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Visual Attention Differences Across The Lifespan: A Study of Inhibition

Emily H. Cointin
Illinois Wesleyan University

Running Head: VISUAL ATTENTION ACROSS THE LIFESPAN

Acknowledgements

First and foremost I would like to thank Johnna Shapiro, my faculty supervisor. Her guidance both in and out of the classroom has been nothing less than inspirational. She is not only a role model and mentor but a friend. I shall miss the daily contact with her next year. Also, I would like to thank Eileen Fowles for all her help with critiques and wonderful ideas for obtaining participants. I would like to thank Don Sweeney and Jim Dougan for their assistance as members of my committee. In addition to my committee members, I thank Lon Shapiro for all his help with the technical part of this project (program design, crashed hard drive, etc).

I would like to thank my good friends who have stood with me for the last four years. We have all been through a lot, yet always seem to end up together. So to Deborah, Erin, Sarah, Lorena, Tom, and Lu, Thank you - the next pitcher's on me! I would like to thank my family who have always believed in me when no one else has. My parents are my inspiration and their love and tolerance is truly wonderful. Finally, I would like to thank Bryan, for the late night phone calls, the support, but mostly for his love.

Abstract

In 1980, Treisman and Gelade proposed a two stage process of attention. According to the Feature Integration Theory, information is first processed automatically through feature extraction while integration of these features occurs later. Feature extraction is a parallel process and therefore automatic while feature integration is a serial process and thus requires attention. Because of the attentional nature of Treisman's theory, it has often been used as a paradigm for studies on attention and inhibition. The theory has also been used to highlight differences in cognitive abilities at various levels of development. In particular, it has been used to demonstrate developing attention in children as well as slowing cognitive abilities in older adults. Significantly, the frontal lobe, which has been linked to inhibition and attention, is the last area of the brain to develop and the first to decline in adults. However, no cross sectional study has been done in which children, teenagers, adults, and older individuals have been tested on a standardized task. The ages of the participants were chosen based on developmental stages of the frontal lobe. Six-year-olds, ten-year-olds, thirteen-year-olds, undergraduates and people over the age of 55 all received the visual attention task. Each participant was given an individually administered standardized intelligence test and a computer task. This computer task required the use of feature extraction, feature integration, or a combination of both. Average reaction times (RT) for each cell were calculated by age group. Findings show no change in RT for the screens requiring parallel searches when the display size increased. However, for

those tasks requiring serial processing (conjoined) a significantly longer RT was found for children when increase inhibition was necessary (display size increased).

Visual Attention Differences Across The Lifespan: A Study of Inhibition

Selective attention is the ability to focus on only those items in the environment that are relevant to the present situation. Inhibition, in the cognitive sense, is the ability to ignore extraneous variables that are not relevant to the current situation, those may cause our attention to be unfocused. It has been shown that visual attention is not constant throughout the lifespan. Additionally, it has been suggested that performance on visual attention tasks improves throughout childhood, peaking in early adulthood. The reduced inhibition hypothesis proposes that one's ability to inhibit decreases with age(Treisman, 1980). With the use of a feature integration task which requires inhibition, this development and decline can be traced.

As their definition implies, selective attention and inhibition are closely related concepts (Treisman, 1980). Many studies point to the frontal lobe for the localization of attention and inhibition. If this is the case, the frontal lobe, it's development and decline, is critical to attention (Dempster, 1992).

Many findings have supported this notion of localization of attention in the frontal lobe. It is thought that the frontal lobe is the sourse of our higher level functioning. It is known that loss of frontal cortex leads to complex functional deficits (Nauta, 1971). The prefrontal region is considered critical for an organism response to novel stimuli (Knight, 1984). Patients with frontal lobe damage perform badly on problems solving tasks (Delis, Squire, Bihrle, Masman, 1992; Dempster, 1992). Reduced inhibitory mechanisms are salient in people with schizophrenia and attention deficient disorder (Cited in Tipper, 1991; Schachar, Tannock & Logan, 1993). People with frontal lobe lesions tend to perform poorly on interference-sensitive tasks in which they are told to sustain attention on a goal directed behavior (Dempster, 1992). Finally, the Wisconsin Card Sort Test (WCST) , which measures flexible thinking in adults, has become a measure of suspected frontal lobe impairment (Dempster, 1992).

The frontal lobe itself goes through distinct developmental changes. The frontal lobe is the last area of the brain to develop in humans (Dempster, 1992). The mass of the frontal lobe increases sharply from birth to two years of age and has a second growth spurt between the ages of 4 and 7. After the seventh year, the frontal lobe develops at a constant rate until the early teenage years (Lucia, 1973). One reason for these changes is the size and complexity of the nerve cell and an increase myelination (Renis & Goldman, 1980 cited in Dempster, 1992)

The frontal lobe is also the first area of the brain to decline. By the seventh or eight decade of life, we see a marked decrease in weight and cortical thickness of the frontal lobe (Dempster, 1992). Most significantly, there is the shrinkage of horizontal dendrites, which are thought to have inhibitory functions (Scheibel & Scheibel, 1975).

