant
Stimulus Sets

Fig. 1

TABLE I

Analysis of Variance

Source	df	MS	F	
Age (A)	1	414.857	13.208	***
Order (B)	1	164.024	5.220	**
Stimulus Set (C)	5	239.210	56.739	****
A X B	1	22.881	< 1.0	
A X C	5	11.714	2.778	*
B X C	5	2.538	< 1.0	
A X B X C	5	4.224	< 1.0	
Error (between Ss)	144	31.412		

* $p < .05$

** $p < .025$

*** $p < .005$

**** $p < .001$

Discussion

Although these results do not eliminate the developmental stage hypothesis for explaining the shift with age from color to form dominance, they do strongly indicate two kinds of setting effects which are quite powerful: sequential order and salience. Sequential order appears to have operated by inducing a color-responding set in the early trials by means of the salience pull toward color responding. As the ordered group proceded through the task, this color expectation was gradually eroded by increasingly form dominant items, but the sequence nevertheless continued to have effects even in the last set (F), and especially for the younger Ss. The scrambled group, on the other hand, getting all kinds of items differing in salience from the very beginning, showed the simple effects of differential salience throughout.

We may conclude that manipulating the saliency of dimensions is a potent way of influencing a child's dimensional preferences, especially when combined with a "fading" sequence like that used in the ordered condition. Apparently the process called decentration by Piaget is responsible for much of the color-form shift with age, since this effect can be experimentally reversed locating the desired cues throughout the figure and restricting the previously ubiquitous and dominant cues to very specific loci.

But at each level of salience and in each order of administration, the fact remains that older Ss were more form-dominant than younger ones. Therefore age or stage must still be considered as a candidate for at least some causal role. It was therefore decided to compare these results, ignoring the effects of sequence, with those of Katz (1971) whose Ss were all the same age, but differed in cognitive style (reflection-impulsivity). If the latter variable, known to be correlated with age (reflectives appear more mature), explains the same effects that in the present study must still be considered as possibly due to age or stage, then the case against the developmental-maturational/hypothesis will have been strengthened. Katz had only three sets of stimuli differing in salience of form and color cues, but a careful comparison of rules for generating stimulus sets and examples of each indicates that her series I, II, and III items are comparable to Sets D, F, and B, respectively. Figure 2 is a plot of all of the Ss reported above against Katz's data. Clearly her

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Figure 2 about here

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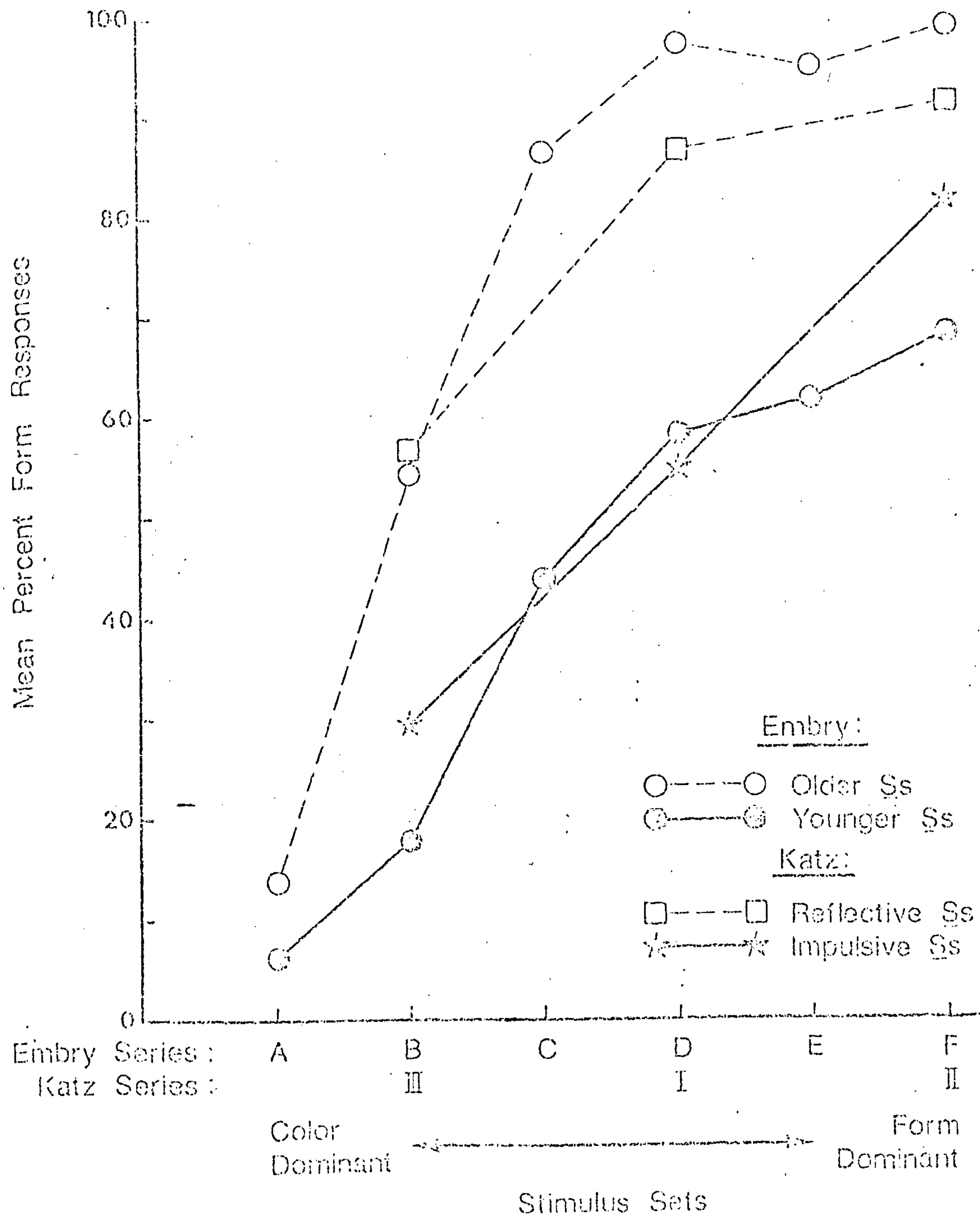
reflective Ss, whose ages almost exactly overlap our two age groups combined, resemble our older Ss, while her impulsive Ss respond like our younger group. Thus it is possible that the remaining effects in the present study still attributable to age may in fact have more to do with visual information processing skills and preferred rate of response than they have to do with maturational phenomena.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Mean Percent Form Responses
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Older Ss
Younger Ss
Katz:
Reflective Ss
Impulsive Ss
Embry Series: A B C D E F
Katz Series: III I II
Color Dominant
Form Dominant
Stimulus Sets

Fig. 2

References

Corah, N.L. The influence of some stimulus characteristics on color and form perception in nursery-school children. Child Development, 1966, 37, 205-211.

Corah, N.L., & Gospodinoff, E.J. Color-form and whole-part perception in children. Child Development, 1966, 37, 837-842.

Corah, N.L., & Gross, J.B. Hue, brightness, and saturation variables in color-form matching. Child Development, 1967, 38, 137-142.

Flavell, J.H. The developmental psychology of Jean Piaget, New York: Van Nostrand, 1963.

Gaines, R. Children's selective attention to stimuli: Stage or set? Child Development, rl, 1970, 41, 979-991.

Katz, J.M. Reflection-impulsivity and color-form sorting. Child Development, 1971, 42, 745-754.

