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THE EFFECTS OF PICTORIAL STIMULI
ON THE DIRECTION-FOLLOWING
BEHAVIOR OF MENTALLY
RETARDED ADOLESCENTS

by

Dennis J. Tucker

Thesis

Submitted in Partial Fulfillment
of the Requirements for the Degree
of Masters of Science in Psychology
at Kansas State College of Pittsburg

1974

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ACKNOWLEDGEMENTS

I wish to extend my gratitude to Dr. Herbert P. Rumford, my thesis advisor, and Dr. Doris M. Sindt, a member of my thesis committee, for providing me with valuable input concerning this study and also for allowing me the freedom and flexibility for conducting off-campus research.

I am especially indebted to Dr. Ingo Keilitz, Assistant Director, Project MORE, Bureau of Child Research, Parsons, Kansas, who gave me excellent supervision and valuable support in the research contained in this thesis.

I would also like to thank Dr. James R. Lent, Director, Project MORE, and Mr. R. Don Horner, (former) Assistant Director, Project MORE, for their support and comments; and Ms. Jennifer F. Holvoet, Research Assistant, for participating as secondary observer and model for the photographs.

Special thanks go to Ms. Mildred Jolly for her excellent typing performance of this manuscript; and to the Project MORE Media Support Services, Bureau of Child Research, University of Kansas for photographing and printing slides for the study.

Finally, but most importantly, I wish to express my thanks and my love to my wife, Pam. No other person could have been so patient and encouraging throughout the course of this thesis, and my entire graduate study, after spending so many evenings alone.

Abstract

Two groups of retarded adolescents were presented sets of multiple verbal directions (imperative sentences). One group was exposed to pictures illustrating the objects and action of each direction in addition to the verbal directions. Subjects were required to carry out performances demanded by the directions. The direction-following behavior of the Verbal + Picture Group was found to be significantly superior to that of the Verbal Group. The groups did not differ significantly in sequencing their performances, i.e., carrying out the verbal directions in the order in which they were presented. Two possible explanations for the superior performance of the Verbal + Picture Group were offered: (1) pictures provided additional relevant stimuli which strengthened the stimulus-response relation between the spoken directions and the required performances; (2) pictures induced visual imagery which increased associations of the stimuli (pictures and spoken words) and the responses (direction-following).

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CHAPTER I

INTRODUCTION

Language can be divided into two aspects: (1) language as a response or production of language, such as written or spoken language, and (2) receptive language or responding to language as a stimulus, such as following directions or instructions.¹ Although equally important, these two aspects of language have not received equal attention among researchers of language disorders and learning disabilities in mentally retarded populations.² Tests of subjects' abilities to follow verbal directions by carrying out some performance have appeared in intelligence tests ever since the construction of the Army Alpha test in World War I, but have rarely been used in experimental studies, despite the fact that such tests could be highly valid, reliable, and convenient measurements in many circumstances.³ Jones⁴ had normal children perform a cancellation task under instructions such as "mark all the numbers except 2, 5, 8." Shipley,

¹D. L. Whaley and R. W. Malott, Elementary Principles of Behavior (New York: Appleton, Century, Crofts, 1971), p. 254.

²N. R. Bartel, D. Bryen, and S. Keehn, "Language Comprehension in the Moderately Retarded Child," Exceptional Children, 1973, February, pp. 375-382.

³J. B. Carroll, "Defining Language Comprehension: Some Speculations," in J. B. Carroll and R. O. Freedle (Eds.), Language Comprehension and the Acquisition of Knowledge (Washington, D. C.: V. H. Winston & Sons, 1972), p. 18.

⁴S. Jones, "The Effect of a Negative Qualifier in an Instruction," Journal of Verbal Learning and Verbal Behavior, 1966, 5:5, pp. 497-501.

Smith, and Gleitman⁵ tested normal children's comprehension by having them respond to commands. Some researchers have studied the effects of reinforcement on instruction-following behavior of mental retardates^{6,7} while others have emphasized the importance of verbal directions or instructions for the establishment and maintenance of certain behaviors of both normal and mentally retarded individuals.^{8,9} Lent, et al.¹⁰ have shown that retarded adolescents are also deficient in direction-following behavior involving receptive nonverbal language functioning.

The present study was undertaken to determine whether performances carried out in response to verbal directions could be facilitated by the

⁵E. F. Shipley, C. S. Smith, and L. R. Gleitman, "A Study in the Acquisition of Language," Language, 1969, 45:2, pp. 322-342.

⁶T. L. Whitman, M. Zakaras, and S. Chardos, "Effects of Reinforcement and Guidance Procedures on Instruction-Following Behavior of Severely Retarded Children," Journal of Applied Behavior Analysis, 1971, 4:4, pp. 283-290.

⁷E. H. Zimmerman, J. Zimmerman, and C. D. Russell, "Differential Effects of Token Reinforcement on Instruction-Following Behavior in Retarded Students Instructed as a Group," Journal of Applied Behavior Analysis, 1969, 2:2, pp. 101-112.

⁸A. Baron, A. Kaufman, and K. A. Stauber, "Effects of Instructions and Reinforcement-Feedback on Human Operant Behavior Maintained by Fixed-Interval Reinforcement," Journal of the Experimental Analysis of Behavior, 1969, 12:5, pp. 701-712.

⁹T. Ayllon and N. H. Azrin, "Reinforcement and Instructions with Mental Patients," Journal of the Experimental Analysis of Behavior, 1964, 7:4, pp. 327-331.

¹⁰J. R. Lent, J. F. Holvoet, C. L. Ferneti, I. Keilitz, and D. J. Tucker, "Direction-Following of Retarded and Nonretarded Adolescents," American Journal of Mental Deficiency, 1973, 78:3, pp. 316-322.

pairing of pictures with the verbal directions. From the standpoint of rehabilitative procedures and methods for effecting behavior change, the use of visual aids held the promise of performance increase. It has been shown that pictures can increase the performances of mentally retarded individuals in several paired-associate learning tasks.

Bruininks and Clark¹¹ and Prehm¹² have demonstrated that mentally retarded individuals' learning performances are facilitated when pictures are used as visual stimulus or response materials. Reese¹³ suggested that pictures may induce greater visual imagery, mental pictures (in paired-associate learning tasks), which facilitates association of stimulus and response items.

Paivio¹⁴ has contended that concrete words, phrases, and sentences can be understood and remembered not only verbally but also in the form of "nonverbal imagery."

Statement of the Problem

There appears to be empirical evidence and some theoretical support for the effectiveness of pictorial aids in performances involving very

¹¹R. H. Bruininks and C. R. Clark, "Auditory and Visual Paired-Associate Learning in First-Grade Retarded and Nonretarded Children," American Journal of Mental Deficiency, 1972, 76:5, p. 565.

¹²H. J. Prehm, "Studies in Paired Associates Learning: I. An Examination of Methodology," American Journal of Mental Deficiency, 1967, 72, p. 494.

¹³H. W. Reese, "Imagery and Contextual Meaning," Psychological Bulletin, 1970, 73:6, p. 409.

¹⁴A. Paivio, Imagery and Verbal Processes (New York: Holt, Rinehart, and Winston, Inc., 1971), p. 450.

circumscribed tasks (i.e., paired-associate paradigm). The purpose of this investigation was to assess the generalizability of these considerations to more "natural" receptive language tasks such as direction-following. Specifically, can the direction-following behavior of institutionalized mentally retarded adolescents be facilitated when verbal directions are simultaneously presented with pictures that illustrate the verbal directions?

Need for the Study

For the mentally retarded many of the most critical language functions can be subsumed under the category of direction-following. With decreased mental abilities, but normal physical abilities, a retarded person may be better able to adapt to the natural and social demands of his environment if he is able to do what he is asked than be able to speak with clarity, precision, and flexibility. This may be especially true for those retarded persons who wish to be successful in a community setting instead of an institution. Success in the community ordinarily involves competitive employment in an unskilled or semiskilled job. Therefore, if the retarded are to find a place in the community (which is the goal of the normalization principle¹⁵, their success would depend, to a large extent, upon their ability to follow simple directions or instructions--to respond in the appropriate manner to the verbal behavior of a speaker or some other source of language.

