A COMPARISON OF LEFT- WITH RIGHT-HEMISPHERIC PERCEPTUAL SKILLS IN HYPERACTIVE AND NORMAL CHILDREN

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ABSTRACT

A Comparison of Left- with Right-Hemispheric Perceptual Skills in Hyperactive and Normal Children. (April 1982)

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Eight hyperactive children were compared to eight control children matched with regard to age, ethnicity and school grade on tests of auditory perception and memory (Digit Span), spatial figure recognition (Gestalt Closure Speed Test), and perceptual/cognitve style (Children's Embedded Figures Test). It was found that hyperactive children were significantly lower ($p < .005$) than control children on the auditory perception and memory variable but not on the spatial figure recognition task ($p < .77$) nor on the perceptual/cognitive style task. The data suggest that hyperactive children are deficient on tasks requiring sequential scanning patterns and involving left cerebral hemisphere functioning but not on tasks involving the right hemisphere, or where sequential scanning patterns are not essential.

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TABLE OF CONTENTS

ABSTRACT ii

ACKNOWLEDGEMENTS iii

LIST OF TABLES v

INTRODUCTION AND REVIEW OF THE LITERATURE 1

Hypotheses 10

METHOD 12

Subjects 12

Materials 12

Procedure 15

RESULTS 17

DISCUSSION AND CONCLUSIONS 19

REFERENCE NOTES 23

REFERENCES 24

APPENDIX A: Request for Parental Permission 29

APPENDIX B: Parents' Permission Form 32

APPENDIX C: Gestalt Closure Speed Test 34

APPENDIX D: Digit Span Test 38

APPENDIX E: Conners' Abbreviated Symptom Questionnaire . . . 40

APPENDIX F: Instructions for the Gestalt Closure Speed Test 42

APPENDIX G: Instructions for the Digit Span Test 44

VITA 46

LIST OF TABLES

I. Means and Standard Deviations 17

II. Analyses of Variance for the Dependent Measures 18

INTRODUCTION AND REVIEW OF THE LITERATURE

The hyperactive child has been described as one who is continually in motion, appears highly distractible, has a short attention span, is impulsive, is a disciplinary problem, is at odds with his peer group, and often experiences academic difficulties (Stewart & Olds, 1973). This syndrome was first described over 100 years ago in the medieval literature (Satterfield, Cantwell, Lesser, & Podosim, 1972; Weiss & Hechtman, 1979). Historically, the many alternative labels which have been given to this disorder, such as "minimal brain dysfunction," have created some confusion as to etiology (Weiss & Hechtman, 1979). For example, "minimal brain damage" implies actual structural central nervous system damage; "minimal brain dysfunction" reflects the view that while observable localized damage is not evident, neurochemical or neuropsychological malfunctions may exist. Similarly, "maturational lag" or "developmental hyperactivity" erroneously suggest the idea of delayed development, with the afflicted children eventually outgrowing their problems.

Recently, the name of this disorder has been changed in DSM-III (Diagnostical and Statistical Manual: American Psychiatric Association, 1980) to "attention deficit disorder with hyperactivity," to emphasize that the attention deficit appears to be a more fundamental disability to the child than other symptoms of the disorder. The following operational criteria for diagnosis are provided in DSM-III:

Citations follow the style and format of those found in the Journal of Abnormal Child Psychology.

(1) qualitatively and quantitatively excessive, general hyperactivity or motor restlessness for the child's age, (2) difficulty in sustaining attention, (3) impulsive behavior, and (4) duration of the above for at least one year (Weiss & Hechtman, 1979).

Hyperactivity or attention deficit disorder has been said to be the most common behavior problem of school age children (Kolb & Whishaw, 1980; Reynolds & Gutkin, 1982; Safer & Allen, 1976). Estimates of the percentage of children displaying hyperactive symptomatology have ranged from ten percent of all children (Delamater, Lahey, & Drake, 1981; Stewart, Pitts, Craig, & Dieruf, 1966), to five percent (O'Leary, 1980), although more conservative estimates suggest a figure of one to three percent of the population (Conners, 1980). Other reports on the incidence of referrals to child guidance or pediatric clinics range from ten percent (O'Leary, 1980) to forty percent (Safer, 1971). Finally, hyperactivity has been reported to be more prevalent in boys than in girls (e.g., Patterson, Jones, Whittier, & Wright, 1968).

Conners (1980), a noted authority on hyperactivity, states that "numbers alone do not give an adequate representation of the anguish hyperactive children and their families experience. The child is frequently considered lazy or undisciplined and gradually finds himself friendless and isolated. He puzzles others and himself because of his obvious brightness and talents which, nevertheless, fail to protect him from academic failure. His social ineptitude and impulsiveness lead to a scarred self image and later maladjustment" (Conners, 1980, p. 3). Similarly, Greenberg and Erikson (1982) report academic and social failure leading to low self-esteem, with the adoption of diversionary but self-defeating actions such as clowning or becoming aggressive, negativistic, or helpless. Thus, they further alienate their peers, parents and teachers which serves only to compound their problems. Concomitant inabilities such as distractibility, incoordination and lack of frustration tolerance complicates things still further.

