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The visual trainer: A visual training program for the Commodore 128

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<u>The Visual Trainer</u>

A Visual Training Program

for the Commodore 128

Senior Research Project

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Abstract

A vision therapy program was devised and written using the Commodore 128 Computer. The program is designed to be used by the patient either at home or with a therapist in the office. This program consists of options to train and enhance saccades, pursuits, convergence and divergence fusion ranges, laterality/directionality, visual memory, and eye-hand coordination. With the use of prisms and lenses the vergence and accommodative systems may also be improved.

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Introduction

Since the advent of the home computer there have been several programs written to aid the therapist in the delivery and administration of vision therapy. The purpose of this vision therapy program, "The Visual Trainer", is to train eye movements, teach improved coordination of the two eyes, and enhance visual perceptual skills for efficient and comfortable binocular vision. The "Visual Trainer" program is designed so that it will be easy enough for the lay person to understand and administer the program at home and sophisticated enough that it may be used as an in office training device for the professional therapist.

The "Visual Trainer" is not meant to supplant traditional therapy. Instead, it is another tool in the therapist's battery. It should be particularly useful for training and motivating children and young teens. While primarily intended for GBD work, it should prove useful for amblyopes and intermittent strabismics.

The program includes some of the most basic important exercises to help the person with reading, comprehension and memory. The exercises are designed to train voluntary fixation, the slow and fast pursuit tracking of objects, and the binocular pointing ability of the two eyes, all of which are necessary for efficient visual information gathering and processing. The "Visual Trainer" also includes exercises for visual memory, right and left laterality/directionality, and eye-hand coordination. Many variations may be used with any of the options in the program. The use of colored filters will act as a suppression control to insure both eyes are simultaneously perceiving a given

stimulus. We found that Red/Blue glasses work better than Red/Green for cancellation. These can be made by replacing the green acetate with blue acetate. Then adjust the color and luminance controls for maximum cancellation. Incorporation of lenses and prisms may be used before the eyes to increase the focusing demand and the eye pointing accuracy.

The techniques included in this program along with any other visual training program require the person to attend to the task at hand. Through the attention given to the task the person is able to improve his visual perceptual skills and coordination of the two eyes together for a more efficient and comfortable binocular visual system. Vision and attention are active cognitive processes that are inseparable at the cortical level. The most powerful visual training techniques are those that harness maximal attentional involvement. The "Visual Trainer" programs have been designed as interactive and performance goal oriented, so as to garner greater patient involvement in short-term as well as long-term outcomes during remedial therapy.

Notes about program operation.

This program requires the following equipment: 1) Commodore 128 Computer. 2) Model 1541 or 1571 Disk Drive. 3) Any compatible monitor or television. 4) Two compatible joysticks.

Loading time with the 1541 disk drive is 2 minutes and 20 seconds. This process can be accelerated with the addition of any commercially available fast load cartridge. Loading then takes less than 1 minute. The 1571 disk drive loads in less than 30 seconds.

To load the program: 1. Turn on the disk drive and monitor.

2. Place the "Visual Trainer" disk into drive. 3. Turn computer
on. The disk contains an 'auto booter' which automatically loads
and executes the program.

To break out of the program at any time and return to the
introductory menu, press the Run/Stop and Restore keys
simultaneously. Then type 'run', or press any of the function
keys, and wait for the program to reset to the main menu.

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TRAINING OPTIONS

1...BUMP'EM
2...LATERALITY
3...RANGE BUILDER
4...SHOOTING GALLERY
5...SPOTTIN' NUMBERS
6...TRACE RACE (1)
7...TRACE RACE (2)
8...VISUAL MEMORY

MAKE A SELECTION 1-8
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Purpose: This exercise is used to train slow pursuits or saccades by using peripheral vision and eye-hand coordination. It also works well as a motivation tool.

Instructions: This is a one-player game requiring a joystick. The goal is to get the highest total of bumps per game. Each game lasts sixty seconds. First, select your favorite targets on screen 1 (Figure 2). Time is recorded on the bottom left side of the screen. The score is on the bottom right (Figure 3). The player controls the red target. The object is to score as many points as you can by bumping the blue target with your red one. If you bump the border, accidentally or on purpose, your joystick-controlled target reappears in the center of the playing field. Todays high score is remembered while the computer is still on, so you can try to beat it later.