¹⁵W. Wolfensberger, The Principle of Normalization in Human Services (Toronto, Canada: National Institute on Mental Retardation, 1972).

Delimitations

The study was delimited to the Parsons State Hospital and Training Center, Parsons, Kansas, during the period from January through May, 1973. The subject sample consisted of twenty-four residents selected from a population of forty-seven mentally retarded adolescents classified as mildly retarded¹⁶ with chronological ages ranging from thirteen to nineteen years of age. Selection of the subjects was restricted to those residents that were free from classes and other commitments during the daily periods available to the experimenter.

Limitations

The study was limited in the following ways:

- (1) The results of the present study may not generalize to retarded adolescents of different levels of mental retardation. That is, the results of the present study may not be indicative of the direction-following behavior of retarded individuals other than adolescents classified as mildly retarded.
- (2) The results of the present study may not generalize to retarded adolescents in another geographical setting or location. Specifically, the direction-following behavior of retarded individuals other than mildly retarded adolescents at the Parsons State Hospital

¹⁶American Association on Mental Deficiency, Manual on Terminology and Classification in Mental Retardation, (Baltimore, Maryland: Pride-mark Press, 1973) pp. 17-18.

and Training Center may differ from those individuals who participated in the present study.

- (3) Since audio equipment for the presentation of the verbal directions was not available for the study, the consistency of presentation of the verbal directions across all subjects by the experimenter was not controlled other than by verbal feedback from the secondary observer.
- (4) A larger subject sample would have been preferred for purposes of statistical control over variability across subjects.

Hypotheses

The three null hypotheses to be tested are as follows:

- (1) There are no significant differences in performances in direction-following between the two groups, one receiving pictures and verbally presented directions, and one receiving only verbally presented directions.
- (2) There are no significant differences in performances in direction following over sessions within the two groups.
- (3) There is no significant interaction between groups and time (sessions).

Definition of Critical Terms

Levels of Mental Retardation. Levels of mental retardation are divided into four categories:¹⁷ "Mild," "Moderate," "Severe," and "Profound." Each level represents a specific range between two consecutive

¹⁷Ibid.

standard deviations below the mean on standardized intelligence tests.

Mild Mental Retardation. Mild mental retardation is "a term used to describe the degree of mental retardation present when intelligence testing scores range between two and three standard deviations below the mean (52 to 68 on the Stanford-Binet and 55 to 69 on the Wechsler Scales); many educable retarded individuals function at this level; such children usually can master basic academic skills while adults at this level may maintain themselves independently or semi-independently in the community."¹⁸

Direction. A direction is "a command, order, authoritative instruction."¹⁹ In the present study a direction is operationally defined as a single imperative sentence presented verbally to a listener.

Direction Set. A direction set, in the present study, consists of three directions presented consecutively prior to the subject having the opportunity to respond.

Direction Sequence. Direction sequence is defined as the order in which the directions are presented within a direction set.

Picture (Pictorial Stimuli). A picture is operationally defined as a 35mm color photographic slide depicting the objects and action conveyed by the corresponding verbal direction.

Correct Direction-Following Response. A correct direction-following response is defined as an overt motor response to a verbal direction in

¹⁸Ibid., p. 149.

¹⁹Webster's New Collegiate Dictionary, Second Edition (Springfield, Massachusetts: G. & C. Merriam Co., 1956), p. 234.

which the object (or objects) and action required by the verbal direction were correctly performed by the subject.

Incorrect Direction-Following Response. An incorrect direction-following response is defined as an overt motor response to a verbal direction in which the correct object but incorrect action or the correct action but incorrect object required by the verbal direction were performed by the subject.

Interobserver Reliability. Interobserver reliability is defined as "the degree to which independent observers agree on what they have observed in the same subject during the same observation session."²⁰

²⁰R. V. Hall, "Behavior Modification: The Measurement of Behavior," Managing Behavior (Lawrence, Kansas: H & H Enterprises, Inc., Vol. 1, 1971), p. 6.

CHAPTER II

REVIEW OF THE LITERATURE

The research relevant to the direction-following behavior of mentally retarded adolescents as conceived in this study can be divided into three major areas of investigation: (1) research related to verbal directions as an independent variable; (2) research related to direction-following behavior as a dependent variable; and (3) research related to pictorial stimuli.

Research Related to Verbal Directions as an Independent Variable

It has been demonstrated that directions, or instructions, are important in the development, maintenance, and modification of certain desired behaviors.^{21, 22} Following a series of experiments, Baron, Kaufman, and Stauber²³ concluded that instructions, with or without reinforcement-feedback, can positively influence the establishment and maintenance of the performances of various tasks by college students. On the other hand, in two consecutive studies with mental patients, Ayllon and Azrin²⁴ demonstrated results conflicting with the Baron, et al., findings. In an attempt to modify a socially desirable eating response of mental patients, reinforcement (e.g., candy, cigarettes, second helping of the meal) increased the

²¹Baron, Kaufman, and Stauber, loc. cit.

²²Ayllon and Azrin, loc. cit.

²³Baron, Kaufman, and Stauber, op. cit., p. 710.

²⁴Ayllon, loc. cit.

frequency of correct responses slightly. When instructions were added to the reinforcement, the desired behavior increased significantly. These results initiated a second experiment by Ayllon and Azrin²⁵ to modify the same behavior. The introduction of instructions without reinforcement increased the appropriate responses from nearly zero percent to about sixty percent and was maintained with the continuance of the instructions. With the addition of reinforcement to the instructions, the correct responses increased to and maintained between ninety percent and 100 percent.

Although the results of Baron, Kaufman, and Stauber²⁶ differed from the findings of Ayllon and Azrin²⁷ in the degree of facilitation by instructions of certain desired behaviors, their studies demonstrated the effectiveness of instructions as an important means of acquisition and maintenance of human operant performance.

Research Related to Direction-Following Behavior as a Dependent Variable

There have been several studies that have utilized directions as a means of investigating important variables in the area of receptive language. In an early study, Bowman²⁸ demonstrated the effectiveness of a

²⁵Ibid., p. 329.

²⁶Baron, Kaufman, and Stauber, loc. cit.

²⁷Ayllon and Azrin, loc. cit.

²⁸V. J. Bowman, "A Study of the Effects of Two Different Methods of Teaching Word Comprehension," Parsons Research Project Working Paper Number 24a, 1960, p. 8.

verbal reinforcement technique to train retarded children's motor responses to a verbal request. The subjects in this experiment were required merely to point to the correct response to the requests (e.g., "Which is the back of the dress?"). Whitman, Zakaras, and Chardos²⁹ went a step further. By combining physical guidance and fading procedures with positive reinforcement, they demonstrated that training procedures can be effectively applied to teach retarded children motor responses to a variety of verbal instructions. In another study, instruction-following behaviors of a class of retarded boys with "attentional deficits" were successfully maintained by token reinforcement procedures administered on a group basis.³⁰

Despite the fact that nonverbal responses to language messages (i.e., following directions) could be a valid, reliable, and convenient procedure for investigating comprehension, such a procedure has rarely been used in empirical studies.³¹ Shipley, Smith, and Gleitman³² tested the responses to directions of young normal children. The directions were varied systematically in syntax and content to assess the children's syntactic comprehension relative to their speech production. The results indicated that all holophrastic speakers (speakers with an inability to combine words into complete phrases) obey single word commands more often than well-informed commands. The reverse was found with telegraphic speakers

²⁹Whitman, Zakaros, and Chardos, op. cit., pp. 286-288.