Due to these profound and significant changes in the frontal lobe, and the fact that the frontal lobe is believed to control higher order thought, the behavior of a person may change along with these physiological changes (Stankov, 1988). One test of this would be a task, requiring attention and inhibition, that showed distinct changes over the lifespan. In 1980, Treisman and Gelade proposed an attention theory that gave us a mechanism to test such a change.

The feature integration theory of attention, which was proposed by Treisman and Gelade (1980), demonstrated the use of inhibition in serial processing. They proposes that visual processing occurring in two stages. Individual features are first extracted and then integrated to form identifiable objects. Each stage, according to Treisman, requires a different type of processing. "...features are registered early, automatically and in parallel across the visual field, while objects are identified separately and only at a later stage, which requires focused attention" (Treisman & Gelade, 1980, p.99).

In the feature extraction stage, features are pulled from the image without attention. This is done through parallel processing where all characteristics of an objects are looked at simultaneously. The features seem to "pop out" at the viewer. Then, in the feature integration stage, characteristics are conjoined to develop the complex image. This is done through serial processing and appears to require attention and inhibition. Treisman claims that without attention, features can not be related to each other.

To test the theory, Treisman (1980) manipulated both stages of visual processing. In one condition, parallel processing was used to extract the features of the target and distracters. In the second condition, serial processing was used which caused the participant to pay attention to the stimuli.

Treisman predicted, and found, that RT for parallel processing would not changes as the display sizes increased, indicating inhibition and attention were not necessary for feature extraction. However, Treisman did see an increase in RT as display sizes increased for the feature integration task. This supported the notion that attention is necessary for serial processing.

Because feature integration theory identifies two distinct processing patterns one of which requires inhibition, it can be used to measure inhibition deficits. In 1989, Plude and Doussard-Roosevelt used feature integration theory to test whether older age adults (mean age 71 years) could perform as well as younger adults (mean age 20 years) on parallel and serial tasks. In their study, participants were exposed to three conditions. In the first, feature extraction was necessary. As the display size increased, older and younger adults showed no difference in RT. This showed that both groups were able to process information in parallel and without problems when there was an increase in the amount to inhibit. However, the second condition required the use of a serial search. It was shown that older age adults produced a much longer RT than their younger counterparts as the display size increased. This suggests an inability to inhibit greater amounts of extraneous variables indicating a lack of inhibition.

Both of these designs had been based on Treisman's (1980) feature integration research. However, Plude and Doussard-Roosevelt went beyond Treisman's original conditions and added a task which required both parallel and serial searches. In this condition, which they called unconfounded, all elements in the visual field are selected in parallel and then serially. However, as the display size increased, older adults had longer RT. Through their research, Plude and Doussard-Roosevelt (1989) showed older adults performed worse on tasks requiring inhibition as the display size increased.

At the other end of the developmental curve is the acquisition of skills in childhood. Although this area has seen substantially less research, Thompson and Massaro (1989) used Treisman's feature integration theory to determine the level of processing children are capable of achieving. Children and adults were exposed to feature extraction and feature integration tasks. The children's RTs were shown to be longer overall. They also showed a dramatic increase in RT during the feature integration task when the display size increased. This increase may be related to the lack of development of the frontal lobe and therefore inhibition in children.

Although evidence has been shown for changes in attention throughout the lifespan, because of variations in design, a meta-analysis can not be done for all these studies. However, a cross section study which controls for design variations could demonstrate this important change. In 1994, Shapiro and Forbes did a pilot study which included children, college age students and older age participants Each participant was exposed to feature extraction, feature integration and unconfounded conditions with display sizes 5, 10, and 15 characters. It was shown that undergraduates had the faster RT followed by older age participant, and children respectively. However, due to the small sample size, conclusions could not be considered conclusive.

This experiment is designed to add to Shapiro and Forbes study by increasing sample sizes of the participants. We expect to find individuals with developing frontal lobes, children, have longer reaction times than individuals with fully developed frontal lobes, undergraduates, and those having declining frontal lobes. Most importantly, we expect a dramatic increase in RT for the six-year-olds during the conjoined task as the display size increases.

Methods

Participants

Participants were 4 six-year-olds (3 f, 1m; mean age = 6.58 years, SD = .27 years), 18 ten-year-olds (5 f, 3m; mean age = 10.38 years, SD = .29 years), 8 thirteen-year-olds (2 f, 6 m; mean age = 13.45 years, SD= .35 years), 56 undergraduates (41 f, 15 m; mean age = 18.55 years, SD= 1.1 years) and 15 older age individuals (11 f, 4m; mean age = 67.87 years, SD = 6.60 years), who each took an individually administered Kaufman's Brief Intellegence Test and completed a computerized visual attention task lasting approximately 45 - 75 minutes. The young subjects, age 6 and 10, were recruited from Beecher Elementary School in Beecher, Illinois. A donation of $10.00 was given to the school in each child's name. The thirteen-years-olds came either from Beecher Elementary School or Bloomington-Normal Boy Scout Troop #19 and $10.00 was donated to the respective organization per child. The undergraduates were enrolled in a beginning-level psychology course at Illinois Wesleyan University and received extra credit for their participation. Older-age participants, individuals over the age of 55, were recruited from a list of Illinois Wesleyan Alumni living in the Bloomington-Normal, Illinois area and received $10.00 for their participation.