Figure 2.   Figure 3.
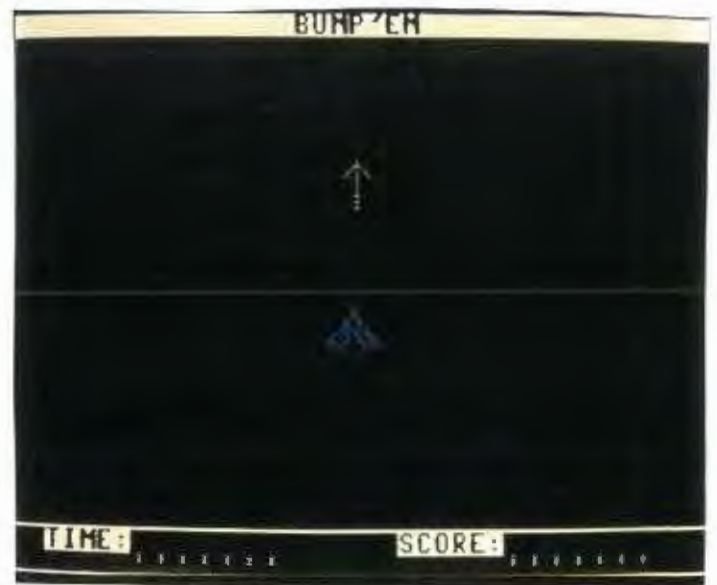
: When the patient watches the red target, the activity becomes basically a pursuit exercise. Monitoring the computer-controlled blue target using peripheral vision makes this more of a saccadic and motor coordination exercise. Red/blue glasses may be used. (See introduction)

Option 5, Spotting Numbers, is similar to Option #1, Bump'Em. Numbers randomly appear in various parts of the screen (Figure A). The patient responds by pressing the numbers on the keypad. Targets are selected on screen one and a numerical score is reported at the finish (Figure B).

Figure A.   Figure B.

Purpose: This exercise is used to train the awareness of right and left, on self and projected out into space.

Instructions: This is a one-player exercise. The setting for this exercise is a farm scene. In figure 4, the farmer is facing away from the patient to begin. Later in the program, in figure 5 he is facing toward the patient. The farmer may have his arm or leg raised. A question about which arm or leg is raised appears at the bottom of the screen. Questions may also be asked pertaining to the position of objects in the picture relative to the farmer. Type R for right or L for left.

Notes to the Trainer: Patient feedback at the beginning can enhance the learning experience with direct participation. Movement of the patient's arms or legs, and verbalizing, can act as a reinforcer. As the patient's skill progresses, mental confounding can be introduced by asking the player to move the same limb, but say the opposite. Variations on this theme include: say same, move opposite, and say and move opposite.

Figure 4.   Figure 5.

Option 3
Range Builder

Purpose: This exercise is used to increase base-out and base-in
duction ranges. In a recent study, Majors demonstrated that this
technique was more effective in increasing BI ranges than
traditional therapy.

Instructions: This is an exercise to increase the flexibility of
your eye pointing. Place the prism in front of your right eye with
the fattest part of the prism on the bottom. Move your head
slightly forwards and back, till you see a third target in the
middle, between the upper and lower images. Look carefully at the
third or middle target. Is it the same color as the top or bottom
target? It should be a mixture of the two colors. Notice that the
middle target, the one you concentrate on, is complete. It has all
it's parts. The top and bottom targets are missing areas. Hit the
space bar to start. Your job is to keep the center target clear
and single for as long as you can. You can pause the game by
touching the space bar or pressing the joystick button. To restart
the targets in the same direction, hit the space bar again. Once
the middle target looks like it splits into two, hit either the <
or > keys to change direction. At the end check your maximum score
for both BO and BI ranges.

Notes to the Trainer: An 8-10 diopter prism is used base-down
before the right eye. When the bottom target moves to the right,
BI vergence demand is stimulated.   Select targets, color, size,
and speed at the beginning. Jumps are another option. To
calibrate, enter the screen width when instructed by program.
After the patient has obtained the third image, in the middle,