³⁰Zimmerman, Zimmerman, and Russell, op. cit., pp. 107-110.

³¹Carroll, loc. cit.

³²Shipley, Smith, and Gleitman, op. cit., p. 329.

(speakers able to combine words to form complete phrases). In another study, Jones³³ tested the performance of normal adolescents on tasks requiring the marking of five out of eight digits in a display. She found that instructions of the negative form, "Respond to all except 2, 5, 8," resulted in significantly slower rates of performance than instructions of the positive form excluding the word "except" (e.g., "Mark the numbers 1, 3, 4, 6, 7."). A variation of this technique has been used by Chomsky³⁴ in investigating the acquisition of syntax in children. Perhaps the most pertinent research for the development of language training programs to remediate direction-following deficiencies per se is reported in a comparative study by Lent, Holvoet, Ferneti, Keilitz, and Tucker.³⁵ In this study, moderately retarded and nonretarded adolescents were verbally presented sets of directions, in the form of imperative sentences (e.g., "Put the ruler on the magazine."), each set consisting of one, two, three, four, or five separate directions. The subjects' competence in following the verbal directions was determined by their ability to carry out the performance required by the direction(s). The results indicated that moderately retarded adolescents, when compared to nonretarded adolescents of equal chronological age, have behavioral deficits in following directions

³³Jones, op. cit., pp. 498-500.

³⁴C. Chomsky, The Acquisition of Syntax in Children From 5 to 10, (Cambridge, Massachusetts: M.I.T. Press, 1969).

³⁵Lent, Holvoet, Ferneti, Keilitz, and Tucker, loc. cit.

that are presented in sets of two, three, and four (especially in sets of three). The retarded individuals also demonstrated deficiencies in their ability to follow directions in the order (sequence) in which they were presented. On the basis of these results, the authors suggested that training programs to habilitate such responses to language be restricted in scope to two, three, and perhaps four directions in number.

It has been demonstrated that mentally retarded adolescents are deficient in following several directions at a time.³⁶ Also, it has been found that reinforcement is an effective means of facilitating the correct performance of simple directions by retarded individuals.^{37, 38, 39} In addition, with normal children, the grammatical structure of a direction has been shown to affect the responses to the direction.^{40, 41}

Research Related to Pictorial Stimuli

Paivio⁴² has theorized that concrete words, phrases, and sentences can be remembered not only verbally but also in the form of nonverbal

³⁶Lent, Holvoet, Ferneti, Keilitz, and Tucker, loc. cit.

³⁷Bowman, loc. cit.

³⁸Whitman, Zakaras, and Chardos, loc. cit.

³⁹Zimmerman, Zimmerman, and Russell, loc. cit.

⁴⁰Shipley, Smith, and Gleitman, loc. cit.

⁴¹Jones, loc. cit.

⁴²A. Paivio, loc. cit.

imagery. Using Paivio's⁴³ example, if a person were told, "The boy is peeling the green orange," his understanding of the sentence would include some kind of mental picture involving the peeling of oranges, and not merely overt or covert rehearsal of the words in the sentence. If he were then asked to remember the sentence, he might do so by recalling the objects and the action involved in the image and somehow forming the sentence from it.

Most researchers have empirically investigated the use of pictures as stimulus materials by the utilization of paired-associate learning tasks.⁴⁴ In a comparative study of mentally retarded and normal adolescents, Prehm⁴⁵ investigated the effects of pictures on rote learning performances. The stimulus and response materials consisted of combinations of either a word or a picture of common object nouns, i.e., word-word lists, word-picture lists, and picture-picture lists. It was found that the rote learning performances of the retarded subjects were inferior to those of the nonretarded subjects when the response to be learned consisted of pronouncing or spelling a word. However, when the stimulus was in the form of a picture, the retarded subjects' performances were equivalent to those of the normals.

⁴³Ibid.

⁴⁴A. Paivio, "On the Functional Significance of Imagery," Psychological Bulletin, 1970, 73:6, pp. 385-392.

⁴⁵Prehm, op. cit., pp. 492-495.

Similarly, Dilley and Paivio⁴⁶ found that with young normal children pictures as stimuli facilitated learning, but as responses hindered learning in a paired-associate learning task. They presented familiar objects either visually as pictures or verbally as words, with different groups learning picture-picture, picture-word, word-picture, and word-word pairs. Paivio's interpretation of these results⁴⁷ was that "pictures pose a decoding problem at the mediational level" for young children. In other words, young children have difficulty in transforming the mental image (which was "encoded" from the stimulus) into a verbal response.

Van Mondfrans and Travers⁴⁸ found no significant differences between pictorial, auditory, and pictorial-auditory modes of presentation of words to college students. But when the stimulus materials consisted of nonsense syllables, the auditory mode of presentation produced learning inferior to the pictorial mode and combined pictorial-auditory mode of stimulus presentation. The interpretation of the results was that when the stimulus

⁴⁶M. G. Dilley and A. Paivio, "Pictures and Words as Stimulus and Response Items in Paired-Associate Learning of Young Children," Journal of Experimental Child Psychology, 1968, 6, pp. 231-240.

⁴⁷Paivio, (1970) op. cit., p. 390.

⁴⁸A. P. Van Mondfrans and R. W. Travers, "Learning of Redundant Material Presented Through Two Sensory Modalities," Perceptual and Motor Skills, 1964, 19, pp. 743-751.

was "meaningful" (words), pictures and a combination of pictures and verbally presented material had no facilitative effect on learning. When the stimulus was "redundant" (nonsense syllables), the pictorial and combined stimuli facilitated learning.

In another study utilizing college students as subjects, Dickey and Schneider⁴⁹ studied the effects of pictorial stimuli on the performance of an industrial task. The task consisted of placing various types and colors of washers on a pegboard via instructions from different modes: pictorial, verbal, and written modes of stimulus (instructions) presentation. The pictorial instructions and the written (typewritten) instructions were presented by means of a 35mm colored slide. The findings were that the pictorial instructions elicited superior learning performance of the task.

Severin⁵⁰ conducted an investigation studying the effectiveness of relevant pictorial stimuli in a recognition task with adolescents of normal intelligence. Statistical analysis of the results indicated that verbal words (single words) about nature subjects combined with pictures related to the verbal words elicited significantly higher performance scores than verbal words only.

⁴⁹G. L. Dickey and M. H. Schneider, "Multichannel Communication of an Industrial Task," International Journal on Production Research, 1971, 9:4, pp. 487-499.

⁵⁰W. Severin, "The Effectiveness of Relevant Pictures in Multiple Channel Communications," Audio-Visual Communication Review, 1967, 15, pp. 386-401.

In a similar study with young retarded and nonretarded children, Bruininks and Clark⁵¹ investigated the effects of the mode of presentation of verbal stimulus materials in paired-associate learning tasks. Common object nouns were presented to the groups in three conditions: auditory (spoken nouns), visual (pictures of nouns), and combined auditory-visual (both spoken nouns and pictures of nouns). Although the overall learning scores of the retarded group were significantly lower than the scores for the nonretarded group, the performances of both groups were significantly better under the visual and combined auditory-visual conditions. The combined auditory-visual condition was higher, but not significantly higher, than the visual condition. Bruininks and Clark⁵² attributed the superior learning performances under the two visual conditions to the "imagery inducing quality of the pictures."

Milgram⁵³ used pictures in a paired-associate learning task in a different manner. Young children were presented stimulus and response pairs either in the form of a sentence or in the form of a picture. For example, the pair "clown-egg" was presented in the context of the sentence, "The clown dropped the egg," and in the picture context depicting the same relationship. The results indicated that verbal contexts were superior

⁵¹Bruininks and Clark, op. cit., pp. 561-567.

⁵²Ibid.