The mean scores on the KBIT were 104.71 for six-year-olds (SD= 9.48), 105.32 for ten-year-olds (SD= 10.57), 104.45 for thirteen-year-olds (SD= 8.05, 111.77) for undergraduate (SD= 6.65) and 116.67 for older age individuals (SD= 4.64). All participants had normal or corrected to normal vision as tested by their ability to read the introductory screen of the computer task. All participants were in good health and free from any neurological problems such as past strokes (based on self report).

Apparatus

The visual attention task was administered on either a Macintosh Centris 610 or a Macintosh Powerbook 170 computer. The Centris was used for procedures performed in the lab, while the Powerbook was used for home testing. Each computer was adapted for the procedure by placing a sticker saying 'yes and 'no' over the '5' and '6' keys respectively. A set of headphones were used to allowed clear discrimination of signaling tones during the experiment, as well as to screen out extraneous noises.

In addition to the computer task, the KBIT was individually administered to each participant. The KBIT has an age-based standard score with a mean of 100 and a standard deviation of fifteen. The test is composed of two subsections, vocabulary and matrices, which tests crystallized and fluid thinking.

Procedure

Each participant or guardian was required to read and sign a consent form as well as complete a background data sheet before beginning the experiment. Presentation of the two phases of the experiment, the KBIT and the visual attention task, were counter balanced. For the visual attention task, an introductory screen appeared which was to be read by the participant. Verbal instructions were also given to ensure understanding. The participants were told that a single target (a sideways 'T') would be used as the target stimulus throughout the experiment. For each trial, the participant was told to focus on a plus sign in the center of the screen when they heard the warning tone. Five hundred milliseconds later, the array appeared. Each person was instructed to press the 'yes' key if the target stimulus was present on the screen and the 'no' key if it was not. All were told to do this as quickly and as accurately as possible. A high-pitched tone signified a correct response and a low pitched tone signified an incorrect response. After the completion of both the KBIT and the visual attention task, the participant was debriefed on the purpose of the study.

The visual attention task was comprised of three factors: condition (simple, conjoined or unconfounded), display size (5, 10 or 15 characters) and the presence or absence of the target stimulus. The combination of condition, size and presence or absence of the target stimuli was completely random within each block, and all subjects were exposed to all combinations 16 times.

All stimuli were 1 cm by 2 cm in size. For all trials, the target stimulus was a sideways 'T'. The distracters differed from the target either in orientation or form. Specifically, the distracters were right side up 'T's and sideways 'P's. The targets and distracters were equally distributed to locations within the visual field.

Figure 1-3 shows examples of displays for each condition. Conditions had the following characteristics:

SIMPLE:

all distracters differ from target on orientation but not form.

CONJOINED:

half of the distracters differ from target on form while the other half differ on orientation.

UNCONFOUNDED:

regardless of display size, two distracters differ from the target on form while all others differ only on orientation.

After reading the introductory screen, which was approximately one to one and a half feet away, each participant began with 12 practice trials. If there were no questions, the participant proceeded with 8 blocks of 36 trials. Between each of the blocks was a one minute break to alleviate fatigue effects.

The participant's responses were automatically recorded by the computer as were the reaction time for each trial. Each participant was instructed to use his/her dominate hand throughout the experiment.

Results

For each of the participants, error data and RT were recorded. For each cell in the three-way design, mean RTs and SDs were calculated. For each given cell, individual trials varying from the cell mean by more than two SD were discarded. Additionally, any participant with an overall error rate of over 20% (one incorrect response for every five trials) was withdrawn from the analysis. All dependent measures were subjected to a between-subjects analysis of variance (ANOVA), with age being a between-subjects factor and display size and condition being within-subjects.

The data analysis revealed a main effect of age [F(4,819)=1196.073; p<.0001] with undergraduates (M=496.073 ms) having consistently faster reaction times than older age participants (M=608.038 ms), thirteen-year-olds (M=900.348 ms), ten-year-olds (M=1188.599 ms), and six-year-olds (M=2339.702 ms). Additionally, main effects of condition [F(2,819)=28.072; p<.0001) and display size [F(2,819)=3.943; p<.05] were also seen. Overall, the conjoined condition produced longer RT than either the simple or unconfounded conditions. Also, increase RT were produced when the display size increased.

An interaction was also seen between age and condition [F(8,819)=3.682; p<.001]. For all participants, the longest RTs came on the conjoined task and shortest RTs on the simple condition. Interactions were also seen for condition by size [F(4,819)=6.807; p<.0001] with each condition having shorter RT with the smaller display sizes and increase RT as display sizes increased.