measure and enter the distance from the patient's face to the screen. Space bar starts the exercise (Base-out). The exercise can be paused by hitting the space bar. Continuing in the same direction is done by again hitting the space bar. To reverse the direction, hit the < or > key. To calculate the limits in each direction, hit "c" during a pause. Monitor binocularity with suppression cues in targets (ex: bubbles on fish, cross on window, features on clown, fuse on bomb). The final screen shows maximum values for the day/trial.
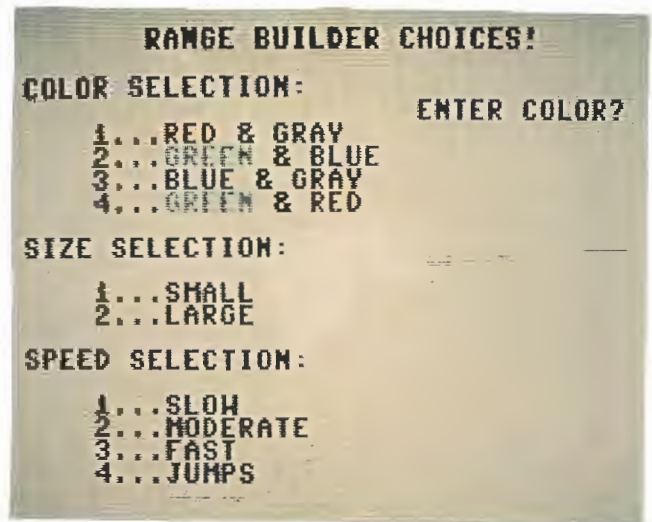
Figure 6.

Figure 7.

Figure 8.

Option 4
Shooting Gallery

Purpose: This exercise is used to train slow and fast pursuit tracking or saccades by using peripheral vision and eye-hand coordination. It also works well as a motivation tool

Instructions: This is a one-player game. The goal is to fill the score box at the bottom left side of the screen before the gun shoots all of your targets lined up on the right border of the screen. You increase your score, and fill the score box with grey by responding correctly to the arrow on each bullet as it comes out of the gun. If the arrow on the bullet points up, your response should be pushing forward on the joystick. Be careful, push the right direction on your first try because you get only one try per bullet. The first screen lets you select your targets. Screen 2 selects speed of the bullet. Speed ranges from 1-15. Fifteen is the fastest bullet speed. If all the bottles are hit by bullets before your score box is full, the game is over. You can then decide whether to try againor return to the main menu.

Notes to the Trainer: 1. Select target (Figure 9) 2. Select speed. Enter choice, 1 through 15. Push return (Figure 10). 3. Push joystick button to begin.

Figure 9.

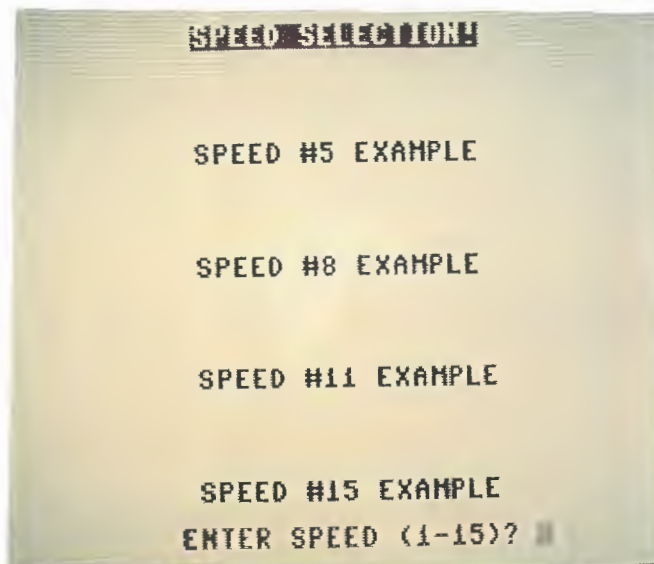GALLERY TARGET SELECTION

SET 1 -
SET 2 -
SET 3 -
SET 4 -

MAKE A SELECTION 1-4

Figure 10.

SPEED SELECTION

SPEED #5 EXAMPLE

SPEED #8 EXAMPLE

SPEED #11 EXAMPLE

SPEED #15 EXAMPLE
ENTER SPEED (1-15)?

Figure 11.