⁵³N. A. Milgram, "Verbal Context Versus Visual Compound in Paired-Associate Learning by Children," Journal of Experimental Child Psychology, 1967, 5, pp. 597-603.

to picture contexts in learning a paired-associate picture list. Milgram⁵⁴ concluded that covert verbalizing responses (i.e., covert verbal rehearsal) provide a better explanation of the data than do covert visualizing responses (i.e., imagery). Paivio⁵⁵ argued that although the verbal presentation of the response term facilitated response retrieval (i.e., recall and reiteration of the response term), imagery may have been involved as a major factor during storage (i.e., retention or remembering the response term).

Reese⁵⁶ also found that pictures facilitated paired-associate learning performance less than sentences in young children, but interpreted the results differently than Paivio. Reese⁵⁷ suggested that young children fail to "read," i.e., fail to observe the association between the stimulus and response presented in the pictorial materials.

In summary, the literature supports the superiority of pictorial stimuli and the combination of pictorial and auditory stimuli over auditory modes of eliciting various learning performances. A review of the literature resulted in only three studies^{58, 59, 60} contrary to the support of pictorial

⁵⁴Ibid., p. 602.

⁵⁵Paivio, (1970) op. cit., pp. 390-391.

⁵⁶Reese, op. cit., p. 412.

⁵⁷Ibid.

⁵⁸Van Mondfrans and Travers, loc. cit.

⁵⁹Milgram, loc. cit.

⁶⁰Reese, loc. cit.

stimuli in learning tasks; nevertheless, it must be emphasized that these three studies involved subjects of normal intelligence who demonstrated a command over the English language. Although mentally retarded individuals have been shown to be somewhat inferior to normal individuals in paired-associate learning tasks, their learning performances were indeed significantly facilitated by stimuli in pictorial form.^{61, 62}

There has been much hypothesized and suggested about pictorial stimuli,^{63, 64, 65, 66, 67} however, it has been noted that only two researchers^{68, 69} have investigated the effects of pictures on learning of mental retardates. These researchers conducted comparative studies between mentally retarded and normal individuals, and a verbal response was required of all subjects in both experiments. Since it is a fact that mental

⁶¹Bruininks and Clark, loc. cit.

⁶²Prehm, loc. cit.

⁶³Paivio, (1971) op. cit., p. 451.

⁶⁴Paivio, (1970) loc. cit.

⁶⁵Bruininks and Clark, loc. cit.

⁶⁶Milgram, loc. cit.

⁶⁷Reese, loc. cit.

⁶⁸Prehm, loc. cit.

⁶⁹Bruininks and Clark, loc. cit.

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retardates usually have some degree of linguistic deficiency,^{70, 71} the interpretations of their results could obviously be incomplete. If the required responses were in the form of overt motor responses (i.e., direction-following behavior), perhaps the learning performances of the mental retardates would be facilitated greater than those in the literature.

⁷⁰J. E. Spradlin, "Language and Communication of Mental Defectives," in N. R. Ellis (Ed.), Handbook of Mental Deficiency (New York: McGraw-Hill, 1963), pp. 512-555.

⁷¹M. R. Denny, "Research in Learning and Performance," in H. A. Stevens and R. Heber (Eds.), Mental Retardation (Chicago, Illinois: University of Chicago Press, 1964), p. 124.

CHAPTER III

RESEARCH DESIGN

Subject Sample

Twenty-four subjects were selected from a population of forty-seven mildly retarded⁷² adolescents residing at the Parsons State Hospital and Training Center (PSHTC). According to PSHTC resident evaluation and diagnostic records, all of the subjects were ambulatory and exhibited no visual or auditory deficiencies. The sex, chronological age, length of institutionalization, intelligence quotient, and experimental condition for each subject is presented in Table I.

Facilities

Experimental Room. The study was conducted in a nine feet by eleven feet experimental room. The room had no windows or wall decorations which may have minimized visual and auditory distractions.

Apparatus. A thirty-six inches by sixty inches display unit, consisting of five shelves of varying depths, contained the stimulus objects. Only the second, third, and fourth shelves were utilized permitting maximum visibility of the objects. An illustration of the display unit is presented in Appendix A.

For presentation of photographic slides, a Kodak Carousel slide projector, Model 800, was used. The slides were projected onto a screen eighteen inches by twenty-four inches, located seven feet directly in front of the subjects.

⁷²AAMD, loc. cit.

TABLE I

SUBJECT CHARACTERISTICS

Verbal + Picture Group				
Subject No.	Sex	Chronological Age*	Length of Institutionalization*	Intelligence Quotient**
1	male	17- 0	3- 1	62
2	female	12-10	5- 4	52
3	female	15- 8	0- 2	63
4	male	15- 7	0- 4	55
5	male	16- 8	0- 9	67
6	male	17- 3	1- 6	63
7	female	17- 3	8- 4	60
8	female	18- 5	4- 0	62
9	male	17- 3	7- 7	63
10	female	15- 3	2-11	66
11	male	17- 8	7- 5	61
Mean		16-5	3-9	61.3
Range		(12-10 to 18-5)	(0-2 to 8-4)	(52 to 67)
S. D.***		1-7	3-1	4.38
Verbal Group				
12	male	16- 7	3- 0	58
13	male	16-10	7- 4	58
14	female	18- 4	11- 0	61
15	female	18- 6	2- 4	66
16	male	16- 7	1- 2	62
17	male	16- 4	3- 6	52
18	male	17- 7	1- 5	60
19	male	14- 1	2-11	50
20	female	17- 7	1- 7	56
21	male	18- 5	8- 6	63
22	male	19- 0	2- 1	65
Mean		17-3	4-1	59.2
Range		(14-1 to 19-0)	(1-2 to 11-0)	(50 to 66)
S. D.***		1-5	3-4	5.05

*In years and months

**WISC or WAIS

*** Standard Deviation

Check lists containing the sets of directions and definitions of correct responses were used as data sheets. An example of a data sheet is presented in Appendix B.

Additional materials used were two desk-top chairs, one metal armchair, a stopwatch, and pencils.

Stimulus Materials. Ninety-five common objects and toys (e.g., fork, spoon, car, airplane) were used as referents in the verbal directions. Only those objects pertaining to the verbal directions presented in each session (nineteen objects per session) were located on the display unit.

The directions consisted of 300 sentences in the imperative form which were generated from nine verbs, ten prepositions, twelve adjectives, and ninety-five nouns corresponding to 95 objects and the directed performances involving those objects. All nouns, verbs, adjectives, and prepositions utilized in the directions are listed in Appendix C. Sentences had one of three basic forms: (1) verb (or verb phrase) + article + noun (e.g., Point to/the/tiger); (2) verb (or verb phrase) + article + adjective + noun (e.g., Give me/the/green/marble); (3) verb (or verb phrase) + article + noun + preposition + article + noun (e.g., Put/the/dog/in front of/the/horse). The 300 sentences were distributed into 100 sets, each set containing three sentences. Each of the three sentence forms was represented in all the sets with the less complex sentence form preceding the more complex sentence form. A single imperative sentence defined one direction. The 100 direction sets were divided into ten sets per session (i.e., thirty directions per session for ten sessions).

The 300 directions were individually illustrated by 35mm color photographic slides depicting the objects and action representing each verbal direction. For example, as illustrated in Appendix D, the direction "Point to the large marble" was represented by a slide depicting the model's index finger extended directly in front of a marble located adjacent to a smaller marble. Only the hand and the lower arm of the model was shown in all the slides.

Experimental Design

Pretest. In a study of the instruction-following behavior of severely retarded children, Whitman, et al.,⁷³ recommended that before a subject is tested with a complex command (e.g., pick up the pencil and put it in a box), it should first be determined whether the subject can perform each of the component parts of a complex command (e.g., pick up, pencil, put, box). In the present study, a pretest was conducted to ensure that all lexical items used in the directions were "understood" by all subjects. The subjects were shown all objects used in the experiment. The pretest for nouns and adjectives was accomplished by requiring the subjects to point to those objects which were named (in the case of nouns) or objects which possessed those attributes (in the case of adjectives) mentioned by the experimenter. Verbs and prepositions were tested by requiring subjects to perform the appropriate action or indicate the correct position (e.g., in, next to, under) designated by the experimenter. All lexical items used in the directions were presented to all subjects in this fashion.