Finally, a significant three-way interaction was seen for age, condition, and size [F(16,819)=1.946; p<.05] (see figure 4). The six-year-olds were shown to have the longest RT of any group when they were exposed to the largest display size, 15, during the conjoined task. Older children and older age adults showed faster RT than the six year olds on the larger size conjoined tasks.

Discussion

The present experiment was designed to address possible lifespan changes in visual attention ability during a feature integration task. It was shown that younger children, age 6, had significantly slower RTs during serial tasks, conjoined condition, when the display size increased. Also, older age individuals showed slower RT for larger display sizes than the undergraduates during the conjoined condition, however, these RT were not as dramatic as the RT for the six-year-olds.

The results demonstrated the gradual acquisition of inhibition in children, the fully functioning inhibition mechanism in adults, and the decline in later adulthood. These results are consistent with the developmental changes of the frontal lobe and the inhibition-deficit theory. Specifically, the cross-sectional component of the study demonstrates that the lack of an inhibition mechanism in younger children may produces a larger attentional deficit than the decline of the mechanism. However, a causal conclusion can not be drawn .

Often, attentional deficits of older aged people and young children are groups together and assumed to be homogeneous. This data demonstrates there is a marked difference between the ability of the young children and older adults. There are two main ways to account for the difference between RT during the conjoined condition at larger display sizes for the older age participants and the six-year-olds. It is possible that the frontal lobe decline is very gradual and that compensatory mechanisms develop to compensate for the loss. If this is the case, the decline of the inhibition mechanism may be occurring although few behavioral deficits may appear. Similarly, our participants may not have been aged enough to have such a significant amount of decline that it would show up clear during the task. It is possible that our participants did not have a significant amount of functional loss due to the fact their inhibition mechanism remains relatively intact.

The data did not reveal as dramatic of an effect for conjunction 15 as Plude and Doussard-Roosevelt's (1989) did. Plude and Doussard-Roosevelt's older participants, however, did exceed this study's older age participants by four years. It is possible that this age difference had a significant effect. Another possible reason for the difference may be the way the task was administered. This study was the first to use a computer task to test visual attention. Additionally, both Treisman & Gelade (1980) and Plude & Doussard-Roosevelt used form and color as their features, where as in this study, form and orientation were the features. The variation in designs may help explain this difference in the data.

The cross-sectinal design of this study assumes that each age group is generalizable to the other. However, without longitudinal data, it is impossible to say if this is true. Intelligence and gender differences may account for some variation in scores. More specifically, the 12 point IQ difference between the six-year-olds and the older age participants could have significant effects on the data outcome and may help account for the less dramatic decline in RT that seen for the older age participants.

Future research should focus on why the difference in RTs occurs between undergraduates and older age participant. More precisely, at what age does a significant deficit in attentional behavior occurs. Multiple older age groups with less variation in ages would assist us in narrowing in on when exactly the inhibitory mechanism breaks down. Additionally, work with people with frontal lobe damage may support a conclusive relationship between the visual attention task and frontal lobe.

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Appendix A

Consent form for older age individuals

Consent for Participation in Research / Non-Carle

Title of Study: Inhibitory Mechanisms in Visual Search Tasks
Principle Investigator: Johnna K. Shapiro, Ph.D.

This is a study of attention and how it may change under different conditions. We are investigating whether factors such as age and presence or absence of brain-injury change the way that people use attention to search arrays of objects. As a participant, you may be asked some general information questions pertaining to your medical and educational background and then be given two tests: a brief intelligence test which takes approximately 30 minutes, and a test involving visual search tasks, which takes approximately 40 minutes and is administered on a computer. (Please note that no computer expertise is required and that your use of the computer will consist only of pressing one of two keys.)

The intelligence test contains items related to your vocabulary and your ability to solve spatial problems. The visual search task requires you to search arrays of letters to determine whether a certain letter in a certain orientation is present or absent. Your accuracy and the time it takes for you to do this will be measured by the computer.

Your intelligence test score, as well as your solution times, will be kept completely confidential. Although the data collected today may be published in the future, your name will never be connected with your scores or with the study in published form.

There are no known risks involved with this study, and although some participants may find the problems challenging, most do not find the tasks uncomfortable.

There are no known direct benefits to you as a result of your participation in this study, but your participation may help others indirectly by providing us with information on the nature of cognition as a result of aging or brain-injury.

As a participant in this study, you have the right to ask questions pertaining to the clarification of your tasks, and to be informed of the nature of the study before you begin. Your participation is voluntary, and as such, you have the right to refuse to participate or to withdraw from the study at any time, with no penalty or loss of benefit. You will receive additional information about the study following your participation. You may, if you wish, receive a copy of this consent form.

By signing below, you acknowledge that you have read this consent form and you understand your rights in this study.