SHOOTING
GALLERY

SCORE

Purpose: This exercise is used to train slow pursuits and
eye-hand coordination. It also works well as a motivator.
Instructions: This is a one-player game. The goal is to race
your car, the one at the top of the screen, to the finish line and
get there before the computer car does (Figure 12). This is done
by using your joystick (Port 1) to move your line over onto the
figure in the middle of the screen. Next, trace over the figure,
carefully keeping your line on top of it. You will know when you
are on top of the figure by listening for the sound of your cars
engine, and watching the outline of the shape turn yellow as you
trace over it (Figure 13). You also have one more trick in your
bag. If the race looks close, as you approach the finish line hit
the joystick button to get a Turbo Boost. The super Turbo Boost
can only be used once during each race, so save it until you need
it. At the end of the race you may watch the Award Ceremony or
return to the main menu. Pressing the spacebar after the ceremony
takes you to the main menu. Press the space bar to begin.
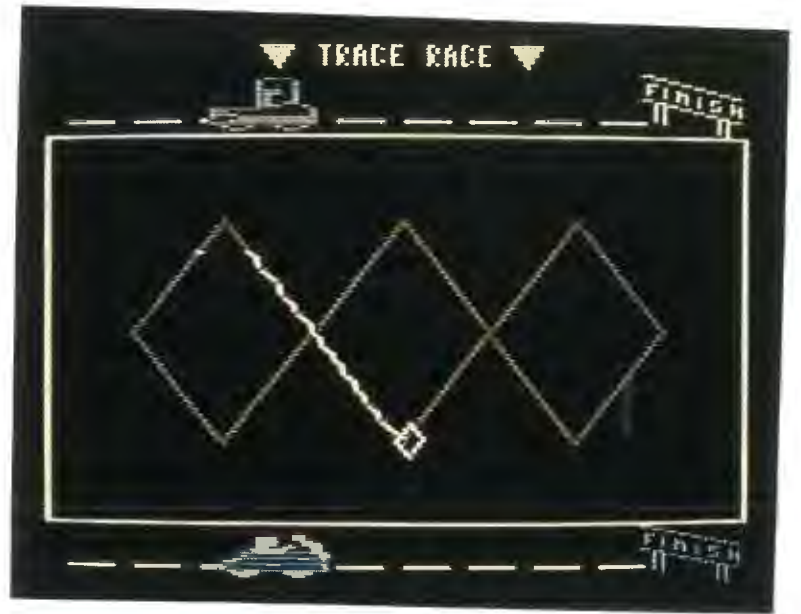
Figure 12.

Figure 13.

Figure 14.

Option 7
Trace Race 2

Purpose: This exercise is used to train slow pursuits and
eye-hand coordination. It also works well as a motivator.
Instructions: This is a two-player game. A helper is needed to
draw a figure with a joystick (Port 2). The goal is to race your
car, the one at the top of the screen, to the finish line and get
there before the helpers car does. This is done by using your
joystick (Port 1) to move your line over onto the figure that is
being drawn in the middle of the screen by the helper. Your line
is red. The helper's line is blue. The helper controls the other
car with his joysyick. Next, trace over the figure, carefully
keeping your line on top of the one being drawn by the helper
(Figure 14). You will know when you are right on the line by
listening for your cars engine, and watching the figures outline
turn yellow as you trace over it. You also have one more trick in
your bag. If the race looks close, as you approach the finish
line hit the joystick button to get a Turbo Boost. The super
Turbo Boost can only be used once during each race, so save it
until you need it. At the end of the race you may watch the Award
ceremony or return to the main menu. Pressing the spacebar after
the ceremony takes you to the main menu. Press the space bar to
begin. Note: Increasing the amount of diagonal lines drawn, (not
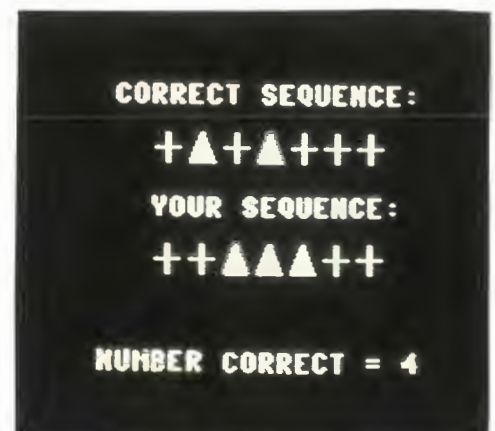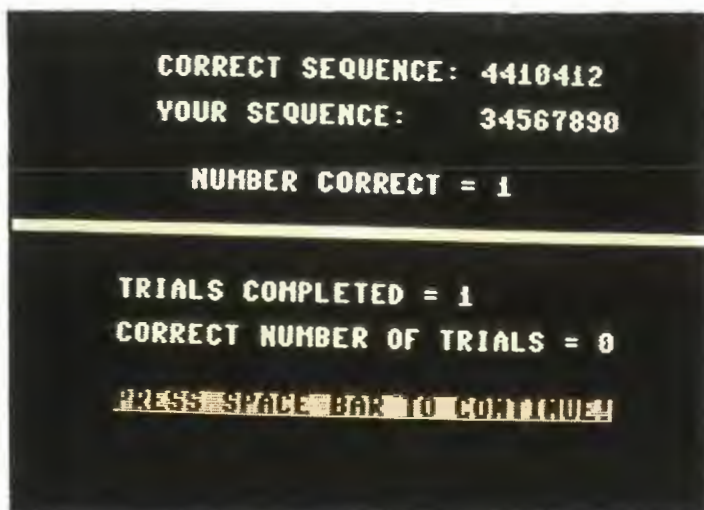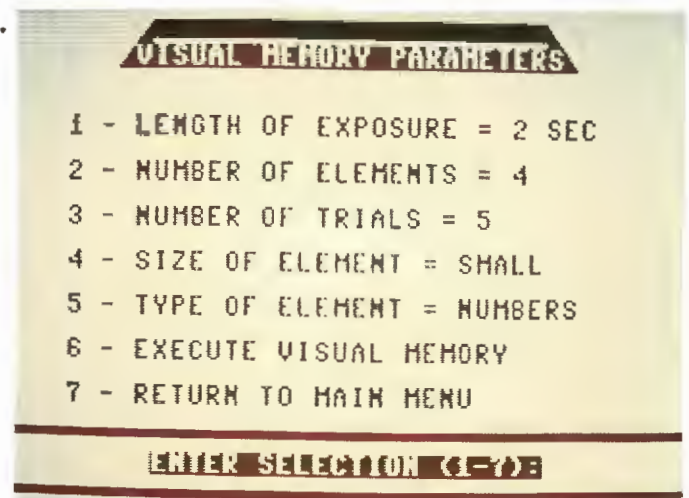up and down, or across), increases the difficulty for the patient.