⁷³Whitman, Zakaras, and Chardos, op. cit., p. 289.

Three subjects failed to correctly identify all the lexical items upon their initial presentation. These subjects were dropped from the study. Two additional subjects were pretested. After correctly identifying all the lexical items one subject was arbitrarily selected and dropped from the study in order to maintain an even number of subjects for purposes of division into two experimental groups for statistical convenience. The pretest resulted in a decrease in the total number of subjects from twenty-four to twenty-two.

Procedure

Subjects were randomly assigned to two groups, Verbal + Picture and Verbal, with eleven subjects in each group.

At the start of the first session subjects in the Verbal + Picture Group were instructed to "...do what I (the experimenter) tell you to do and what the pictures show you to do." Subjects in the Verbal Group were instructed simply to carry out the performances demanded by the verbal directions presented. Both groups were instructed to initiate their performance at the end of a direction set (i.e., block of three directions) signaled by a prompt ("Go ahead") given by the experimenter. Directions were presented in a normal conversational tone; each direction was spaced to begin within 5.0 seconds, such that a direction set presentation (including the prompt) lasted approximately 15 seconds. No time limit was placed on the subjects' performances.

In addition and simultaneous with the verbal directions, the Verbal + Picture Group was exposed to color photographic slides depicting the

performances demanded by the verbal directions. Simultaneous with the initiation of each spoken direction, the corresponding slide was projected onto the screen for a duration of 5.0 seconds coinciding with the duration allotted for each verbal direction. At the end of the presentation of each direction set, a black cardboard slide was inserted automatically into the projector blocking the light source and leaving the blank screen unlighted. The purpose of this procedure was to further minimize possible factors of visual distraction.

The subjects were seated in a chair located at the side of the unit displaying the referent objects used in direction-following performances. Closed sides of the unit blocked visibility of the objects during direction presentations.

Each subject's direction-following performances were observed and scored by the experimenter. During sessions selected at random an observer simultaneously but independently of the experimenter observed and scored each subject's performance for purposes of interobserver reliability. No systematic reinforcement was provided. Noncontingent favors (e.g., candy bars, gum, and verbal expressions of appreciation) for participation were given to subjects at the end of each session.

Statistical Analysis. The significance of differences was determined by the use of a 2 x 10 analysis of variance: a two-factor (Groups X Sessions) mixed design with repeated measures on one factor (Sessions).⁷⁴

⁷⁴J. L. Bruning and B. L. Kintz, Computational Handbook of Statistics (Glenview, Illinois: Scott, Foresman, and Company, 1968), pp. 54-61

This statistical design was utilized since it not only permits the comparison of the differences in performances of the two experimental groups, but it also permits the evaluation of changes in performance due to practice and due to the combination of experimental groups and practice. The .05 level of significance was adopted.

CHAPTER IV

ANALYSIS OF DATA

Results

The raw scores were converted from the session by session data sheets directly to a composite sheet in tabular form which is presented in Appendix E.

A test for the homogeneity of variances was conducted to determine whether the assumption of homogeneity was met for purposes of using the analysis of variance. The results of the test, $F(10, 10) = 2.09$, $p > .10$, demonstrated no significance, thus supporting the use of the analysis of variance.

The raw data were then analyzed by means of a 2×10 analysis of variance: a two-factor (Groups X Sessions) mixed design with repeated measures on one factor (Sessions). The results of the analysis are presented in Table II.

Interpretation of Results

Correctness. Figure 1 shows the number of correct responses to directions for the two groups on each of the ten sessions. Points plotted represent group means calculated from individual session scores. As is evident in Figure 1, the Verbal + Picture Group performed a greater number of directions correctly than the Verbal Group over all the ten sessions. The Verbal Group consistently fell well below 20 correct direction-following responses out of 30 possible responses; the Verbal +

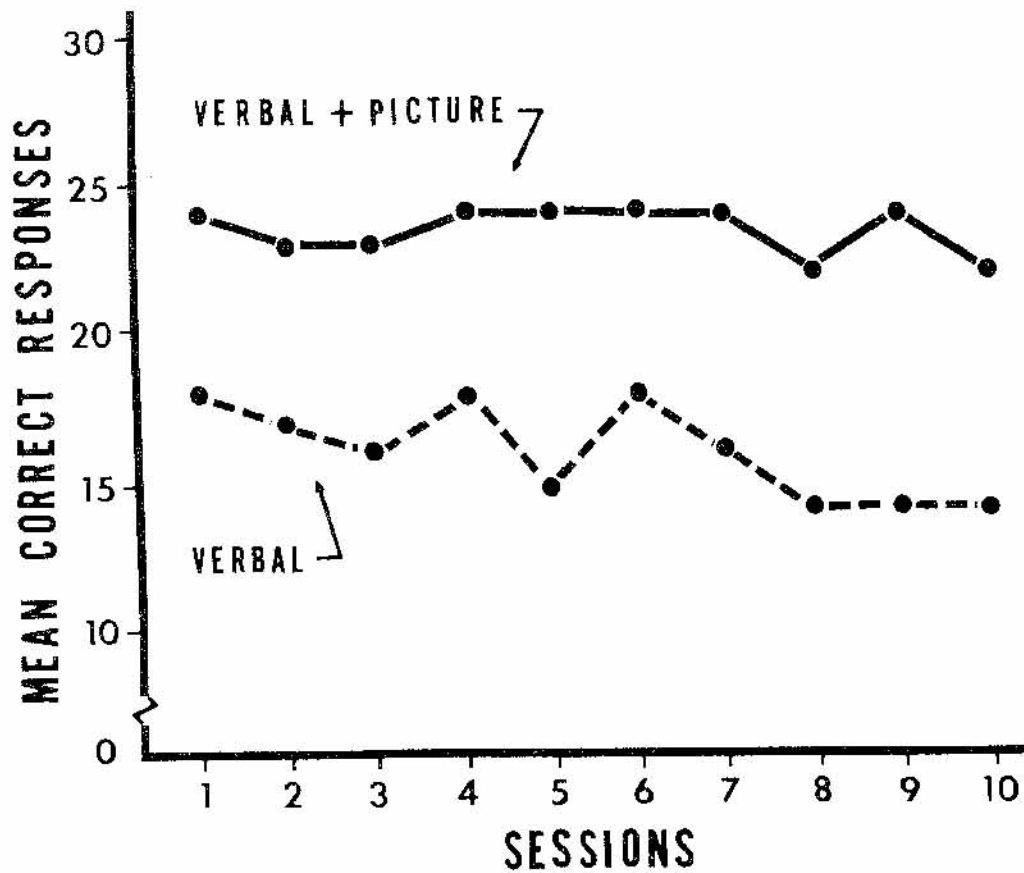


Figure 1

Mean number correct responses for the Verbal + Picture and Verbal groups performing multiple directions in sets of three directions over ten sessions.

TABLE II
RESULTS OF ANALYSIS OF VARIANCE

Source	Ss	df	ms	F	P
Total	7133.44	219	--	---	---
Between Subjects	5787.54	21	--	---	---
Groups	2716.04	1	2716.04	17.68	<.001*
Error _b	3071.50	20	153.57	---	---
Within Subjects	1345.90	198	--	---	---
Sessions	182.21	9	20.24	3.37	<.001*
Groups X Sessions	81.91	9	9.10	1.51	n.s.*
Error _w	1081.78	180	6.00	---	---

*"n.s." = not significant; "<" = less than $\left["p < (\text{level of significance})" \right]$.