Name of participant (please print) ______________________________

Signature of participant ______________________________

Date signed ______________________________

Name of experimenter ______________________________

Signature of experimenter ______________________________

Date signed ______________________________

Name of witness ______________________________

Signature of witness ______________________________

Date signed ______________________________

Location of testing: Date 1______________ Date 2______________

Appendix B

Consent form for undergraduates

Illinois Wesleyan University
Department of Psychology
Consent Form for Undergraduate Research Participants

Title of Study: Inhibitory Mechanisms in Visual Search Tasks
Principle Investigator: Johnna K. Shapiro, Ph.D.

This is a study of attention and how it may change under different conditions. We are investigating whether factors such as age and presence or absence of brain-injury change the way that people use attention to search arrays of objects. As a participant, you may be asked some general information questions pertaining to your medical and educational background and then be given two tests: a brief intelligence test which takes approximately 30 minutes, and a test involving visual search tasks, which takes approximately 40 minutes and is administered on a computer. (Please note that no computer expertise is required and that your use of the computer will consist only of pressing one of two keys.)

The intelligence test contains items related to your vocabulary and your ability to solve spatial problems. The visual search task requires you to search arrays of letters to determine whether a certain letter in a certain orientation is present or absent. Your accuracy and the time it takes for you to do this will be measured by the computer.

Your intelligence test score, as well as your solution times, will be kept completely confidential. Although the data collected today may be published in the future, your name will never be connected with your scores or with the study in published form.

There are no known risks involved with this study, and although some participants may find the problems challenging, most do not find the tasks uncomfortable.

There are no known benefits to you as a result of your participation in this study, but your participation may help others indirectly by providing us a comparison for people who are older or who have suffered injury to the brain.

As a participant in this study, you have the right to ask questions pertaining to the clarification of your tasks, and to be informed of the nature of the study before you begin. Your participation is voluntary, and as such, you have the right to refuse to participate or to withdraw from the study at any time, with no penalty or loss of benefit. You will receive additional information about the study following your participation. You may, if you wish, receive a copy of this consent form.

By signing below, you acknowledge that you have read this consent form and you understand your rights in this study.

Name of participant (please print)______________________________

Signature of participant____________________________________

Date signed ____

Experimenter and witness signatures required on the back of this page.

Appendix C

Parental Consent form for children

Parental Consent for Participation in Research

Title of Study: Inhibitory Mechanisms in Visual Search Tasks
Principal Investigator: Johnna K. Shapiro, Ph.D.

This is a study of attention and how it may change under different conditions. We are investigating whether factors such as age and presence or absence of brain-injury change the way that people use attention to search arrays of objects. As a participant, you may be asked some general information questions pertaining to your child's medical background. Your child will then be given two tests: a brief set of cognitive measures which take approximately 30 minutes, and a test involving visual search tasks, which takes approximately 40 minutes and is administered on a computer. (Please note that no computer expertise is required and that your child's use of the computer will consist only of pressing one of two keys.)

The cognitive measures contain items related to your child's vocabulary and his/her ability to solve spatial problems. The visual search task requires your child to search arrays of letters to determine whether a certain letter in a certain orientation is present or absent. Your child's accuracy and the time it takes for him/her to do this will be measured by the computer.

Your child's score on the cognitive measures, as well as his/her solution times, will be kept completely confidential. Although the data collected today may be published in the future, your child's name will never be connected with his/her scores or with the study in published form.

There are no known risks involved with this study, and although some children may find the problems challenging, most do not find the tasks uncomfortable.

There are no known direct benefits to your child as a result of participation in this study, but his/her participation may help others indirectly by providing us with information on the nature of cognition as a result of aging or brain-injury.

As participants in this study, you and your child have the right to ask questions pertaining to the clarification of the tasks, and to be informed of the nature of the study before your child begins. Your consent and your child's participation are voluntary, and as such, you or your child have the right to refuse to participate or to withdraw from the study at any time, with no penalty or loss of benefit. You will receive additional information about the study following your participation. You may, if you wish, receive a copy of this consent form.

By signing below, you acknowledge that you have read this consent form and you understand your rights and those of your child in this study.

Name of participant (please print) ______________________________

Signature of parent or guardian ______________________________

Date signed ______________________________

Name of investigator ______________________________

Signature of investigator ______________________________

Date signed ______________________________

Name of witness ______________________________

Signature of witness ______________________________

Date signed ______________________________

Location of testing: Date 1________________ Date 2_____________

Appendix D

Background data sheet

Background Data Sheet

Department of Psychology-Illinois Wesleyan Unviersity

General Information

Name____

Address____

Phone_____________________________

Birthdate__________________________

Family Background

Marital Status S M D W

Children ____________________________

Medical History

Current medications____________________

Any past neurological problems (e.g., stroke(s), epilepsy, fainting, numbness, tingling)

Any current health problems:

Educational History

Highest level of formal education/degrees___________________________

Occupation____

Special training/courses

Current classes or projects

Appendix E

Kbit form

See "Discontinue Rule" in Chapter 2 of the K-BIT manual for information on when to discontinue testing on each task.