Traditionally, clinical descriptions of these children depict them as highly distractible (Douglas, 1976) implying that an outside, irrelevant stimulus pulls the child away from the task at hand. Current research, however, has shown that these children are not, in fact, any more distractible than normal children, but rather they demonstrate a deficiency in the ability to focus attention upon, or selectively attend to specific stimuli, to sustain attention upon specific environmental stimuli and to produce sequential stimulus scanning procedures (Douglas, 1976).

It has been reported (Hoy, Weiss, Minde & Cohen, 1978; O'Leary, 1980; Weiss & Hechtman, 1979) that there are developmental changes associated with hyperactivity. In infancy smiles are rare, drastic mood swings are evident, the infant may be difficult and unpredictable, according to these authors. Sleep is typically erratic. As a preschooler, the hyperactive child has a sharp temper, is strong-willed and excessively demanding, and evidences a short attention span. During middle childhood extreme activity, distractibility, attention problems, poor scholastic performance and mood changes are seen. Adolescence is characterized by poor self image, continued poor school work, rejection by parents, siblings and peers, increased aggression and, while excessive activity decreases, poor attentional control remains. Adults tend to exhibit personality disorders, and may become alcoholic.

A problem of major concern for both parents and educators is the management of hyperactive children. Pharmacotherapy has been a major weapon in the treatment of hyperactivity (Barkley, 1977; Greenberg & Erikson, 1982). The major tranquilizers and antidepressants have been shown effective, but their effectiveness seems to be due to sedation rather than restoration of normal attentional capacities. Minor tranquilizers do not appear to be useful (Greenberg & Erikson, 1982). The drugs most frequently used in the treatment of hyperactivity appear to be stimulants such as amphetamines, methylphenidate (Ritalin), and magnesium pemoline (Cylert) (Barkley, 1977). The so-called "paradoxical" effect of the stimulants calming hyperactive children can be understood once the underlying or primary problem of deficits in attention are considered rather than the secondary problems such as high activity level (Greenberg & Erikson, 1982). Of the three types of stimulants, the most prescribed is methylphenidate, because it results in fewer side effects. Barkley (1977) states that on the average, 74% of hyperactive children given amphetamines improved while 26% were unchanged or made worse. Similar improvement rates are seen for methylphenidate and magnesium pemoline in that 77% and 73%, respectively, of the children taking these drugs improved. These figures clearly exceed the 39% average improvement rate noted for placebo treatments (Barkley, 1977).

But long term studies of stimulant medications indicate that drugs alone are not enough to produce a favorable outcome (Weiss & Hechtman, 1979). While the use of cerebral stimulants may be effective in the treatment of some hyperactive children, many authorities recommend the use of non-medical interventions whenever possible (Freedman, 1971; Walden & Thompson, 1981). In particular, it has been found (Bugental, Whalen & Henker, 1977) that hyperactive children given Ritalin tend to attribute their improved behavior to external sources (the medication) rather than to internal sources (their own coping strategies). Interestingly, their peers make similar attributions. Therefore, the danger exists that hyperactive behaviors and attention deficits might temporarily be alleviated without providing the child with the sense of competence necessary for future learning achievements.

Behavioral management, or operant procedures, can be used to shape new behaviors in hyperactive children and eliminate undesirable ones (see Prout, 1977). Carefully chosen, appropriate, positive reinforcers, both tangible and social, have been shown to substantially increase the on-task and attending behavior of the hyperactive child (Prout, 1977; Walden & Thompson, 1981). Shaping, that is reinforcing closer and closer approximations to a target behavior, has also been shown to be effective with hyperactive children (Allen, Henke, Harris, Baer, & Reynolds, 1967; Bidder, Gray, & Newcombe, 1978; Krop, 1971).

Modeling refers to those behaviors which are acquired through observation and imitation (Walden & Thompson, 1981). Douglas, Parry, Marton and Garson (1976) have successfully employed modeling techniques along with self verbalization designed to promote internal control of hyperactive behavior. Contingency contracting (Homme, 1974) and time-out procedures (Hackett, 1975) have also proven effective.

Biofeedback is a procedure for allowing an individual to become aware of involuntary bodily functions through the use of electronic instruments. Brand, Lupin and Brand (1975) found increases in self-concept and confidence coincident with E.M.G. biofeedback aided control over undesirable movements. With the increased confidence, emotionality and frustration decreased. These areas have not been noted to improve at all with drug therapy (Walden & Thompson, 1981). Cobb and Evans (1981) provide an excellent review of the use of biofeedback techniques with children exhibiting a variety of learning and behavioral problems.