Purpose: Efficient visual learning is the product of many complex processes. Effective visual learning requires adequate short-term visual memory function. This includes the ability to transfer information to longer term storage and rapid accurate access to that information. This visual perceptual exercise is used to improve visual attention, short term visual memory, and retrieval. One area where this skill is important, is in the process of learning to read.

Instructions: This is a game to help you remember things you see. While you concentrate on the screen, a series of numbers, letters, colors, shapes, or words are flashed on the screen. Your job is to reproduce them from memory by typing them into the computer. The computer will then tell you how accurately you remembered them. The more you get right, the better you are doing. The first screen lets you choose what kind of target you will see, how long it will be flashed on the screen, how many will be in each flash, the size of the target, and how many trials you get (Figure 15). Push 6 to start and 7 to quit. You have a keyboard overlay to show which keys to hit for the colors and shapes. On all other types of targets just hit the correct keys on the computer keyboard. For targets other than the colors and shapes, watch the spot in the middle of the screen. This will make sure you are looking in the right area when your targets are flashed. After you type your answer, hit the return key, except for colors and shapes, to let the computer know that you are done. Push space bar to start. At the end, push space bar again to return to the

Visual Memory menu.

Notes to the Trainer: The shortest exposure time for any element
is .05 sec. This time may be varied depending on the difficulty
level. Maximum number of objects or digits per flash is 9 for the
small targets, and 7 for the large ones. The word lists are
graded with approximately 125 words for each grade, 1 through 6.
Grades 7 through 12 have 25 words each. Remember to hit return
after entering except in the case of colors and shapes.

Figure 15.

VISUAL MEMORY PARAMETERS

1 - LENGTH OF EXPOSURE = 2 SEC
2 - NUMBER OF ELEMENTS = 4
3 - NUMBER OF TRIALS = 5
4 - SIZE OF ELEMENT = SMALL
5 - TYPE OF ELEMENT = NUMBERS
6 - EXECUTE VISUAL MEMORY
7 - RETURN TO MAIN MENU

ENTER SELECTION (1-7)

SOGLUYU

EXTRICATE

CORRECT SEQUENCE: 4410412
YOUR SEQUENCE: 34567890

NUMBER CORRECT = 1

TRIALS COMPLETED = 1
CORRECT NUMBER OF TRIALS = 0

PRESS SPACE BAR TO CONTINUE

CORRECT SEQUENCE:
+▲+▲+++
YOUR SEQUENCE:
++▲▲▲++

NUMBER CORRECT = 4

Conclusion

The "Visual Trainer" is a Commodore 128 software program designed for both in office and home vision therapy. The following hardware is needed to run the program: Commodore 128 computer, Commodore 1541 or 1571 disk drive, a computer or television monitor, and two compatible joysticks.

The main program consists of 8 options designed to improve oculomotor skills; break suppression; increase fusional ranges; improve visual memory; teach laterality; and/or improve eye-hand coordination. Various lenses and prisms may also be used to improve the vergence and accommodative systems.

Computer visual training programs have proven to reduce asthenopia, improve vergence ranges, and correct binocular anomalies. Computers also serve as a great motivational tool for the patient. For these reasons the "Visual Trainer" has been designed to enhance and add variety to any traditional therapy program.

References

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