Tighe, L.S., Tighe, T.J., Waterhouse, M.D., & Vasta, R. Dimensional preferences and discrimination shift learning in children. Child Development, 1971, 41, 737-746.

Smiley, S.S., & Weir, M.W. The role of dimensional dominance in reversal and nonreversal shift behavior. Journal of Experimental Child Psychology, 1966, 4, 296-307.

Wright, J.C. In: Annual Report, Kansas Center for Research in Early Childhood Education, University of Kansas, 1972.

HABITUATION OF CONCEPT STIMULI IN TODDLERS

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Project Code 3HOK03-4

Attention and Cognitive Style

December, 1972

Habituation of Concept Stimuli in Toddlers

Abstract

Eighteen 3-year-old subjects were shown four sets of slides: miscellaneous slides, a concept set to be habituated, test slides, and a second miscellaneous set. Response times of looking-on slide, looking-off slide, and total time of looking while each slide was on were recorded. During the test slides, looking times on the previously habituated category slides were the shortest, looking time on new slides similar to the habituated category were second longest, and new slides from a novel category received longest looking times. It was concluded that the toddlers did have a conceptual category and showed generalized habituation to similar slides in that conceptual category more than to slides in a novel category. Habituation of response was also shown within sessions and between sessions. Dishabituation of attention to previously habituated slides was demonstrated during the test set. Individual patterns of habituation were distinguished and served to "predict" differential looking response recovery on the test slides.

Habituation as an adaptive process

It seems probable from accumulated evidence that learning takes place in a context of interaction between the biological-maturational limitations of the child and environmental experience. Learning can be thought of as an adjustment in the cognitive structures of the child due to individual experience. If the cognitive structures established prior to the learning situation are known, the learning situation may be manipulated and particular kinds of learning demonstrated. However, it is impossible to know all the experiences a given child has had, and all the processes involved in learning are themselves still not well defined.

This paper is addressed to the concept of <u>habituation</u> as one process that facilitates learning by limiting the organism's input. Habituation serves to terminate familiarization as a learning process, and correspondingly to free the organism to attend selectively to changed or novel inputs. It also may constitute a developmental bridge from simple stimulus generalization to the formation of the earliest protoconcepts or schemas.

Habituation is often considered an indication that initial learning (i.e., familiarization) has taken place. As Kessen et.al. (1970, p.341) put it:

> "The typical argument has been that habituation represents learning not to respond to certain stimuli. Since habituation may predate positive learning in that it does not require the occurrence of a new response, habituation may provide an index of early learning that avoids the troublesome problem that ease of response elicitation is often confounded with age."

Individual differences

Habituation data, especially with infants and young children (Self, 1971) are difficult to interpret conclusively because of persistent individual differences. Systematic analysis of individual habituation patterns can therefore help clarify these complex phenomena (McCall & Kagan, 1970). Hopefully, individual predictions of learning and/or performance could be made from such patterns.

Self (1971) points out the interaction between individual differences and stimulus novelty. Self found habituation of infants' looking times to repeated slides (using the subject-control procedure), and recovery of looking time when an auditory stimulus was added. She also analysed different modes of looking in her subjects and divided her subjects into three groups on that basis. One group was composed of subjects who showed some decrease in looking over four presentations of the habituation slides and some increase when the auditory stimulus was added. The second group were those who showed shorter looks at the first presentation of slides but greater proportionate increases when the auditory stimulus was added. The third group showed no habituation to slides and no increase when the auditory stimulus was added. This form of analysis served to simplify her results and facilitate interpretation.

Lewis and Goldberg (1969) studied the "acquisition and violation of expectancy" in 44-month-old children. They used four pairs of slides in a predetermined order, presented for a predetermined time.

Response decrement and recovery were measured by visual orientation along with other measures. They found response decrement upon repeated presentations and response recovery to stimulus change.

McCall and Kagan (1970) studies individual differences of infants in responding to a standard stimulus and then to a novel stimulus "with varying amounts of discrepancy from the standard stimulus". They found some subjects who responded only to the first presentation of the novel stimulus, others that responded with longer fixations as the discrepancy between familiar and novel became larger, and still others who failed to habituate and "failed to respond differentially to the discrepant stimuli". They concluded that the general looking pattern must be assessed individually if habituation is used to predict effects of discrepancy.

Bhana (1970) found large individual differences both in total fixation times, and in rate of habituation, measuring slide fixation times in infants. She also found habituation dependent upon the stimulus, its order of presentation during a session, and rates of exposure. Bhana suggested modifying her procedures to look at habituation across sessions rather than within them. She also suggested making an individual criterion for habituation rates rather than using an arbitrary criterion for all subjects.

Formation of concepts and generalization of habituation

Vinacke (1951) states "Concepts must be regarded as selective

mechanisms in the mental organization of the individual, tying together sensory impressions, thus aiding in the identification and classification of objects." This mental organization can be discussed for difficult, abstract concepts, and also for simple categories formed by a toddler on the basis of color or some other "alike" feature. Although researchers have often studied the acquisition of concepts in children, they have not often sought to determine at what states or ages children firs ome capable of formation of concepts.

Habituation in children has been associated with "a more efficient model building system". (Lewis, 1967). To the extent that protoconcepts involve similarity of basic responses to different members of a single stimulus category, this paper considers the possiblity that the generalization of attentional patterns from one instance of a category to another constitutes evidence of the earliest states in concept formation. Lewis (1967) related habituation rates to a number of subject variables. An important finding was; "response decrement was shown to be directly related to measures of cognitive capacity such as IQ in the preschool child and performance on a concept formation task." (1967, p.10). This association has been strongly indicated for response decrement in visual looking, but it is not yet known how response decrement in other modalities is related to cognitive capacity.

There is at least a continuum, if not a sharp difference, between stimuli clustered mainly by perceptual clues (color, form etc.)

and stimuli that are alike because of a conceptual linkage that requires more complex mediation. Lee (1965) determined which concept cues children from 3 yrs.,6 mon. to 6 yrs., 5 mon. of age used and found that analytic concepts (similarities based on components of the total stimulus) and sex-typed concepts produced the most errors when children were asked to find the stimulus that was different in an array. The conceptual dimensions of color, size, form and number produced least errors. Such studies indicate that the young child tends not to utilize these more complicated forms of classification.

In a germinal paper on the orienting reflex and attention, Jeffrey (1968) discusses serial habituation and the formation of "chains of attending responses" as the earliest manifestation of cognitive schemas. In regard to cue salience, Jeffrey points out that the response of the child changes, not the stimulus. Although verbal mediators are the most popular targets of research because of their observability, Jeffrey says that this does not mean that perceptual mediators "images, concepts, cognitive structures, or schemata" are nonexistent or do not have a "potential functional relationship with overt behaviors." Moreover, he strongly suggests that such perceptual mediators are more utilized in the conceptual activity of preverbal children (i.e., 2-4-year-olds).

Following this thinking, it can be said that primative concepts are perceptually mediated, and the generalized habituation would be an indication that some concept has been formed. It may be an especially useful and important indication in dealing with proto-

concepts in young children where verbal mediators are not yet available. To follow this thinking further: if serial habituation of attention to generalized perceptual stimulus attributes such as color can be demonstrated, there should also be evidence of generalized habituation with stimuli that are conceptually alike on a more complex cognitive level. It is hypothesized that if there is generalization of habituation from a repeated stimulus to physically similar stimuli, then to the child, those stimuli are in some sense psychologically similar. Correspondingly if habituation of a stimulus generalizes to other stimuli that are logically, functionally, semantically or categorically related to it, though not physically similar on a simple, obvious level; it could then be said that the stimuli are somehow psychologically or congitively conceptualized together by the child. A process of this degree of sublety could easily be disrupted by a variety of extraneous stimulus features, therefore simple, standardized stimuli, bearing an obvious conceptual relationship to one another would be needed to demonstrate such protoconcepts.