See "Obtaining Raw Scores" in Chapter 3 of the K-BIT manual for information on how to calculate raw scores.

Suggestions for follow-up testing or other recommendations

For additional forms, call or write AGS, 4201 Woodland Road, Circle Pines, MN, 55014-1796; toll-free 1-800-328-2560. In Canada 1-800-263-3558. Ask for item # OT3352, K-BIT Individual Test Records (25/package).

Kaufman Brief Intelligence Test SCORE PROFILE

See "Graphing Standard Scores" in Chapter 3 of the K-BIT Manual for directions.

	Standard Score ± Band of Error
Vocabulary	±
Matrices	±
K-BIT IQ COMPOSITE	±

Standard Score: 40 50 60 70 80 90 100 110 120 130 140 150 160

-4SD -3SD -2SD -1SD Mean +1SD +2SD +3SD +4SD

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K·BIT KAUFMAN BRIEF INTELLIGENCE TEST

by Alan S. Kaufman and Nadeen L. Kaufman

Individual Test Record

Name ______ Sex

Parents' names ______

Home address ______ Phone ______

Grade (if enrolled in school) ______ Highest grade completed (if no longer in school) ______

Current or previous occupation (if applicable) ______

Examiner ______

	YEAR	MONTH	DAY
Test date			
Birth date			
Chronological age			

SUBTESTS	Raw Score	Standard Score ± Band of Error % Confidence (Table C.1, C.3)	National % ile Rank (Table)	Descriptive Category	Other Data (please specify)
Expressive Vocabulary					
Definitions	+				
VOCABULARY		±			
MATRICES		±			
Sum of Subtest Standard Scores					

Transfer sum to K-BIT IQ Composite below

COMPOSITE	Sum of Subtest Standard Scores	Composite Standard Score & Band of Error % Confidence (Table C.2, C.3)	National % ile Rank (Table C.4)	Descriptive Category (Table C.4)	Other Data (please specify)
K-BIT IQ COMPOSITE		±			

Subtest Standard Score Comparison	Vocabulary Standard Score	Matrices Standard Score	Standard Score Difference	Significance Level (please circle) Table C.5
				NS .05 .01

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5

6

Subtest 1 – VOCABULARY
Part A – Expressive Vocabulary

Item	Response	Score (circle)
1. bed		1 0
2. fork		1 0
3. frog		1 0
4. hammer		1 0
5. bus		1 0
6. umbrella		1 0
7. window		1 0
8. piano		1 0
9. ladder		1 0
10. drum		1 0
11. leaf		1 0
12. lamp		1 0
13. flashlight		1 0
14. owl		1 0
15. smoke		1 0
16. feather		1 0
17. bridge		1 0
18. water fountain		1 0
19. pencil sharpener		1 0
20. calendar		1 0
21. tack		1 0
22. doorknob		1 0
23. penguin		1 0
24. hook		1 0
25. ruler		1 0
26. screw		1 0
27. saddle		1 0
28. binoculars		1 0
29. globe		1 0
30. cactus		1 0
31. cash register		1 0
32. battery		1 0
33. magnifying glass		1 0
34. anchor		1 0
35. antlers		1 0
36. escalator		1 0
37. tweezers		1 0
38. fire extinguisher		1 0
39. life jacket		1 0
40. fire hydrant		1 0
41. funnel		1 0
42. outlet		1 0
43. compass		1 0
44. hexagon		1 0
45. thermostat		1 0

Ceiling Item = highest item administered
Errors = total number of items scored 0

Ceiling Item ◯
minus Errors ◯
equals Raw Score ▢

Comments and Observations

Subtest 1 – VOCABULARY
Part B – Definitions

Item	Response	Score (circle)
Sample A	brown	
Sample B	antique	
1. school		1 0
2. rainbow		1 0
3. sunshine		1 0
4. delicious		1 0
5. plow		1 0
6. chimney		1 0
7. daisy		1 0
8. uncle		1 0
9. Eskimos		1 0
10. lie		1 0
11. gallant		1 0
12. experiment		1 0
13. evacuate		1 0
14. jeopardy		1 0
15. gratitude		1 0
16. elevate		1 0
17. sufficient		1 0
18. indicate		1 0
19. vitamin		1 0
20. relinquish		1 0
21. confound		1 0
22. tenacious		1 0
23. hypochondriac		1 0
24. chaos		1 0
25. caricature		1 0
26. apathetic		1 0
27. indelible		1 0
28. enamored		1 0
29. clandestine		1 0
30. omnipotent		1 0
31. lethargic		1 0
32. contingent		1 0
33. rancor		1 0
34. valedictorian		1 0
35. acquiesce		1 0
36. enigma		1 0
37. serendipity		1 0

