SCIENTIFIC AMERICAN FRONTIERS

TEACHING GUIDE

www.pbs.org/saf/1302

Make Up Your Mind

Activity 2: Grades 5-8

The Stroop Effect

As you saw in "Tough Choices," your brain has specific areas that process different types of information. One region works with language - able to decode letters and recognize the meaning of the words they form. Another analyzes colors. When the messages from these two centers clash, the brain is in conflict. To sort out the discrepancy and arrive at the "best" solution, scientists on the program theorize that brain relies on an area as called the anterior cingulate to help it focus.

The Stroop Effect was named after psychologist Ridley Stroop who investigated this phenomenon in the 1930s. He uncovered that the act of reading words sends a message to the brain that is difficult to suppress. When a word's meaning is combined with a conflicting message, such as the word's color, it interferes with processing, causing delays and errors in the response. The activity that follows is a low-tech version of the Stroop Test that challenged Alan on this show.

This activity page will offer:

- Insight into understanding processing conflicts
- A hands-on minds-on activity using the Stroop Effect
- An opportunity to design psychological tests

MATERIALS

- Markers
- Unlined white paper
- Ruler
- Pencil

PROCEDURE

1. Use the ruler and a pencil to draw five horizontal lines across a sheet of drawing paper. Don't press down too hard with your pencil, since the lines will act only as a guide to insure that your writing remains level and consistent. Each line should contain four words, so arrange the spacing accordingly.
2. Pick any colored marker. Then, use that marker to spell out any color other than that of the marker. For example, if you select a red marker, you could write the word "blue" or "green" or "orange". The only word you should not write is "red."
3. Pick another marker. Again, use this marker to write a color word that contrasts with the actual ink color of this marker. Continue in this fashion until the five lines are filled with a total of twenty contrasting color words.
4. Select a subject who will participate in your survey. Display the chart and use the first word as an example. Explain that the subject needs to identify the color of ink used to create each word - not the word that is being spelled. So if red letters are used to spell the word blue, the subject must say "red".
5. Once they understand their responsibilities, you are ready to proceed. Begin with the top line, reading across. Ask them to recite the correct ink colors for each of the displayed words. When they are done, have them continue with the other lines. Once all twenty words are read, ask them to repeat the exercise.

Questions

1. How did your subjects respond to the test?
2. Does practice improve a person's ability to identify colors?
3. Do you think that turning the chart upside down would affect the results?
4. What strategy might help to identify the words with less difficulty?

EXTENSIONS

Quantitative Results

Now that you see how this works, it's time to produce hard data associated with the Stroop Test. Create a strategy for measuring time as part of this activity. How should you begin? Should you see how long it takes someone to recite the whole list? Should a subject go back and start from the beginning when a mistake is made? Or should the time be fixed, with the number of

wrong answers recorded when time is called? Perhaps you should measure the amount of time that a person hesitates before stating their answer? It's up to you.

Gender Bias?

Do you think that the Stroop Effect equally effects males and females? Why or why not?

(Accept all reasonable answers.)

Design a test that might show the influence that gender might have on color word confusion. Once you have developed your strategy, share it with your teacher. With the instructor's permission, gather data on a group of subjects. Keep a record of how the groups organized by gender perform. Share your research conclusion with your classmates.

Sound Too

Is the Stroop Effect limited to colors, or can we expand this to other sensations? Think about the meanings of the three words "right, left and center." When you hear these words most like you associate each mentally with a specific direction. Suppose you heard the words spoken to you from a certain direction, and that direction was the opposite of the word's meaning (For example, the word "left" is spoken on your right side). Would that affect how you process the information? Would you identify the direction of the spoken word sooner if it were consistent with the meaning of the word? Now, it's your turn. Use what you learned in the activity above and create a strategy for inquiry in which you could explore this sound version of the Stroop Effect. How would you develop a controlled experiment? What variables might be problematic? How would sounds be presented?

WEB CONNECTION

Explore the Brain and Spinal Cord
http://faculty.washington.edu/chudler/introb.html
Neuroscience for kids is one of the best sites on brain basics.

The Stroop Effect
http://faculty.washington.edu/chudler/words.html
This fun site offers an interactive online Stroop Test that times your responses.

PBS - The Stroop Test *http://www.pbs.org/wgbh/nova/everest/exposure/stroopdesc.html*
Learn how the Stroop Test is used to test climbers for altitude sickness, then take the test yourself.

The activities in this guide were contributed by Michael DiSpezio, a Massachusetts-based science writer and author of "Critical Thinking Puzzles" and "Awesome Experiments in Light & Sound" (Sterling Publishing Co., NY).

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Questions

1. How did your subjects respond to the test?
   (Most will demonstrate confusion and slowed processing when trying to deal with conflicting messages. Often, they first say the incorrect word but quickly go back and correct themselves.)
2. Does practice improve a person's ability to identify colors?
   (Accept all reasonable answers such as it will help people identify the color sequences they have practiced, but it may not improve performance when faced with a new set of confusing words.)
3. Do you think that turning the chart upside down would affect the results?
   (Yes - When the words are upside down, you can't read them. Since you wouldn't register a meaning for the symbols, there would be no conflict and therefore your processing would not be suffer from the Stroop Effect.)
4. What strategy might help to identify the words with less difficulty?
   (Accept all reasonable answers such as Alan's trick of trying to see the letters as nonsense symbols and not elements of language)

EXTENSIONS

Gender Bias?

Do you think that the Stroop Effect equally effects males and females? Why or why not?

(Accept all reasonable answers.)

Design a test that might show the influence that gender might have on color word confusion. Once you have developed your strategy, share it with your teacher. With the instructor's permission, gather data on a group of subjects. Keep a record of how the groups organized by gender perform. Share your research conclusion with your classmates.

CURRICULUM LINKS

General Science - Scientific Method:

Experimentation
Data Collection and Analysis

Biology:

Visual Sensory Systems
Auditory Sensory Systems
Stroop Effect
Experimental Design

NATIONAL SCIENCE STANDARDS (Grades 5-8)

Science as Inquiry- Content Standard A

Students will develop a systematic measurement strategy in order to collect more accurate data.

Students will design and conduct a controlled experiment.

Students will analyze data and draw conclusions about cause and effect relationships.

Students learn about advancement of science through legitimate skepticism, by asking questions and querying other scientists' explanations. Students evaluate these explanations by examining and comparing evidence while identifying faulty reasoning. Students will also suggest alternative explanations for other scientists' observations.

Life Science - Content Standard C

Students will examine behavioral response to external stimulus.