Picture Group maintained an average near 25 over the ten sessions. A slight decrease in the number of correct responses over sessions can be ascertained for the Verbal Group. The almost horizontal curve depicting the performance of the Verbal + Picture Group suggests no such decrease in this group. A 2 x 10 (Groups x Sessions) analysis of variance revealed a statistically significant main effect of groups, $F(1,20) = 17.68$, $p < .001$ and sessions, $F(9,180) = 3.37$, $p < .001$ ⁷⁵, but no significant

⁷⁵Note: in addition to the analysis of variance a nonparametric statistical test (the Mann-Whitney U-test for Differences Between Independent Samples) was used resulting in a significant main effect between groups, $U(11,11) = 8$, $p < .001$, and sessions, $U(10,10) = 0$, $p < .001$.

Groups x Sessions interaction, $F(9,180) = 1.51$, $p > .10$.

Sequence. The sequence in which the directions were performed, either correctly or incorrectly, was scored in terms of an index reflecting the extent of deviation from the presented sequence of directions within each set.⁷⁶ An incorrect performance of a direction was defined as direction-following responses in which the correct object but incorrect action or the correct action but incorrect object required by the presented verbal direction were carried out by the subjects. Any responses other than a correct or incorrect performance were not scored. A score was recorded for each direction carried out only if it was preceded by another performed direction which was presented earlier in the sequence. For example, a three-direction set sequenced in the order 1, 2, 3, as presented, was given the maximum score of $2 + 1 = 3$ indicating that two direction-following performances (Direction 2 and Direction 3) occurred later in the sequence than Direction 1, and that Direction 3 occurred, as presented, later in the sequence than Direction 2. A direction set sequenced in the order 1, 3, 2 was scored $2 + 0 = 2$ indicating that two performances (Direction 3 and Direction 2) were performed as presented later in the sequence than Direction 1, but that Direction 2 was carried out only after Direction 3 was carried out, i.e., not in the order it was presented.

The mean sequence scores for the two groups for the ten sessions are graphically depicted in Figure 2. The Verbal + Picture Group apparently

⁷⁶Lent, Holvoet, Ferneti, Keilitz, and Tucker, loc. cit.

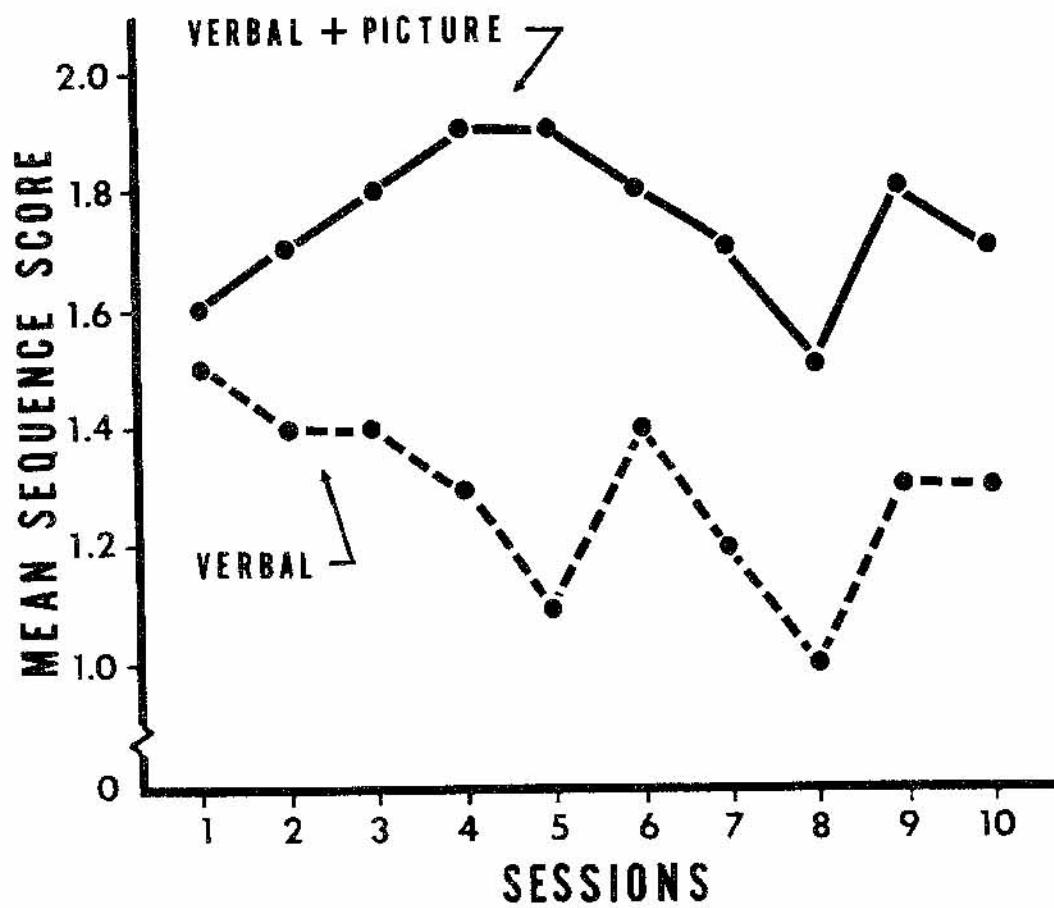


Figure 2

Mean sequence scores for the Verbal + Picture and Verbal groups performing multiple directions in sets of three directions over ten sessions.

carried out more of the directions in the sequence in which they were presented than the Verbal Group over all ten sessions. These differences in sequencing of direction-following performances, however, were not statistically reliable. A 2×10 (Groups x Sessions) analysis of variance of the sequence index scores revealed no statistically significant effects of Groups, Sessions, or Groups x Sessions.

Reliability

One indication of how well a behavior has been scientifically defined is determined by obtaining a measure of the reliability of observation.⁷⁷ Hall defined reliability as "the degree to which independent observers agree on what they have observed in the same subject during the same observation session."⁷⁸ In the present study, data collected by the observer were utilized for assessment of interobserver reliability of recording only. Agreements between the experimenter (the prime observer) and the observer were defined as instances when both agreed in scoring a single direction-following performance as either correct or incorrect; conversely, disagreements were instances in which observers disagreed in scoring performance either correct or incorrect. Reliability percentages, computed by dividing the number of agreements by the number of agreements plus the number of disagreements⁷⁹ per session, ranged from eighty to 100 percent with a mean of 97.9 percent.

⁷⁷Hall, loc. cit.

⁷⁸Ibid.

⁷⁹Ibid.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Summary and Conclusions

For the mentally retarded adolescents in the present study, direction-following behavior was clearly facilitated when the verbal presentation was supplemented with correlated pictorial materials. These results generally parallel and extend into applied situations studies in which pictorial stimuli and combined auditory-visual modes of presentation were shown to lead to superior performances in paired-associate tasks than auditory presentations alone.^{80, 81}

In the first session, the Verbal + Picture Group performed 23.8 or seventy-nine percent of presented directions correctly while the Verbal Group performed 17.9 or sixty percent of the directions correctly. These results prove interesting when compared with the performance of the retarded group of adolescents in the comparative study reported by Lent, *et al.*⁸² Retarded adolescents in this study were presented 18 verbal directions almost identical to those presented the Verbal Group in the present study. Their correct direction-following performance, in terms of a group average, was sixty-five percent or only slightly superior to the Verbal Group but still inferior to the Verbal + Picture Group in the first session of the present study. The only apparent procedural difference between the present study

⁸⁰Prehm, loc. cit.

⁸¹Bruininks and Clark, loc. cit.