Ceiling Item ◯
minus Errors ◯
equals Raw Score ▢

Comments and Observations

Subtest 2 – MATRICES

Item	Response	Score (circle)
Sample A	A	
1. A		1 0
2. C		1 0
3. E		1 0
4. D		1 0
5. A		1 0
6. C		1 0
7. B		1 0
8. D		1 0
9. E		1 0
Sample B	C	
10. A		1 0
11. F		1 0
12. B		1 0
13. F		1 0
14. C		1 0
15. B		1 0
16. A		1 0
17. H		1 0
18. C		1 0
19. G		1 0
20. A		1 0
21. D		1 0
22. F		1 0
23. E		1 0
24. E		1 0
25. A		
26. H		
27. D		
28. H		
29. C		
30. F		
31. B		
32. G		
33. G		
34. G		
35. C		
36. E		
37. C		
38. D		
39. A		
40. H		
41. A		
42. H		
43. B		
44. A		
45. B		
46. B		
47. A		
48. G		

Ages 6-10 go to item 10.
Ages 11-90 go to item 15.

Ceiling Item ◯
minus Errors ◯
equals Raw Score ▢

Comments and Observations

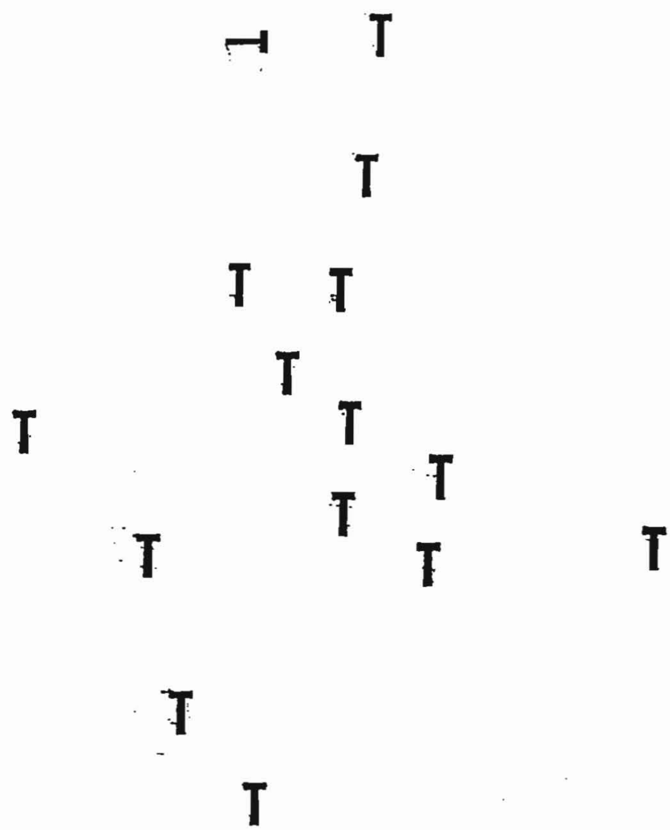
Figure Captions

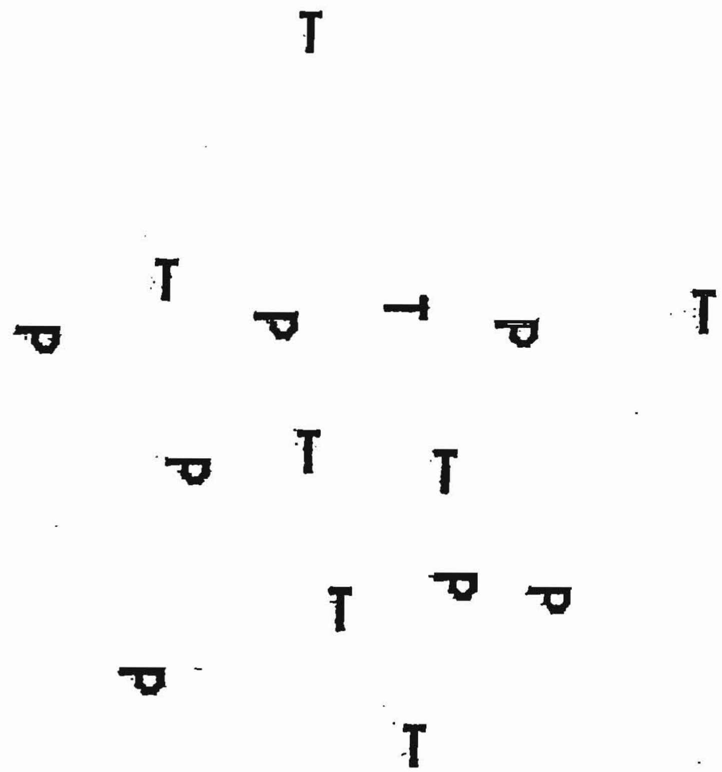
Figure 1. Simple condition with a display size 15 and target stimuli present.