The physiological characteristics of hyperactive children have also been avidly studied. Findings indicate a decrease in autonomic reactivity (Rugel & Rosenthal, 1974; Satterfield & Dawson, 1971; Satterfield, Cantwell, Lesser, & Podosin, 1972; Sroufe, Sonies, West & Wright, 1973). It should be noted, however, that Delamater, Lahey, and Drake (1981) do not concur with the above findings. Differences in cortical evoked potentials between hyperactive and non-hyperactive children have also been reported (Dainer, Klorman, Salzman, Hess, Davidson, & Michael, 1981; Grunewald-Zuberbier, Grunewald & Rasche, 1975) as have differences in cardiac reactivity (Porges, Bohrer, Keren, Cheung, Franks, & Drasgow, 1981), E.E.G. (Grunewald-Zuberbier et al., 1975), and differences in body movements during vigilance tasks (Rugel, Cheatham, & Mitchell, 1978). Additionally, Cohen and Young (1977) and Barkley (1977) observed differences in brain chemistry in hyperactive versus control subjects; specifically, there were deficiencies in dopamine and an apparent excess of dopamine-beta hydroxylase (an enzyme responsible for the conversion of dopamine to norepinephrine).

The new terminology in DSM-III, attention deficit disorder, focuses upon the prime symptom associated with hyperactivity. It appears as though hyperactive children are not capable of focusing and maintaining attention (Douglas, 1976) and thus are easily distracted and display a high amount of ambient motor activity. Barkley (1977) reviews much of the literature on measurement of attention in hyperactive children and reports consensual agreement as to attentional deficits in hyperactives. Satterfield and Dawson (1971) suggest dysfunction at lower brain levels such as the reticular activating system, resulting in an inability to filter irrelevant stimuli from the more relevant. Thus, the higher brain areas are constantly bombarded by stimuli, which in a normal child would not reach cortical regions (Samuels and Edwall, 1981). Sheer (1974) and Sheer and Hix (Note 1) have demonstrated deficits in 40 Hz production by the central nervous systems of hyperactive children. The 40 Hz signal has been shown in animals (Sheer, 1970) and humans (Giannitrapani, 1969) to be associated with focused attention; that is, the ability to concentrate on a stimulus and to exclude intrusion by irrelevant stimuli. Other investigators have demonstrated similar neurological and electrophysiological evidence of attention deficits in hyperactive children (Dainer, et al., 1981; Grunewald-Zuberbier, et al., 1975; Michael, Klorman, Salzman, Borgstedt & Dainer, 1981).

It has been shown that hyperactives have problems in controlling voluntary eye movements; in fact, Lauler (1971) states that the relative inability to maintain voluntary gaze can be used as one index of attentional deficits. The procedure advocated by Lauler (1971) involves holding a pencil in a stationary position ten inches away from the child's face, then moving the pencil in various directions while noting maintenance of voluntary gaze. The hyperactive child tends to exhibit involuntary escape from gaze at the stationary pencil and erratic pursuit of the moving pencil. The importance of eye movements in visual perception has been amply demonstrated. Haber and Hershenson (1980) state that the position and movement of the eyes and head provide a basis for selection among visual stimuli and thus, are major determinants of selectivity in normal perception. The physiological data from studies of eye movement in hyperactive children are unclear. It would appear that at least three physiological structures are involved but the manner of their involvement is currently obscure.

First, the Reticular Activating System, located in the midbrain, appears responsible for arousal and apparently focused attention (Satterfield & Dawson, 1971). Secondly, the diencephalic tectal region (Kolb & Whishaw, 1980) seems to be involved in involuntary eye movement (i.e., aspects of pursuit and initiating motoric responses to commands from cortical structures). Fuchs (1976) points out interactions between the diencephalic tectal area and the reticular activating system in the control of eye movements. Thirdly, Kolb and Whishaw (1980) note that damage to the frontal cortical lobes in humans results in poor voluntary gaze, disrupted movement programming and impaired response inhibition (the fact that all are shown in the hyperactive is extremely intriguing). Finally, it is important to note that Mattes (1980), based on clinical symptoms shown by hyperactive children and on evoked cortical potentials, E.E.G., orienting reactions and neurological data concluded that there is considerable evidence that many of the functions of the frontal lobes are inadequate in hyperactive children.

There is also evidence (Greenberg & Erikson, 1982) that children with an attentional deficit tend to process information at a lower rate and more erratically than normal children. These children seem to have difficulty processing information (especially auditory) rapidly enough to understand and respond in an appropriate fashion to long messages and complex instructions. This difficulty is exacerbated by fatigue, boredom or a distracting environment.

Based on the preceding considerations about hyperactivity, the purpose of the present study was to compare left cerebral hemispheric perception with right hemispheric processing in hyperactive versus normal children. Discrepancies in the functions of the cerebral hemispheres of humans, termed "lateralization of function," has received considerable attention during recent years. Considerable insight into lateralization of function was provided initially by "split brain" surgery for the treatment of epilepsy (Gazzaniga, 1970). The left cerebral hemisphere is more specialized than the right for cognitive tasks involving verbal skills and requiring logical, sequential and analytical sorts of thinking; the right hemisphere is more specialized for holistic or Gestalt types of information and functioning--for example, perception of spatial figures (Hartlage, 1982; Kolb & Whishaw, 1980; Springer & Deutsch, 1981).

Thus it seemed both interesting and logical to select variables measuring perception in accord with the above findings. The auditory perception and memory variable, as measured by Digit Span capacity, was selected as an index of left hemispheric functioning. Hartlage (1982) indicates that tasks involving auditory sequencing should be sensitive to left hemispheric dysfunction. The Gestalt Closure Speed Test (Thurstone & Jeffrey, 1966) was utilized to assess spatial perception and thus, right hemispheric functioning. In addition, the Children's Embedded Figures Test (Witkin, Oltman, Raskin, & Karp, 1971), a measure of perceptual/cognitive style, was included. This measure indicates the extent to which an individual relies upon internal or environmental cues in perception.