Kounin (1943) did a satiation/co-satiation study in which, when the response of drawing schematic animals was satiated by repetition, co-satiation of the response for schematic drawings of similar animals was observed in normal children. However, the co-satiation observed was much less for young retardates and approached zero for older retardates. His interpretation, based on

Lewinian field theory, was that any response feature, like satiation, should generalize to similar stimuli only if S perceived the similarity and grouped the stimuli together, as the normal Ss did.

Design of the study

Based on the foregoing reasoning, this study was designed to determine whether the existence of simple categories (protoconcepts) in three-year-olds could reasonably be inferred from habituation data. Specifically it sought to demonstrate greater generalization of habituation of attention (looking time) within a category of stimuli than between categories of stimuli.

Each session consisted of four sets of slides presented one at a time, with S controlling presentation rate.

Table 1 about here

The first set was a pretest containing 18 miscellaneous slides (Misc. 1). The second set (6 slides) was the conceptual category to be habituated, and was repeated six times. The third set was a test series of 18 slides, containing the 6 familiar (habituated) slides, 6 slides that were similar (in the same category), and 6 novel (new category) slides in random order. The fourth set was a post-test consisting of 18 miscellaneous slides (Misc. 2), very similar to Misc. 1. All Ss received the same treatmen , except that the category to be habituated was counterbalanced across Ss. Each child participated in 2 sessions, the second being a replication of the first with new habituated and novel categories.

Group I 3 females 3 males	Group II 3 females 3 males	Group III 3 females 3 males	No. of Slides Shown
Practice Session			
Practice Slides	Practice Slides	Practice Slides	
Session 1			
Misc. 1	Misc. 1	Misc. 1	18
Habituate on A_1	Habituate on B_1	Habituate on C_1	36
Test $f = A_1$	Test $f = B_1$	Test $f = C_1$	6
$s = A_2$	$s = B_2$	$s = C_2$	6
$n = B_1$	$n = C_1$	$n = A_1$	6
Misc. 2	Misc. 2	Misc. 2	18
Session 2			
Misc. 1	Misc. 1	Misc. 1	18
Habituate on B_1	Habituate on C_1	Habituate on A_1	36
Test $f = B_1$	Test $f = C_1$	Test $f = A_1$	6
$s = B_2$	$s = C_2$	$s = A_2$	6
$n = C_1$	$n = A_1$	$n = B_1$	6
Misc. 2	Misc. 2	Misc. 2	18

<u>Components of Test Set</u>

f = familiar habituated slides
s = similar slides from habituated category
n = novel category slides

<u>Categories used</u>

A_1, A_2 = Fruits
B_1, B_2 = Farm Animals
C_1, C_2 = Environmental Patterns

Table 1. Experimental Design

Method

Subjects

The subjects in this study were eighteen toddlers from the Edna A. Hill Preschool ranging in age from 32 months to 42 months with an average age of 39.5 months. They were randomly assigned to three groups of six, counterbalancing for sex. Each group of six subjects received a different conceptual category to be habituated on each of their two habituation sessions.

Apparatus

Figure 1 shows the major apparatus used in this study.

Figure 1 about here

The apparatus was designed and built by Wright (1970) to observe eye-movements of Impulsive-Reflective children. It has a slightly backward tilted seat so the child's head is comfortably supported by a cushion and tends to remain immobile. This position also produces a favorable camera angle for video-taping eye movements. The slide are changed by an extended lever which the child can reach without moving his head. Either a right-hand or a left-hand lever can be used by S. There are adjustable stirrups at either side of the front chair legs for the child's feet. The slides were reflected from a carousel projector, off a mirror onto the back of the screen in front of the child.

Not shown in figure 1 is the video tape recorder used to tape each session, and the TV monitor used by the observer to score on-

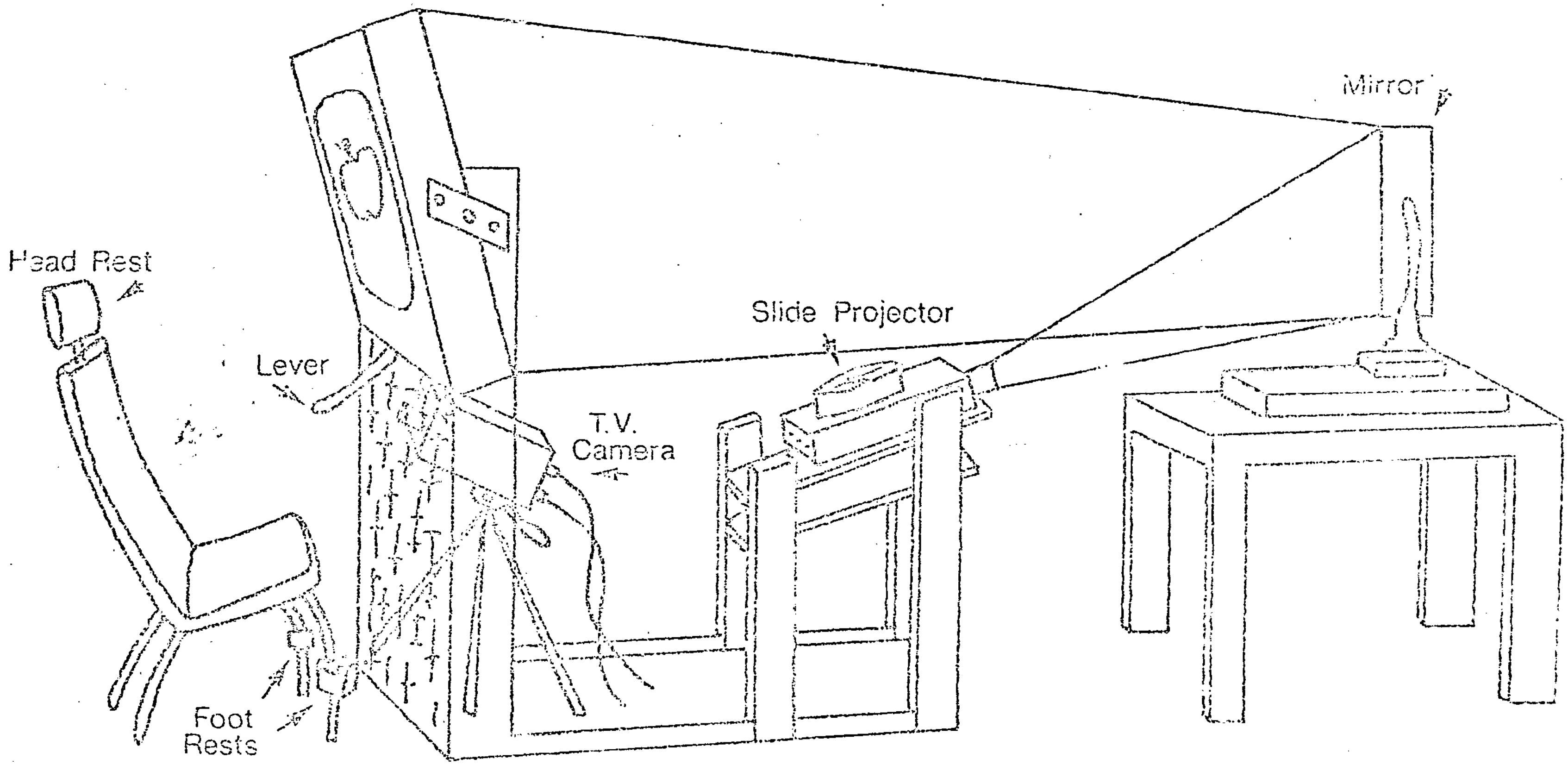

Figure 1. Apparatus Used In Habituation Study

or off-stimulus fixation of the eyes. The observer had a simple two-button switch, one depressed continuously when S was looking at the slide (on-stimulus) and one for when S was looking off the slide. She watched the monitor live, and her button presses were recorded on an Esterline-Angus event recorder for subsequent analysis of on-stimulus looking times. Six channels of the Esterline-Angus Recorder were used. Two channels recorded the S's slide-change lever presses; two channels recorded forward vs. backward rotation of the slide drum (for repeating habituation sets); and two channels recorded on- vs. off-stimulus fixations from buttons operated by the observer.