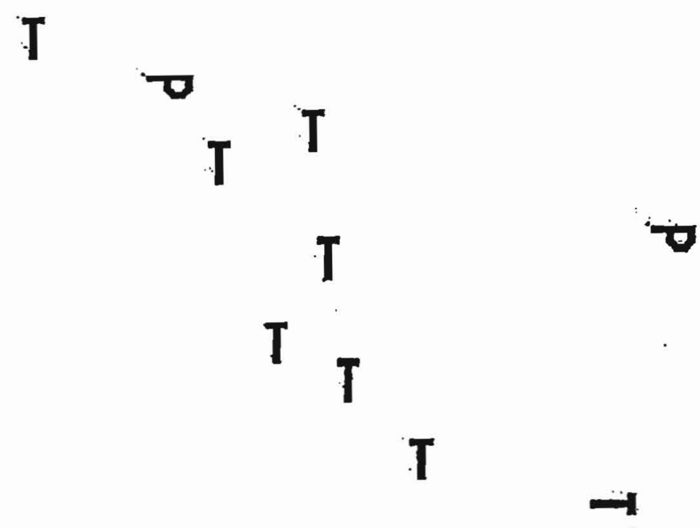
Figure 2. Conjoined condition with a display size of 15 and target stimuli present.

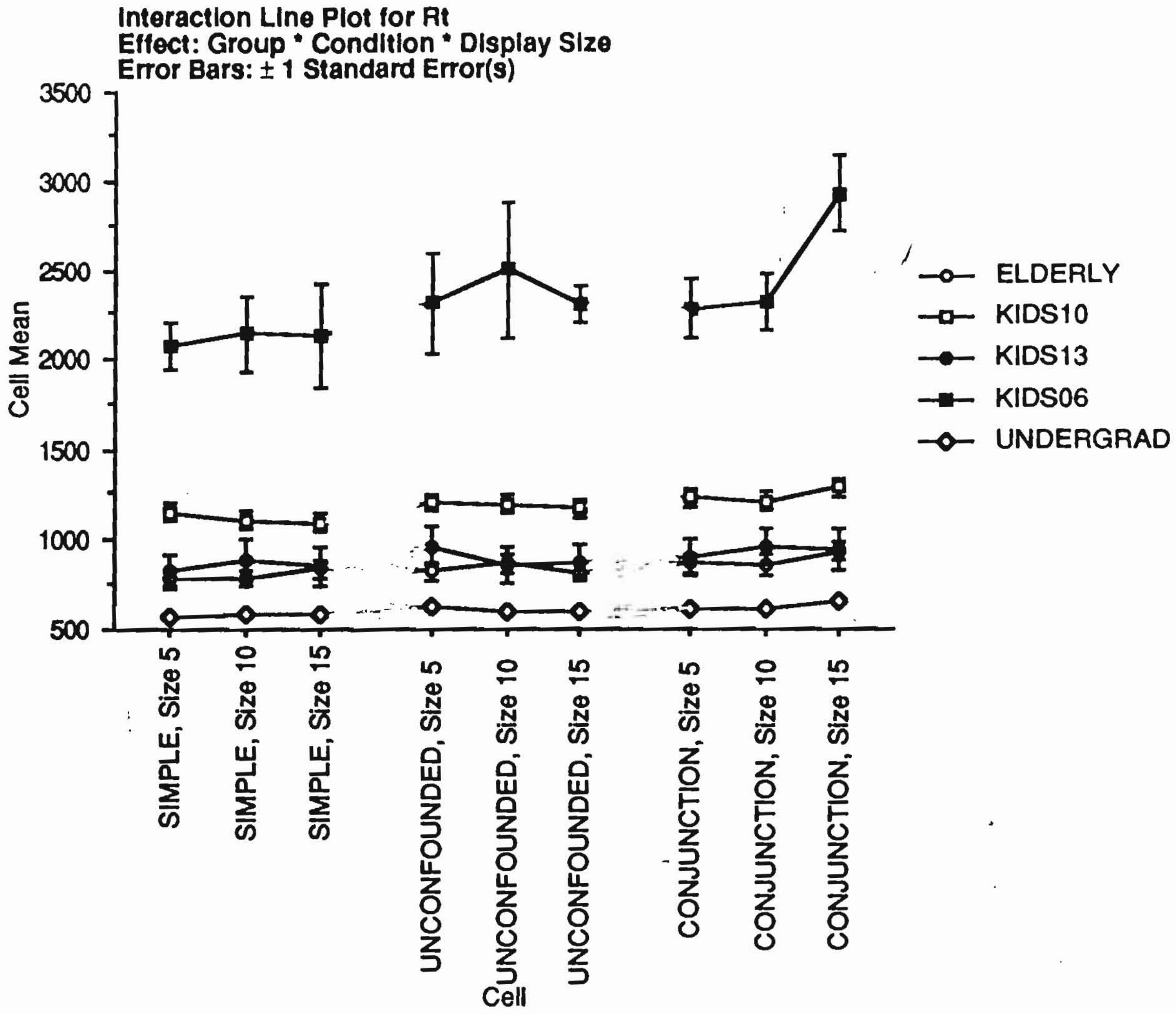
Figure 3. Unconfounded condition with a display size of 10 and target stimuli present.

Figure 4. Three-way interaction between age, size and condition.









Bonferroni/Dunn for Rt