⁸²Lent, Holvoet, Ferneti, Keilitz, and Tucker, loc. cit.

and that of Lent, et al.⁸³ appears to be the use of tokens (exchanged for pennies after the session) contingent on correct responses by Lent, et al.⁸⁴ This suggests that any additional control of direction-following behavior exerted by contingent reinforcement may be negligible when such behavior is already largely under the control of verbal directions. In an unpublished study (see, Keilitz and Lent⁸⁵) it was confirmed that the effects of a token reinforcement procedure on multiple-direction following in mentally retarded individuals may be minimal. The implications of this consideration, especially in view of the significant facilitory effects of pictorial stimuli on direction-following in this study, are not quite clear. Perhaps, from the standpoint of effective training programs aimed at the improvement of verbal direction following, more emphasis needs to be placed on the design of antecedent events (i.e., supplemental visual materials) and less on the manipulation of consequences (i.e., reinforcement) of direction-following behavior. Once a stable level of performance has been established, however, the problem of maintenance of that level may well become one of management of contingent consequences (cf., Zimmerman, Zimmerman, and Russell⁸⁶).

⁸³Ibid.

⁸⁴Ibid.

⁸⁵I. Keilitz and J. R. Lent, "Nonverbal Responses to Language Stimuli: Direction Following," in progress report, "Communications Research with Retarded Children," NICHD Grant 00870, 1973.

⁸⁶Zimmerman, Zimmerman, and Russell, loc. cit.

Although the subjects were not explicitly instructed to carry out the directions in the order they were presented, the lack of any significant difference in sequencing between the two groups seems noteworthy. Apparently supplemental pictorial stimuli enhance correct performance without dramatically affecting the order in which the directions are carried out. A possible explanation may be that the pictures contained relational information that served to strengthen associations formed between actions and objects within single directions, thereby facilitating correct performance of that direction, while leaving any associations between separate directions unaffected. This explanation is plausible since the pictures were presented for the same length of time and simultaneous with the verbal directions. The possibility exists that a simultaneous presentation of three pictures in some spatial arrangement corresponding to and overlapping with successive verbal presentations of a set of multiple directions might well facilitate sequencing, as well as correct performance. In such a combined auditory-visual arrangement the separate directions may be linked in a spatial configuration which could enhance association of the directions and thus facilitate sequencing.

Direction-following behavior may be regarded broadly as a type of stimulus-response relation in which the controlling stimuli are spoken directions. One possible explanation for the superior direction-following performance of the Verbal + Picture Group as compared to the Verbal Group is that the pictures provided additional functionally equivalent or relevant redundant stimuli which strengthened the stimulus-response relation between

the spoken directions and the required performances. Furthermore, since the direction-following response itself requires no verbal output, pictorial stimuli controlling specific responses may have allowed the bypassing of verbal information acquisition altogether. That is, it is conceivable that simple imitative responses to pictures may have facilitated the performance of the Verbal + Picture Group.

A considerable body of research reviewed and integrated by Paivio⁸⁷ seems to leave little doubt that procedures designed to encourage greater visual imagery (mental images) can have dramatic effects on learning and recall. An explanation for the present results, somewhat more speculative than the relevant redundant stimuli explanation, is that pictorial stimuli induced visual imagery which increased associations of the stimuli (pictures and spoken words) and the responses (direction-following). Clearly, if the directions in the present study were more "vividly" remembered and associated with the referent objects and actions, it would seem that the subjects' performance would be enhanced.

Recommendations for Further Research

It seems reasonable to assure that nonverbal receptive aspects of language, such as direction-following, play a crucial role in the communication of mentally retarded individuals. Moreover, it may be argued that their environment is often so constructed that such aspects are more crucial to the retarded person than the nonretarded person. The present

⁸⁷Paivio, (1971) loc. cit.

results suggest that pictorial presentations may be particularly effective in remediation of deficiencies in nonverbal aspects of language. From a broader educational viewpoint, these results suggest that instructional programs be designed to include, as much as possible, the use of pictorial aids.

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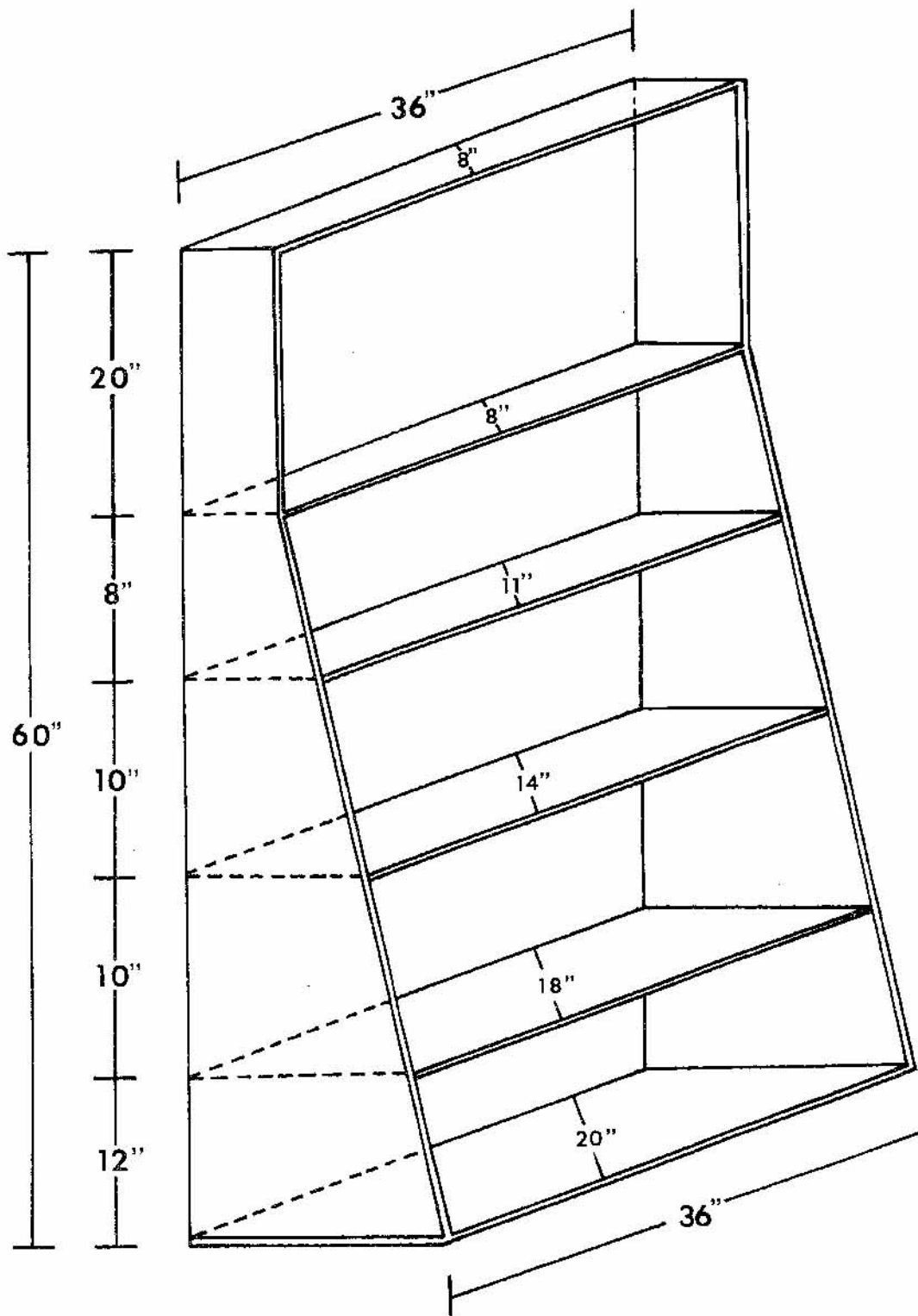
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APPENDIX A