Based on past research efforts indicating hyperactive children demonstrate deficits in attentional scanning procedures, the following hypotheses were advanced.

Hypotheses

(1) Hyperactive children would score significantly lower than control children on the Digit Span Task, which involves left hemisphere functions and requires systematic, sequential scanning procedures.

(2) The difference between hyperactive and control children on the

Gestalt Closure Speed Test, a task sampling right hemisphere function and not requiring a sequential scanning procedure, would not attain statistical significance.

(3) The difference between hyperactive and control children on the Children's Embedded Figures Test, a test of perceptual style as well as right hemisphere functioning, would not attain statistical significance.

METHOD

Subjects

Eight hyperactive children and eight control children were selected based on scores on the Conners Abbreviated Symptom Questionnaire (see Appendix E) and based on matching with regrad to age, ethnicity, and grade level. Hyperactivity was operationally defined as an average score of 1.5 or greater on the Conners scale (CASQ). All children were male, of normal intelligence (according to school records), not emotionally disturbed nor physically handicapped. The mean CASQ score for hyperactives was 2.01 (s.d. = .64), and for controls was 0.40 (s.d. = .30). The children ranged in age from eight to eleven years, and were between the third and sixth grades. Parental permission was obtained through letters sent home from school with the children (see Appendix A), with inclusion in the study dependent on approval by the child and by return of the signed Informed Consent Form (Appendix B) by the parents. All participants were chosen from elementary and middle schools located in two south-central Texas communities. Confidentiality of each child's responses was maintained throughout the study by use of a number coding system. A report summarizing the research was made available both to participating schools and to the parents.

Materials

The Children's Embedded Figures Test (Witkin, Oltman, Raskin, & Karp, 1971) was used to measure perceptual cognitive style. The

Children's Embedded Figures Test has demonstrated adequate reliability (Dreyer, Nebelkopf, & Dreyer, 1969; Tryon, 1957) and validity (Corah, 1965; Konstadt & Forman, 1965; Witkin, Dyk, Faterson, Goodenough & Karp, 1962).

The Gestalt Closure Speed Test (Thurstone & Jeffrey, 1966), shown in Appendix C, was chosen as a measure of spatially oriented, right hemispheric functioning. Specifically, this instrument measures the ability to perceive an apparently disorganized and unrelated group of parts as a meaningful whole (Thurstone, 1944). Reliability and validity of this instrument have been shown to be adequate (Thurstone & Jeffrey, 1966).

The auditory perception and memory variable (Smith, Note 2) consists of a tape recording of lists of numbers varying in length from three to ten digits. The stimulus series consists of three sequences of each digit length presented in random order (see Appendix D). This measure is a modified version of the Digit Span subtest of the various Wechsler Intelligence Scales (Wechsler, 1974). Scoring of the auditory perception and memory task utilized a median correct procedure (i.e., each child's score was the length of the digit span correctly recalled 50% of the time). The entire sequence was presented with an audiotape recorder. Each digit span was presented with a one second interval between digits. Following the presentation of each set of digits, the child attempted to vocally reproduce that set, and his responses were recorded.

The Conners Symptom Questionnaire is the scale most frequently used in research dealing with hyperactivity. It is composed of five factors, each of which yields a separate score. The factors are Aggressive Conduct, Daydreaming-Inattentive, Anxious-Fearful, Hyperactivity, and Sociable-Cooperative (Cantwell, 1975). Of these factors, the Hyperactivity factor, known as the Conners Abbreviated Symptom Questionnaire (see Appendix E), has been widely used as a selection tool for studies that seek to distinguish hyperactive from normal children (Copeland & Weissbrod, 1978).

Studies have reflected an increasing reliance on the Conner Abbreviated Symptom Questionnaire as a method of assessing hyperactive behavior because of its ease of use and sensitivity to different methods of intervention. Its repeated reliability and validity were similar to those obtained through complex procedures of observation and assessment (Henker, Whalen, & Collins, 1979; Zentall & Barach, 1979).

It should be pointed out that the Conners Abbreviated Symptom Questionnaire has shown versatility in that it is used by both teachers and parents (Conners, 1980). Werry and Sprague (1974) concluded from a comprehensive study comparing different methods of observation and assessment that the teacher ratings were stable, sensitive, informative, and were the best sources of information for assessing drug effects. This scale also identifies hyperactivity across cultures, with similar proportions of children being found deviant (Margalit, 1981; Werry, Sprague & Cohen, 1975). Research has shown that teacher questionnaire scores were found to correlate significantly with independently observed behavior in children, suggesting that the scale "successfully taps observable dimensions of hyperactivity supporting the usefulness of this scale as a good assessment tool" (Copeland & Weissbrod, 1978, p. 342).