Later the video tapes were used by a second observer to assess the reliability of on- and off-stimulus looking times. The experimenter operated the forward-backward switch to change the direction of rotation of the slide drum during the habituation set so that those six slides could be presented forward and backward and forward again, etc. to produce habituation.

Stimuli

The stimuli were kodak slides made by photographing pictures from books or real objects. The miscellaneous sets contained 18 slides each, of a variety of objects such as preschool play equipment, vehicular toys, landscapes, furniture, and the like. Randomly inserted among the miscellaneous set were three slides each of the categories used in the study. None of these nine category slides were the same as any used in the habituation or test sets. The habituation and test slides consisted of twelve common fruits, twelve farm aminals, and twelve envirormental pattern slides.

Each conceptual category of twelve slides contained a series of six used for the habituation set and a similar matched series of six used in the test set to test for generalization within the category. A blank slide separated each series from the next one.

Procedure

With one exception because of illness, the children were run on three consecutive days. For one S, six days elapsed between the 1st and 2nd experimental sessions. Due to the young age of the Ss, E spent time preceding the experiment in each of the four toddler classes to become generally acquainted with the children. Each S was then taken by appointment from his classroom to the experimental room, which contained the described apparatus, a one way mirror to the adjoining observation room, and a small chair for the experimenter.

The first session was spent on a set of practice slides of the nurse in the pre-school with whom all the children were acquainted, some pictures of the preschool, and some other miscellaneous slides that were unrelated to any of the slides in the next two sessions. The E sat so as to be out of sight of S. Due to the short attention span and general restlessness of such young subjects on such a long task (90 slides), E occasionally had to encourage the child to go on or adjust him in the chair. Talking was held to a minimum and as much as possible adjustments and talking were done during the blank slides between sets. Moreover, when S did talk to E, S typically looked away from the screen to do so. Therefore looking times (on-slide) were not affected.

When brought to the room, S was given a choice of small dime-store toys and the toy he selected, which he received for finishing the session, was placed under his chair. He was told that he could change the slides all by himself and when he got tired of the picture to go on to the next one. The E made sure the child was lever pressing correctly during the practice session. In the 1st and 2nd experimental sessions, three warm-up slides were presented, and then E said, "Now I will sit right here. You can change the slides all by yourself and we can talk when you are through." The E held the forward-backward switch controlling the rotation of the slide projector drum in her hand and S changed the slides. This enabled S to go through the habituated category of six slides repeatedly. The E operated the reversal switch at the end of one pass through the habituation set. Then when S pressed the lever as usual, the slide projector drum went the opposite direction making it possible to see the habituated set six times without using duplicates or changing slide drums.

The miscellaneous set of 18 slides has already been described. (Table 1). The second set of six slides (habituation set) was either animals, fruits, or environmental patterns. The same set of six slides was shown to one group of subjects on their first session and another set of six slides was shown on their second session. The category serving as novel stimuli for session 1 became the habituated category for session 2, and the third category then was used as the novel one. As Table 1 indicated the groups differed only in which category was assigned to which set.

Observer reliability was computed during the test and satiation

series, because that is when the most variable looking behavior occurred, and because the burden of the conclusions is based most strongly on Ss' behavior in those series. Two observers independently recorded look-on and look-off times while observing S's face on the TV monitor. One observer recorded these looks live, and the other from the video tape. The percent agreement between observers over blocks of event recorder chart paper (each representing 5[illegible] seconds) was calculated as agreement divided by agreements plus disagreements.

The Ss were numbered sequentially as they ran, and reliability was taken on S no1. (86%); S No6. (87%); S No8. (94%); S No10. (92%); S No12. (85%); and S No18. (91%). The mean observer reliability was thus 89 per cent. Reliability was calculated on Ss 6, 8, and 18 for Session 2 and on S's 1, 10, and 12 for Session 3.

Results

Since the three groups of Ss differed only in assignment of categories to sets in the two sessions, a preliminary comparison of the three overall group means was made. Looking times (on-stimulus) in seconds per slide for each group were averaged over the last three habituation runs (h), the familiar (f), similar (s) and novel (n) test slides, over both sessions, and for the sexes combined. The resulting means were: Group 1: 2.91 sec. (S.D. = 1.17); Group 2: 3.14 sec. (S.D. = 1.21); and Group III: 2.00 sec. (S.D. = .64). A one-way analysis of variance was performed on these means and yielded no significant difference between the three groups ($F(2,15)=2.69$; $p >$ .10). Therefore groups were collapsed in the remaining analyses, except where category was a factor.

Figure 2 shows the results of the habituated (last three runs) set (h) and the test set, (f, s, and n) by categories. The main effect of familiarity (h,f,s,n) was apparent for each category used.

Insert Figure 2 here

The least looking was at the end of the h set. Dishabituation was obtained for the same slides in the test set (f). Generalization of habituation was obtained on similar slides (s) during the test, and the longest looking times were associated with the novel (n) test slides. An analysis of variance was run on each session separately[1] for these differences due to familiarity and for systematic effects of categories (fruit, animals, patterns). For Session 1 a significant effect of familiarity was obtained ($F(3,45)=4.49$; $p<.01$). There was no significant effect of categories ($F(2,15)=2.65$; $p>.10$), and no significant interaction between categories and familiarity ($F(6,45)=1.06$; $p>.10$). For Session 2, again only the effect of familiarity was significant ($F(3,45)=6.69$; $p<.001$).

Figure 3 shows the habituation and test effects for sex and session. With the exception of females (Session 2) the same effect as above was shown. There was lower reponse to the similar slides than the familiar slides, but only during the test set of Session 2 for females.