DISPLAY UNIT FOR STIMULUS OBJECTS



APPENDIX B

SAMPLE DATA SHEET

Direction	Definition of Response
_____ 1. Fold the construction paper	1. Manipulate paper so that it has one or more folds in it
_____ 2. Give me two horses	2. Extend two horses within reach of <u>E</u>
_____ 3. Put the pen inside the basket	3. Place pen in contact with inner surface of basket
_____ 1. Hand me a rubber band	1. Extend one or two rubber bands within reach of <u>E</u>
_____ 2. Point to the small block	2. One or more fingers placed in front of or touching small block
_____ 3. Hold an airplane over the dog	3. Hold one or more airplanes higher than the dog in the same vertical plane but not touching
_____ 1. Turn over the basket	1. Manipulate the basket such that the side originally touching shelf is rotated on its vertical axis
_____ 2. Point to the large marble	2. One or more fingers placed in front of or touching large marble
_____ 3. Put the scissors in front of the block	3. Scissors placed next to one or more blocks on open (front) side of shelf
_____ 1. Point to the chain	1. One or more fingers placed in front of or touching chain
_____ 2. Hand me the large horse	2. Extend large horse within reach of <u>E</u>
_____ 3. Put a marble beside the blocks	3. Set one or more marbles by side of blocks within 2½ inches

Direction	Definition of Response
_____ 1. Turn over the penny	1. Manipulate penny such that the side originally touching shelf is rotated on its vertical axis
_____ 2. Give me two marbles	2. Extend two marbles within reach of <u>E</u>
_____ 3. Put the dog beside the lighter	3. Set dog by side of lighter within 2½ inches
_____ 1. Hand me the pen	1. Extend pen within reach of <u>E</u>
_____ 2. Turn over the block	2. Manipulate block such that the side originally touching shelf is rotated on its vertical axis
_____ 3. Put the lighter beside the ashtray	3. Set lighter by side of ashtray within 2½ inches
_____ 1. Turn over the fork	1. Manipulate fork such that the side originally touching shelf is rotated on its vertical axis
_____ 2. Give me the white airplane	2. Extend white airplane within reach of <u>E</u>
_____ 3. Put the scissors in the coloring book	3. Put chalk in contact with inner pages of coloring book
_____ 1. Give me a horse	1. Extend one or more horses within reach of <u>E</u>
_____ 2. Hand me two marbles	2. Extend two marbles within reach of <u>E</u>
_____ 3. Put the fork under the dishrag	3. Place fork beneath bottom surface of dishrag
_____ 1. Point to the tiger	1. One or more fingers placed in front of or touching tiger
_____ 2. Give me the green marble	2. Extend green marble within reach of <u>E</u>
_____ 3. Put the dog in front of the horses	3. Dog placed next to one or more horses on open (front) side of shelf

APPENDIX C

LIST OF SENTENCE COMPONENTS

Nouns

pen	towel	flag	envelope	toothbrush
dishrag	rabbit	ribbon	sheep	car
lighter	eggbeater	elephant	angel	key
ashtray	screwdriver	banana	cowboy	safety pin
coloring book	house	lightbulb	belt	pocket knife
button	comb	shoe	purse	indian
penny	lipstick	thread	toolbox	crayons
basket	gun	leaves	watch	cow
horse	boot	corn	hat	magazine
kleenex	hammer	saw	pear	pan
marble	orange	mirror	tomato	paper
airplane	ring	toilet paper	carrot	plate
dog	tablet	washrag	tractor	toothpaste
tiger	boat	coat	spider	ball
scissors	dice	zipper	pliers	ruler
fork	apple	saltshaker	axe	cup
chain	padlock	flashlight	spool	handkerchief
block	pig	sack	glasses (eye)	grapes
rubber band	glass (drink)	bandaid	sock	spoon

Verbs

Adjectives

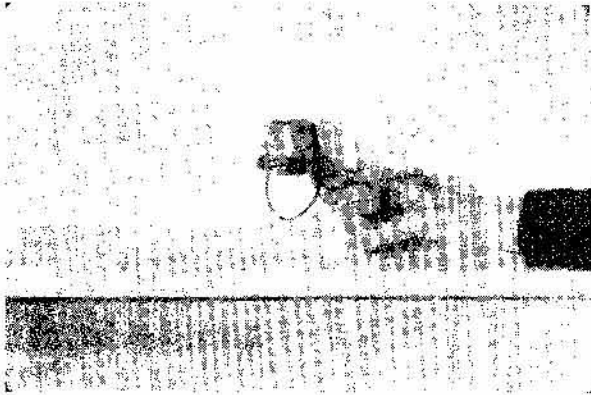
Prepositions

fold	large	in
give me	blue	next to
pick up	black	under
cut	little	inside
point to	pink	over
hand me	yellow	in front of
turn over	small	behind
open	two	on
close	one	beside
	big	above
	green	
	white	

APPENDIX D

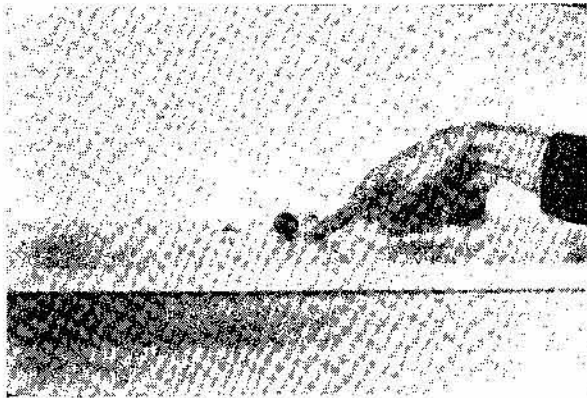
Photographic Slides
Depicting A Direction Set

1



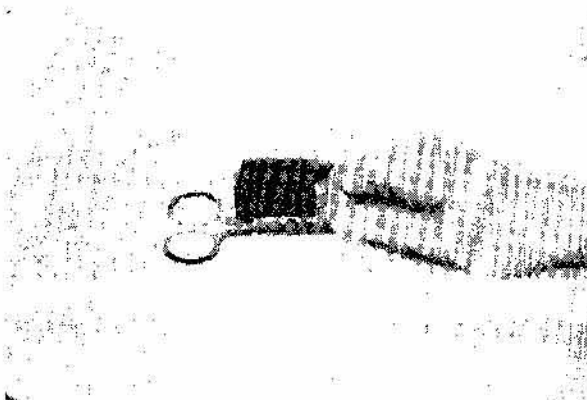
"Turn over the basket"

2



"Point to the large marble"

3



"Put the scissors in front of the blocks"

APPENDIX E

COMPOSITE DATA SHEET OF RAW SCORES

Subject \ Session		1	2	3	4	5	6	7	8	9	10	
	1	25	21	22	22	20	22	26	20	22	19	219
	2	17	24	22	21	25	22	26	26	25	22	230
	3	27	27	24	27	23	27	21	19	26	22	243
	4	20	16	18	19	20	16	16	14	19	16	174
	5	22	24	20	23	25	24	25	24	23	23	233
	6	19	19	21	15	19	24	22	13	15	17	184
	7	23	23	22	24	22	25	24	20	22	19	224
	8	28	22	23	28	26	22	24	28	29	24	254
	9	30	28	28	29	28	28	27	29	29	26	282
	10	25	21	23	28	26	25	25	26	24	25	248
	11	26	23	27	27	28	25	27	24	27	24	258
Total		262	248	250	263	262	260	263	243	261	237	2549
	12	7	10	7	7	4	8	5	3	4	4	59
	13	25	23	17	24	21	27	25	20	19	19	220
	14	19	19	13	16	18	17	17	12	13	17	161
	15	26	23	19	22	18	26	18	17	19	18	206
	16	15	11	12	18	14	19	19	16	19	17	160
	17	19	17	19	18	18	17	13	8	20	13	162
	18	10	13	13	15	10	11	10	13	7	11	113
	19	22	13	13	14	13	16	13	15	15	12	146
	20	13	18	14	16	14	20	20	15	15	17	162
	21	18	19	21	20	11	22	13	21	19	19	183
	22	23	19	19	23	19	18	21	21	20	21	204
Total		197	185	167	193	160	201	174	161	170	168	1776