Procedure

Equal numbers of special and regular education teachers were selected and asked to fill out the Conner Abbreviated Symptom Questionnaire on their students. All questionnaires were scored blind (i.e., the researcher did not know which came from each type of classroom). From this sample, eight hyperactive and eight control children were selected and assigned an identification number. Testing was conducted in a comfortable, unoccupied classroom on the student's campus. Total testing time was approximately 45 minutes per child.

Upon entering the testing situation, the child was seated across the table from the examiner. Several minutes were allowed at this point for friendly conversation aimed at the establishment of rapport between the examiner and the student. Each child was informed that he was assisting the examiner with a school project by participating in a few simple games. The children were also informed that the examiner would record their responses, but were assured that there were no right or wrong responses in association with the games.

The Children's Embedded Figures Test was administered first in strict accordance with the administration procedures specified in the Embedded Figures Manual (Witkin, et al., 1971). The Gestalt Closure Speed Test was administered next with slight modifications in direction, timing and recording procedures to facilitate its use with children (Appendix F).

Following the Gestalt Closure Speed Test, directions for the Digit Span Test were read to the child. The actual stimuli were presented with an audiotape recorder. Digits were paced at one second intervals.

Once all data were collected, blind procedures were used to score the data, and a completely randomized analysis of variance was used to evaluate each of the dependent variables (Kirk, 1968). The .05 level of confidence was used for the rejection of the null hypotheses.

RESULTS

A completely randomized (one-way) analysis of variance design was used to compare the hyperactive and control children on each of the dependent variables. Table I depicts the means and standard deviations for each of the dependent variables, and Table II shows

Table I. Means and Standard Deviations

Test	Hyperactives	Controls
Digit Span	$\bar{x}$ = 4.73 s.d. = 0.69	$\bar{x}$ = 5.94 s.d. = 0.76
Gestalt Closure Speed Test	$\bar{x}$ = 11.50 s.d. = 2.56	$\bar{x}$ = 12.00 s.d. = 4.07
Children's Embedded Figures Test	$\bar{x}$ = 17.25 s.d. = 3.92	$\bar{x}$ = 20.50 s.d. = 3.16

the results of the analyses of variance. As can be seen in Table II, there is a statistically significant difference between hyperactive and control children for the Digit Span Test of auditory perception and memory. As predicted, the analysis for the Gestalt Closure Speed Test did not attain statistical significance, nor did the analysis for the Children's Embedded Figures test, when comparing hyperactive with control children.

Table II. Analyses of Variance for the Dependent Measures

Test	degrees of freedom		Mean Square		F-ratio	p > F
	group	error	group	error		
Digit Span	1	14	5.88	0.53	11.21	0.005
Gestalt Closure	1	14	1.00	11.57	0.09	0.77
Children's Embedded Figures	1	14	42.25	12.68	3.33	0.09

DISCUSSION AND CONCLUSIONS

The observed deficits of hyperactive relative to control children on the Digit Span task, a left hemishpere problem, but not the Gestalt Closure Speed Test, a right hemisphere problem, would tend to confirm the hypothesis of differential hemispheric deficits. These results support the statements of Greenberg and Erikson (1982) indicating that hyperactives process auditory information slower than normal children, and the findings by Douglas (1976) of a deficit in producing sequential scanning procedures by hyperactive children. Similarly, the suggestions of Hartlage (1982) indicating that tasks involving auditory sequencing should be sensitive to left hemispheric dysfunctions would seem correct. It is interesting to note that Kunce and McMahon (1979) report a significant correlation between the Digit Span subtest of the WISC-R and auditory perceptual dysfunction. The essential normality of hyperactive children on the Gestalt Closure Speed variable is revealing, and would seem to warrant subsequent study designed to elucidate this apparent differential hemispheric dysfunction.

Thus hyperactive children may be deficient on tasks involving left hemisphere functions and requiring sequential scanning, but essentially normal on tasks requiring spatial, holistic perception which involves right hemisphere functioning. Spatial perception, then, seems relatively unaffected by a lack of sequential scanning abilities. Similarly, the lack of a statistically significant difference between hyperactives and controls on the Children's Embedded

Figures Test--which also requires the perception of spatial forms as it samples perceptual style--supports this assertion. An interesting speculation centers on the fact that the difference between hyperactives and controls on the latter measure approached statistical significance. In that the test measures not only a holistic perception but also is likely influenced by the child's motivation to perform on difficult tasks, it may be that young hyperactives do not differ form normals on such problems, but that the motivational component weakens for older hyperactives who have had repeated academic failures. In other words, future studies should incorporate a developmental component to learn whether perceptual style becomes increasingly field dependent for hyperactives as they grow older.

Presently educators address hyperactivity as if it were merely environmental or situational (Conrad, 1977). Their attempts at a solution have been to make "adjustments" in the environment which they feel is causing the "excessive behavior" (Prout, 1977). Rigid structuring of the child's environment is advocated. The perceived need to remove the child from "distracting stimuli or situations causing the hyperactivity" is seen as justification for isolating the hyperactive child in a "quiet corner or office" (Walden & Thompson, 1981), where he certainly can't disrupt the teacher's lecture. Hyperactive children are denied involvement in activities that are considered "too stimulating" (Walden & Thompson, 1981). When scientific evidence is readily available to professionals in all fields indicating that hyperactive children are in no way merely "distractible," and that true hyperactivity is neither environmental nor situational but instead is an actual neurological deficit, this approach seems both ludicrous and tragic. A mind which is denied stimulation stagnates.