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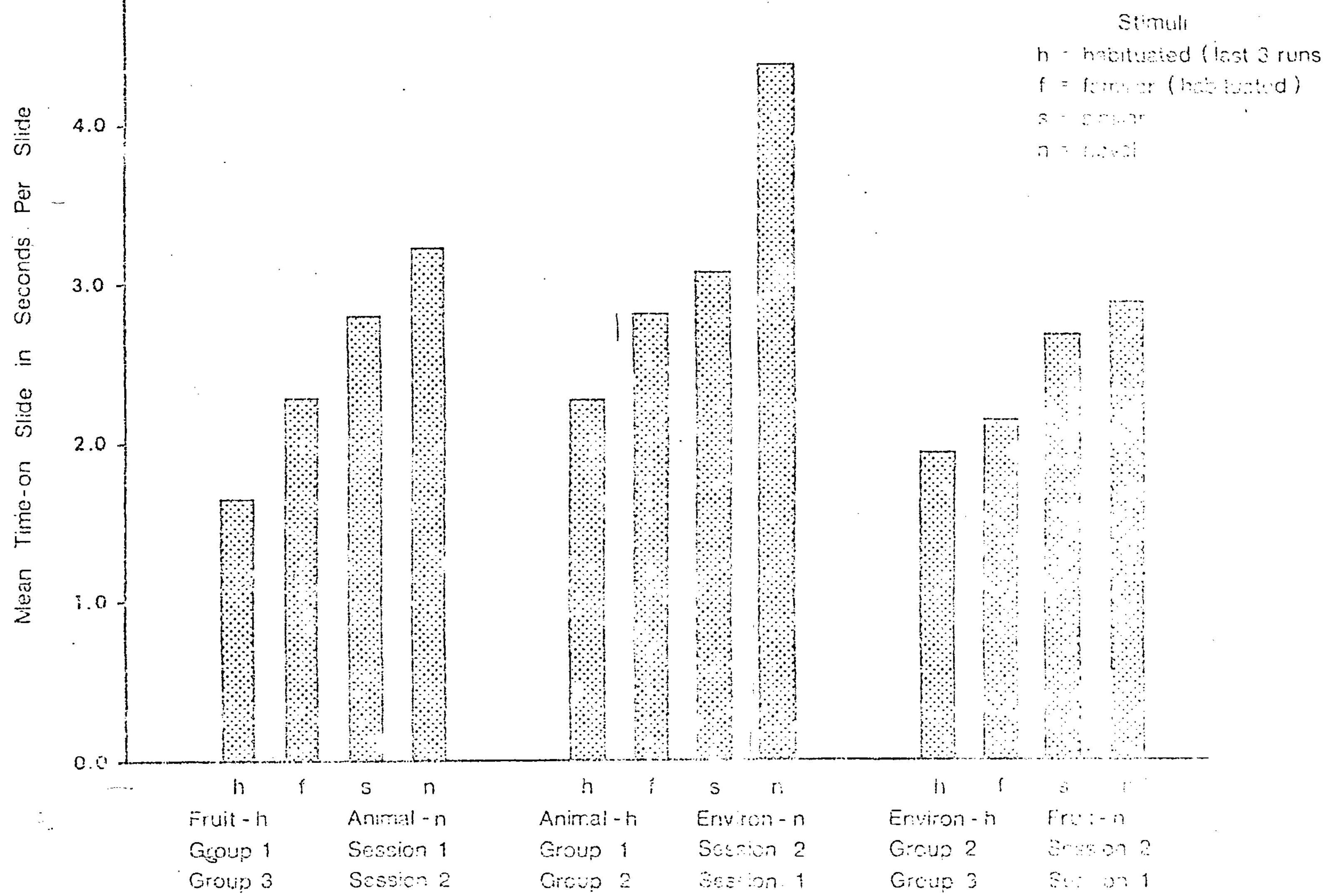
1. Sessions were analysed separately so as to avoid a partially repeated measures design in which interactions would not be testable.

Figure 2. Habituated, Identical, Similar, and Novel Slides by Category (Sessions 1 & 2 Combined)



Insert Figure 3 here

An analysis of variance was performed on the data in Figure 3, collapsing the data across sessions and categories. There was no significant difference between the sexes. A significant effect of familiarity was again obtained ($F(3,48)=10.80$; $p<.001$). The Bonferroni *t*-test (Wike, 1971) was used to test the correlated means, and the differences between the means for n and h, n and f, and h and s were all significant (crit. diff. = 0.75).

Figure 4 shows response decrement (habituation) during sessions from first miscellaneous set to second miscellaneous set of slides,

Insert Figure 4 here

and for both sessions together. There was also an overall decrement from Session 1 to Session 2. On Session 1 there was a mean pre-post decrement of .40 sec. per slide and on Session 2 there was a decrement of .59 sec. per slide. For both sessions combined, there was a decrement of .50 sec. per slide from Misc. 1 to Misc. 2. Combining Misc. 1 and Misc. 2 within sessions yielded an overall decrement from Session 1 to Session 2 of .15 sec.

The analysis of variance for Figure 4 tested differences on Session 1 vs. Session 2; Misc. 1 vs. Misc. 2; and the interaction of Misc. X Sessions (Winer 1962, p.368). There was no significant difference between Sessions. There was a significant difference between Misc. 1 vs. Misc. 2 ($F(1,17)=5.68$; $p<.05$). There was also