Therefore, these data strongly suggest the necessity of subsequent research to evolve instructional strategies tailored to compensate for the individual hyperactive child's perceptual deficit, thus allowing for the child potential mastery of fundamental academic skills which before were impossible. This would not only produce a more effective learning experience, but also one which is more enjoyable both for the teacher and the child.

The findings also suggest that properly chosen learning activities, specifically those catering to right hemisphere functioning and not requiring sequential scanning routines, would allow a hyperactive child, who is a chronic underachiever in spite of normal intelligence, an opportunity for school related success. Such success may tend to immunize the hyperactive child against failure, aid in self-esteem, and perhaps decrease the sense of being ridiculed by teachers and peers.

It is possible that properly structured right hemisphere functioning might provide a bridge to the remediation of deficits in left hemisphere functions. Ideally this would occur early in the hyperactive child's education, but might also occur later in the child's educational experience through properly chosen learning activities designed to cultivate proper attentional and scanning procedures, which would then find a hyperactive child--with a background of successes--possessing the capacity to build appropriate left hemispheric functioning strategies and skills.

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APPENDIX A

Request for Parental Permission

TEXAS A&M UNIVERSITY
College of Liberal Arts
Department of Psychology
College Station, Texas 77843

Dear Parent:

Your child, ____________________, is being requested to participate in a study that I am conducting at the ____________________ school. This letter is to describe the study and to ask for your permission for him or her to take part in the project. Please be aware that no child will be forced to participate against his or her will, and so even if you do consent, your child will not be included unless he or she also agrees to take part.

I am a senior at Texas A&M University studying child development, and my project is being supervised by Dr. Candida Lutes (845-5141), who is on the faculty there. Please feel free to call her if you have any questions that are not answered in this letter. The purpose of my study is to find out more about how children solve word problems and picture problems; some of the tasks measure creativity, others deal with memory, and still others are concerned with finding pictures that are hidden within pictures. I will not be evaluating any of the children in terms of who is "better" or "worse" since the tasks I have selected do not lend themselves to scores of that type. Instead I will be looking for differences in how children go about trying to solve these problems. We have found from past research that children typically view these tasks as games and enjoy doing them.

At the end of the study, I will be writing a thesis that will go on file in the Texas A&M University Library, and will also write a report describing my findings for the school system and for the parents of any of the children participating. If you would like a copy of that report, please mark the appropriate box in the enclosed form, and I will be happy to mail it to you.

Please be assured that no child's name will ever be released in connection with this study. Once the study is completed I will destroy the names of all participants. In my descriptions of the children's performances, I will never include information that would allow anyone else to identify a specific child; instead, information averaged across groups of children will be presented.

I very much appreciate the consideration that you are giving to my request. Please feel free to contact me (693-1684) or my supervisor, Dr. Lutes, if you have additional questions or comments. We would be happy to discuss this with you.

Sincerely,

Lisa A. Moore

APPENDIX B

Parents' Permission Form

PARENTS' PERMISSION FORM

Name of Child: ____________________ Name of Parent: _______________

I hereby give permission for my child to participate in Lisa Moore's study, if he or she chooses to do so. I understand that he/she will not be forced to participate against his/her will.

____
Signature of Parent

If you have given permission for your child to participate, please answer the following questions:

1. Child's date of birth: ____

2. Child's grade in school: ______________________________________

3. What language is spoken at home? __English __Spanish __Other

4. Is your child currently taking any kind of medication?

   __No __Yes: please specify: _________________________________

Would you like to receive a copy of the results during the spring of 1982? __Yes __No. If you marked "yes," please print your mailing address below: ____________________________________

____

____

____

APPENDIX C

Gestalt Closure Speed Test

CLOSURE SPEED
(Gestalt Completion)

Please fill in:

Name ____________________

Age ________ Sex ______ Date ________

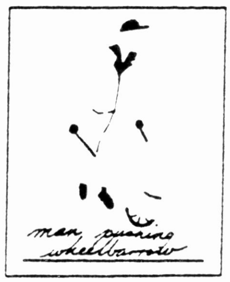
Occupation ____________________

____

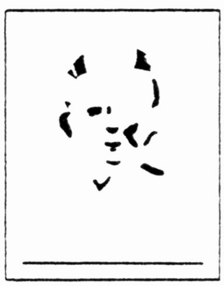
Prepared by: L.L. Thurstone, Ph.D. and T.E. Jeffrey, Ph.D.
The Psychometric Laboratory The University of North Carolina

Directions

Below is an incomplete picture of a man pushing a wheelbarrow. A description of what the picture represents has been written on the black line under it.



Below are some more pictures for you to identify. Write your answers on the lines.

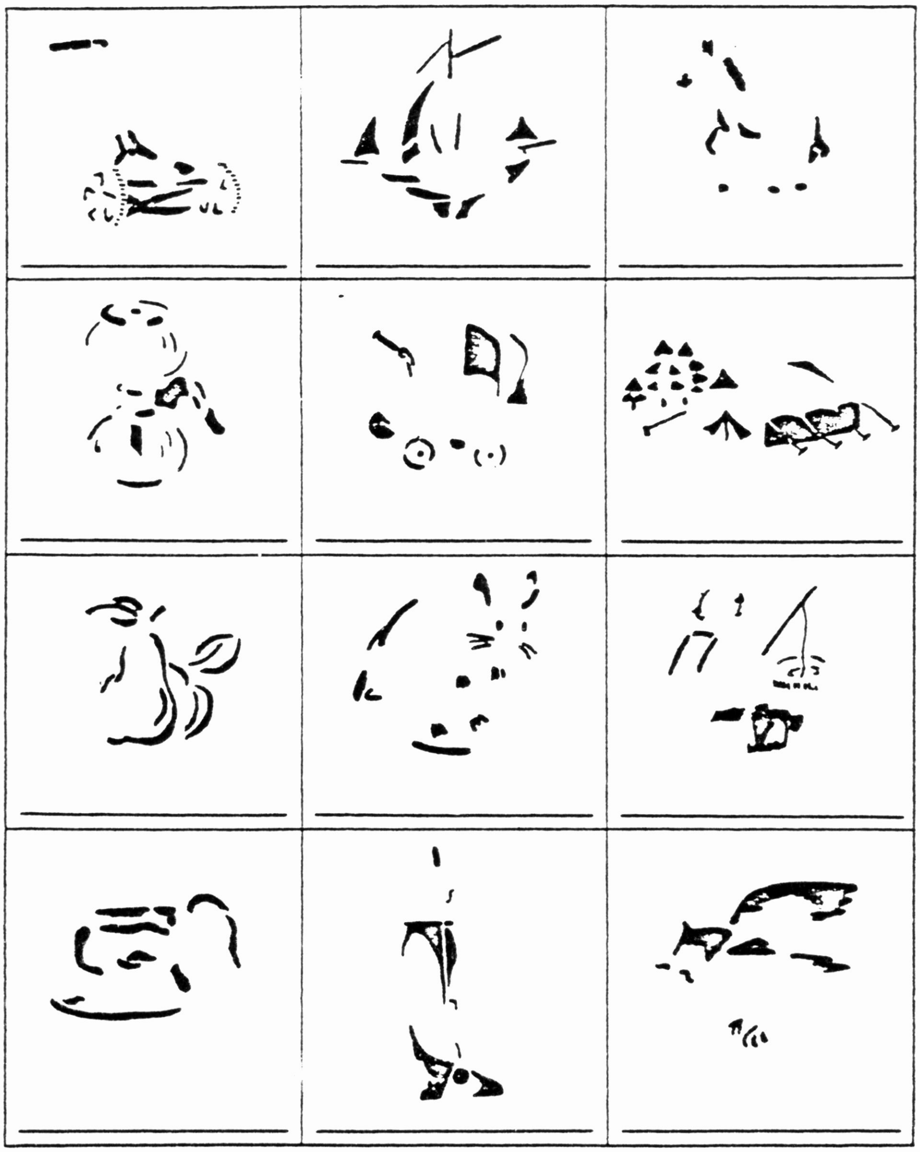


WHEN YOU GET THE SIGNAL TO BEGIN, open your booklet and identify more pictures of the same kind. Work as fast as you can until you are told to stop. If some pictures are too difficult, skip them, and return to them later if you have time. You may need more than one word to identify the picture fully. You will have three minutes to do as much as you can.