Figure 3. Habituation by Sex, Sessions, and Familiarity

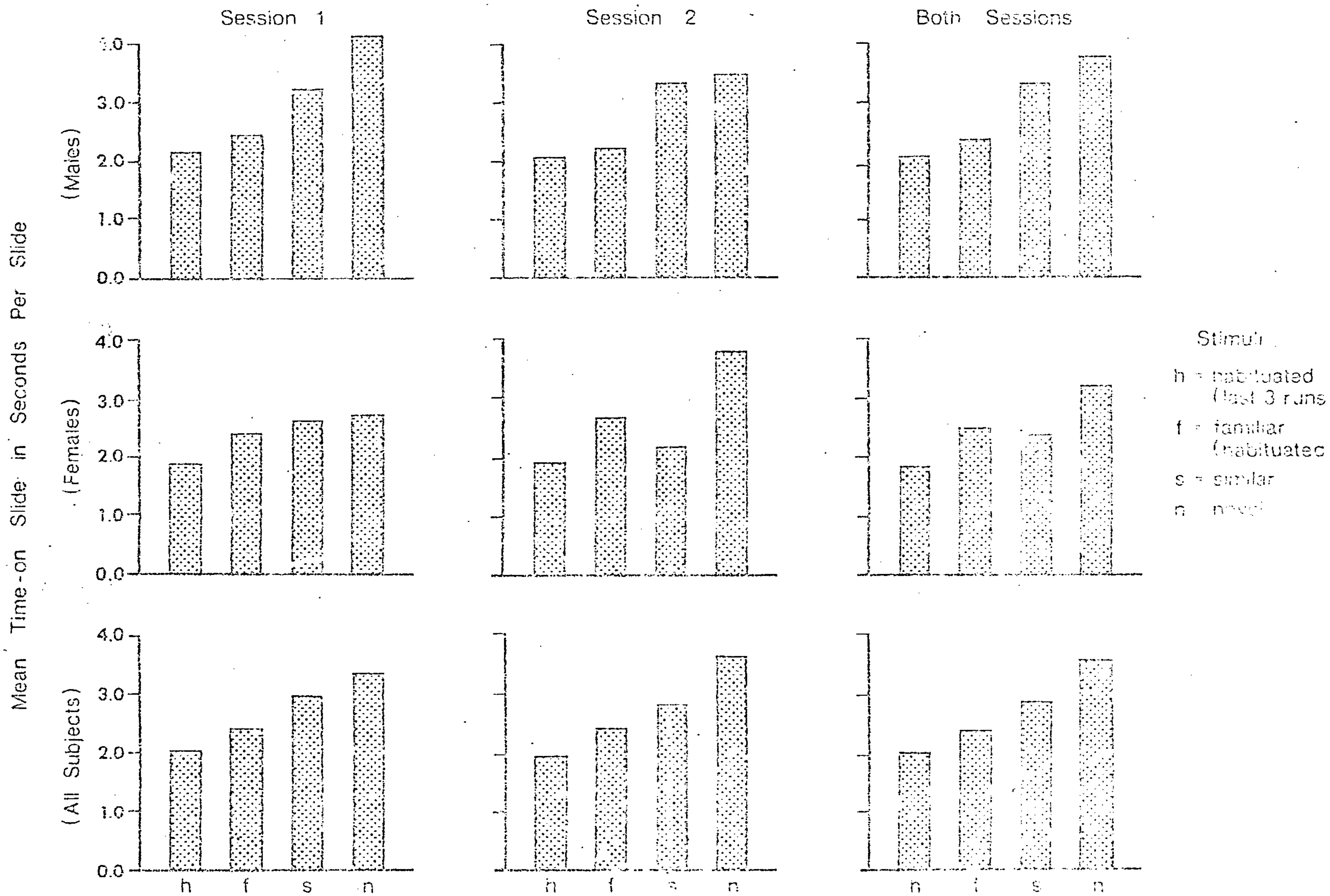
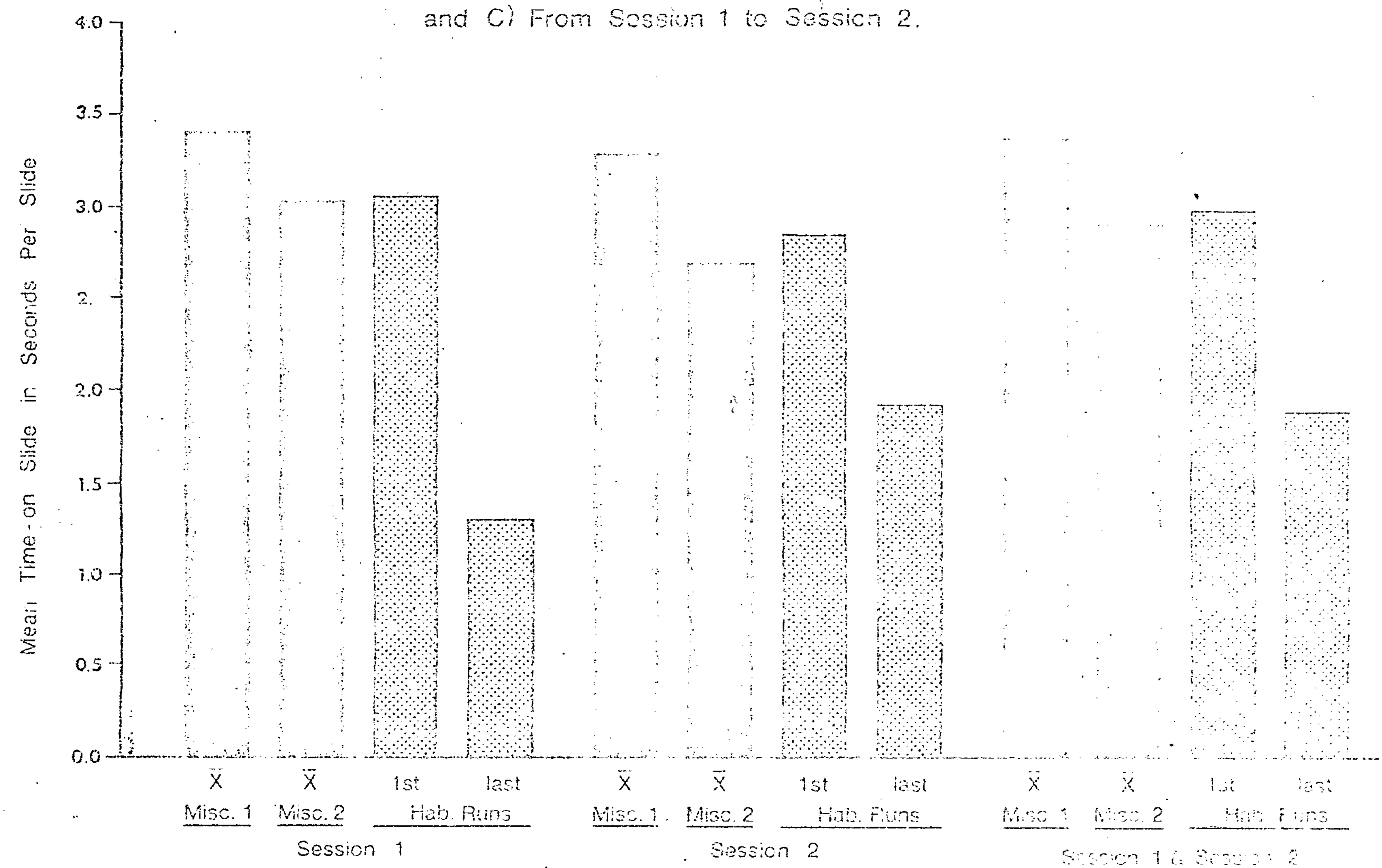


Figure 4. Habituation: A) From Misc. 1 to Misc. 2 Within Sessions, B) From First to Last Habituated Set Within Sessions, and C) From Session 1 to Session 2.



a significant interaction between Misc. and Sessions ($F(1, 17) = 12.39$; $p < .005$).

Figure 4 also shows response decrement from first habituation run (6-slides) to last habituation run. Three t-tests were used to compare 1st habituation run with last habituation run for the first session ($T(17)=4.13$; $p < .001$); for the second session ($T(17)=3.44$; $p < .005$); and for the sessions combined ($T(17)=4.76$; $p < .001$).

Individual differences in habituation patterns

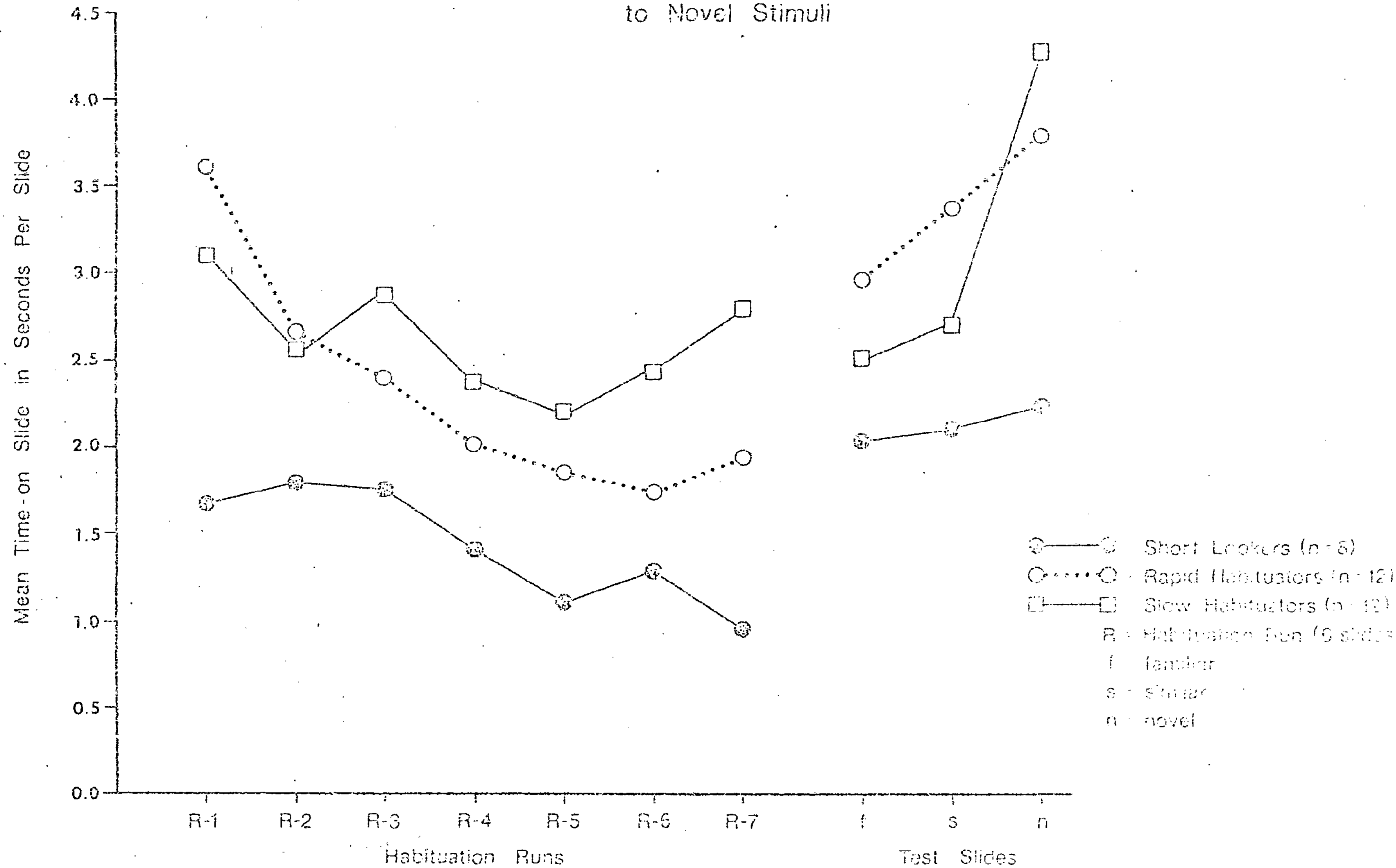
Figure 5 shows mean fixation rates and patterns of the three groups of "short lookers", "rapid habituators" and "slow habituators."