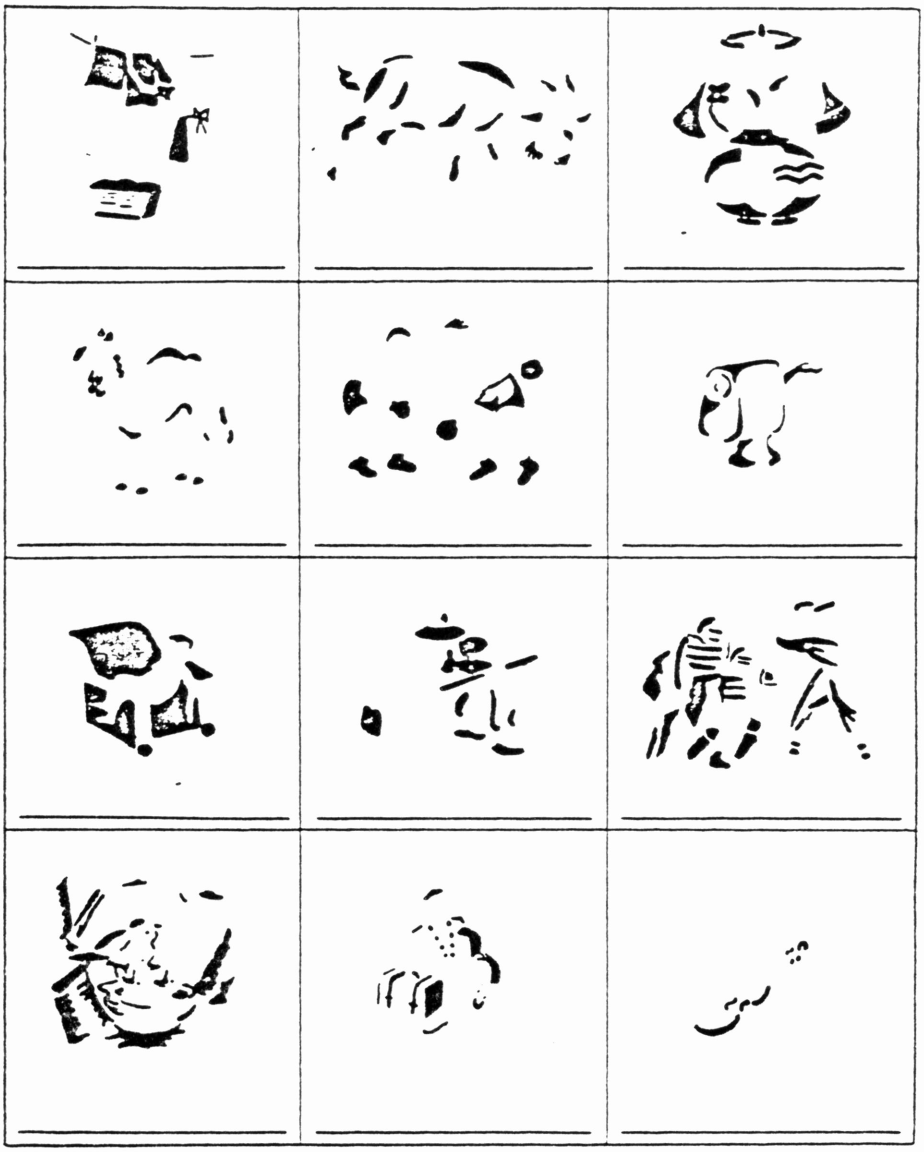
STOP HERE. WAIT FOR FURTHER INSTRUCTIONS.

Published by Industrial Relations Center · The University of Chicago
1225 East 60th Street · Chicago, Illinois 60637

Identify the pictures. Return later to those you find difficult.



DO NOT STOP. GO ON TO THE NEXT PAGE.



STOP HERE.

APPENDIX D

Digit Span Test

STIMULI FOR DIGIT SPAN TEST

A. 7859

B. 674

C. 215693

D. 9063457128

E. 58076

F. 1250893

G. 417802569

H. 79185402

I. 13842

J. 8261430579

K. 207

L. 049512836

M. 1362

N. 3109654728

O. 4526971

P. 648320

Q. 421056983

R. 86791420

S. 0534

T. 93217854

U. 5780396

V. 76350

W. 394

X. 894231

APPENDIX E

Conners' Abbreviated Symptom Questionnaire

CONNERS' ABBREVIATED SYMPTOM QUESTIONNAIRE

Child's Name: ______________________________

Teacher's Observations

Information Obtained: ______________________ By: ________________
month day year

Observation:	Not At All 0	Just A Little 1	Pretty Much 2	Very Much 3
	Degree of Activity:			
1. restless or overactive	0	1	2	3
2. excitable, impulsive	0	1	2	3
3. disturbs other children	0	1	2	3
4. fails to finish things he starts; short attention span	0	1	2	3
5. constantly fidgeting	0	1	2	3
6. inattentive, easily distracted	0	1	2	3
7. demands must be met immediately --easily frustrated	0	1	2	3
8. cries often and easily	0	1	2	3
9. mood changes quickly and drastically	0	1	2	3
10. temper outbursts, explosive and unpredictable behavior	0	1	2	3

OTHER OBSERVATIONS OF TEACHER (Use reverse side of form if more space is required). ____

____

From D. M. Ross & S. A. Ross. Hyperactivity: Research, Theory and Action. New York: Wiley, 1976. P. 314.

APPENDIX F

Instructions for the Gestalt Closure Speed Test

INSTRUCTIONS FOR THE GESTALT CLOSURE SPEED TEST

Now we're going to play a different kind of game. Here is a picture of a man pushing a wheelbarrow. See--here's his cap, feet, hands, and part of the wheel. Below the man are some other pictures for you to look at. Sometimes these pictures look <u>incomplete</u>. Do you know what that means? But the object of the game will be to try and figure out what the pictures are anyway.

[Child identifies sample pictures.)

When I tell you to begin, open the booklet. Look at each picture carefully. Also be as fast as you can. Try to figure out what the picture is. I'll write your answers on paper. Game time is short, so work quickly. You may not finish all the pictures, but that's OK. If one picture seems hard, skip it, and we'll go back to it later. Any questions?

APPENDIX G

Instructions for the Digit Span Test

INSTRUCTIONS FOR THE DIGIT SPAN TEST

Now we're going to play a game with numbers. When I turn on this tape recorder, you'll hear a man's voice read a letter and some numbers. Sometimes there will be a lot of numbers and sometimes there won't be many. After the numbers, you will hear a soft high hum. It sounds like this: "hummm." When you hear this hum, say the numbers back to me in the same order you heard them, and I'll write down what you say.

Would you like to try a practice one? Say these numbers: "E. 2468 hummm".