Insert Figure 5 here

These groups were obtained by a method similar to McCall and Kagan's (1970). Each session was placed in a group on the basis of differential response decrement of looking times from first habituation run to last habituation run.

First the subjects were ranked according to the sum of their first two and last two habituation runs. The short looker group was the bottom third of this distribution. The remaining subjects were divided into rapid and slow habituation groups by the slope of habituation indicator: (H6 + H7) - (H2 + H3)/(H2 + H3). Following McCall and Kagan, "The resulting distribution of ratios was divided at the median, producing a slow-habituation and a rapid-habituation group, where positive or low-negative ratios indicated slow habituation and high negative ratios reflected rapid habituation over the six sets of stimuli." Four sessions of data were eliminated because of erratic

Figure 5. Patterns of Habituated Stimuli and Attention to Novel Stimuli



patterns that showed no evidence of habituation or simple short looking.

Each of the two sessions of a subject were treated as separate data in Fig. 5 rather than requiring that the S remain stable over sessions. However, following separation of the Ss, there was some stability evidenced over sessions. One session for each of four Ss was eliminated due to irregular habituation curves. One S went from the slow habituation to the rapid habituation pattern over sessions. Three Ss moved from the rapid habituation to the short looker pattern over sessions and ten subjects displayed the same pattern in both sessions.

There was no analysis of variance run on the Habituation Runs because of variable Ns in each group. Also some Ss reached habituation criterion by declining to continue prior to going through the habituation series six times, making the repeated measures variable.

Test scores from the first and second sessions were subjected to a 3 X 3 variable-n analysis of variance. The sessions were analysed separately (see footnote 1). In Session 1 the effect of patterns (see Fig. 5) was highly significant ($F(2,13)=24.15$; $p<.001$). The effect of familiarity was even more significant ($F(2,26)=79.17$; $p<.001$), as was the interaction of patterns X familiarity ($F(4,26)=37.74$; $p<.001$). The session 2 data produced still greater significance of patterns ($F(2,13)=44.54$; $p<.001$), familiarity ($F(2,26)=164.68$; $p<.001$), and the interaction ($F(4,26)=67.80$; $p<.001$).

Discussion

Methodology

In order to assess the existence and cohesion of conceptual groupings in toddlers, a difficult task in children so young, responses were chosen (looking and slide-changing) which it was hoped would be as natural as possible. The task was designed so as to assess protoconcepts indirectly from these natural responses, rather than requiring more complex and difficult rule-governed behaviors such as card sorting or verbal naming. As Bruner et.al. (1959) remarked regarding the child's discovery of recurrent regularities,

> "Identifying these recurrent regularities is often confounded for the child by stimulus noise and by the pattern of responding required."

Habituation procedures, on the other hand, have been typically employed with infants and infra-human animals to assess simpler processes in attention and learning. Rather than merely comparing familiar and novel stimulus looking times, as such studies have often done, however, this study borrowed habituation techniques to study the generalization of habituation within and between experimenter-defined conceptual groupings.

The stimuli selected for this study represented conventional categories (fruits and animals) and also perceptually homogeneous, but not conventionally named categories (environmental patterns).

The subjects could have responded only on the basis of perceptible features and not "true" concepts. That is to say, the results could be defined exclusively in terms of stimulus generalization (especially for the environmental patterns). Some simple

generalization probably did occur, as the fruits were all black backgrounds and the animals were done in similar water-color art-work. Because of the unnamable aspect of the environmental patterns, no subject could have used only conventional names of categories to mediate generalization. Since there was no significant difference among the categories, the results probably reflect a mixture of cognitive skills representing the transition from purely stimulus generalization to cognitive clustering. Such groupings can be called protoconcepts.

Another important aspect of the method of this study was the method of measuring looking times. Using video tape to score where the child looked and using only looking-on time as a measure of attention and habituation was more precise than a simple rate of slide changing (total on time) could have been.

Table 2 shows the different means for F S N obtained if total slide-on were measured, as compared with the actual results when this time was corrected by subtracting off-slide looking time. Total time is at least doubled when looking away is not subtracted. The discrimination between FSN would also have been attenuated although the same gradient would have been present for groups I and II. In Group III, the main effect would not have been evident.

Table 2 about here

Group Results

The hypotheses regarding habituation, dishabituation, generalization of habituation, and novelty were supported. As predicted there was no effect of categories, indicating that whatever was lacking in

	Familiar	Similar	Novel
Group I Means			
Total slide-on	7.10	7.71	9.00
Total slide-on minus looking-off	2.70	3.10	3.90
Group II Means			
Total slide-on	7.01	10.19	10.96
Total slide-on minus looking-off	2.58	3.30	4.20
Group III Means			
Total slide-on	5.44	6.54	5.58
Total slide-on minus looking-off	1.90	2.10	2.30

Table 2

Means of total looking-on time as measured in this study (Total slide-on minus looking-off) and total slide-on time (uncorrected) in seconds, to familiar, similar and novel slides.

preformed categories was made up by selective generalization on common stimulus features. A future study should attempt to replicate results comparing A) conventional categories designed to be otherwise more physically similar and B) abstract stimuli which could be grouped only on the basis of physical stimulus features. The predicted session effect was not found to be significant although children generally looked less during the second session.

Sex Differences

Although not statistically significant, there were slight indications of sex differences in looking times. Females had slightly longer looking times and more generalization of habituation from familiar to similar stimuli. This finding could be consistent with the idea of "females being more stable along physiological and physical dimensions" (Kagan 1969). This interpretation makes the assumption that more generalization of habituation to other stimuli indicates more stability in cognitive development. Such an assumption would seem warranted.

There is also an indication of stability for females in the habituation pattern data. The short lookers were 50% female subjects and 50% male subjects; the rapid habituators were 29% female and 71% male subjects; and the slow habituators were 62% female and 38% male subjects. The slow habituation pattern could be interpreted as a more stable, conservative rate of learning or development and contains the highest percent of female subjects. The rapid habituation pattern is more erratic and the short looker group could easily be associated with a short attention span in general.

Individual Patterns

Some speculations can be made about the importance of the different habituation patterns and the value of using such patterns to predict discrimination of novel similar slides from habituated slides during the test. Possible hypotheses are A) a floor-ceiling effect for some children, B) differential familiarity by the end of habituation, and C) a longer term habituation sequence.

Under the floor-ceiling effect one would argue that short lookers do not have room to exhibit either much habituation (floor) or much dishabituation and discrimination of novelty (ceiling), the latter because they perhaps have a maximum attention span to any slide. Rapid habituators clearly have more variable or less constrained looking times in general, and would thus be expected to show more dishabituation. Apparently no ceiling effect operated for slow habituators either, although this hypothesis could not predict that outcome. The hypothesis is further weakened by consideration of the dishabituation curve for short lookers not in absolute times, but relative to their low baseline during habituation. From this perspective they show better evidence of dishabituation.

Under the differential familiarity hypothesis, one would predict that if more total looking time occurs prior to habituation, the familiar set becomes more familiar, and therefore less dishabituation would occur to familiar and similar slides, but more to the novel ones. For slow habituators the familiar stimuli would be most familiar, thus producing less relative dishabituation to them, but, by contrast, more attention to the novel stimuli. The rapid habituators, by this argument, should show better dishabituation to familiar stimuli but

less sharp discrimination of novelty. Finally the short lookers should show clear, but nondifferential dishabituation, at least relative to their lower baseline. In general these derivations appear to be supported by the data in Figure 5.

A longer-term habituation sequence hypothesis emerges from the analysis of pattern changes vs. stability from the first habituation session to the second one (recall that the complete experiment was performed twice with each S, the second time with a new category to be habituated). Ten of the eighteen Ss remained in the same pattern the second time around. Four did not produce categorizable patterns on one session or the other. The remaining four Ss showed only two kinds of pattern-shift between experiments: A) from slow habituator to rapid habituator (one S) and B) from rapid habituator to short looker (three Ss). If there were a long-term progression or habituation sequence over repeated experiences of the kind presented, it would most logically be one of general response decrement. This should show up in the data as increasingly rapid habituation over sessions. The pattern indicating least experience (or perhaps lower developmental status) would be one of slow habituation. The next step, with increased experience and/or development would be the rapid habituation pattern. Finally, the most advanced or experienced Ss would be expected to habituate so rapidly that they come out as short lookers. There is no S in the study whose pattern classification violates this developmental sequence. Multi-session replication in a short-term longitudinal study would be needed to further test this hypothesis, and while promising, it leads to no differential predictions about

generalization or dishabituation on the test series. The long-term sequence hypothesis is thus not incompatible with the differential familiarity hypothesis, and both appear to receive support from these data.

These findings are comparable to McCall and Kagan's (1970) except for the slow habituators' reponses. The data presented show more habituation for this group than McCall's did. While these Ss continued to dishabituate to familiar and similar stimuli, indicating the presence of a conceptual category, they showed the largest proportional increase of response recovery to novel stimuli. While McCall, et.al. found that attention did not increase with increasing amounts of discrepancy from the familiar standard, the present study did show such results from each group of subjects. This difference might be attributed both to the stimuli used and to the ages of Ss. In this study each set of six slides was averaged, rather than being scored as single stimulus times.

Summary

The results of this study generally support the notion that the existence of protoconcepts can be demonstrated in toddlers. There was significant general response decrement of short-term duration over the habituation trials, longer term habituation within sessions (Misc. 1 - Misc. 2) and some decrement (not significant) between sessions (Session 1 - Session 2).

There was significant dishabituation (response recovery) of habituated slides when mixed with new test slides of similar and novel categories. There was always decreasing generalization of habituation from familiar, to similar, to novel slides.

Finally, there were consistent individual differences in habituation patterns. Those $\underline{S}$s showing least habituation (defined by habituation slope) showed least discrimination of familiarity vs. novelty. All groups showed discrimination between test slide types, but rapid habituators and slow habituators showed the most discrimination. The rapid habituation group, which showed steepest habituation slope also showed the largest dishabituation during the test set.

This study supports the proposition that habituation is a continuing phenomenon in the child's development. It is an adaptive process that enables the child to utilize stimuli efficiently. Less strongly supported is the possibility of habituation evidencing more conceptual learning processes. Habituation may be a process that facilitates learning by screening out familiar stimulus properties or familiar stimuli, but it does not necessarily indicate learning.

While generalized habituation was found in three year olds, it probably gives way to other conceptual processes in older children. It is possible that generalized habituation as a primitive perceptual organizer leads directly to other forms of mediation. Habituation may or may not continue to indicate perceptual learning in the older child. Nevertheless these data show an orderly process indicative of selective generalization of a discriminative response (habituated looking) within categories of stimuli, however the child may have achieved the grouping. Such data then indicate the existence of at least short-term protoconcepts in toddlers. Additional research may help determine the degree to which perceptual vs. conceptual processes underlie this phenomenon and whether protoconcepts do indeed mark an

intermediate point in the development of grouping from stimulus generalization to conceptual categorizing.

References

Bhana, Kastoor, Response decrement and recovery as an index of visual discrimination in young human infants. Unpublished doctoral dissertation, University of Kansas, 1970.

Bruner, J. S., Wallach, M., & Galanter, E. The indentification of recurrent regularity. American Journal of Psychology, 1959, 72, 200-209.

Jeffrey, W. E. The orienting reflex and attention in cognitive development. Psychological Review, 1968, 75, 323-334.

Kagan, J. Continuity in cognitive development during the first year. Merrill-Palmer Quarterly, 1969, 15, 101-120.

Kessen, W., Haith, J. M., & Salapatek, P. Human infancy: A bibliography and guide. In P. H. Mussen (Ed.), Carmichael's Manual of Child Psychology. New York: Wiley, 1970 (Third Edition) Vol. 1.

Kounin, J. S. Intellectual development and rigidity. In R.G. Barker, J. S. Kounin, & H. F. Wright (Eds.), Child Behavior and Development. New York and London: McGraw-Hill Co., Inc., 1943, 179-199.

Lee, L. C. Concept utilization in preschool children. Child Development, 1965, 36, 221-228.

Lewis, M. Infant attention: Response decrement as a measure of cognitive processes, or what's new, Baby Jane. Paper presented at the Society for Research in Child Development Symposium on The Role of Attention in Cognitive Development, New York, March, 1967.

Lewis, M. & Goldberg, W. The acquisition and violation of expectancy: An experimental paradigm. Journal of Experimental Child Psychology, 1967, 7, 70-80.

McCall, R. B. & Kagan, J. Individual differences in the infant's distribution of attention to stimulus discrepancy. Developmental Psychology, 1970, 2, 90-99.

Self, Patricia A. Individual differences in auditory and visual responsiveness in infants from three days to six weeks of age. Unpublished doctoral dissertation, University of Kansas, 1971.

Vinacke, W. E. The investigation of concept formation. Psychological Bulletin, 1951, 48, 1-32.

Wike, E. L. Data Analysis: A Statistical Primer for Psychology Students. Aldine-Atherton: Chicago & New York, 1971.

Winer, B. J. Statistical Principles in Experimental Design. New York: McGraw-Hill Book Co., Inc. 1962.