What Conflicting Mental Tasks Reveal About Thinking: The Stroop Effect

Experimental Procedure

This project follows the Scientific Method. Review the steps before you begin.

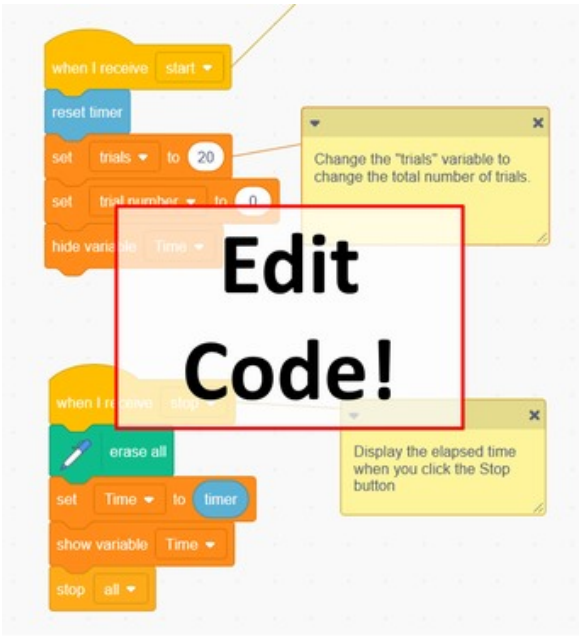
Working with Human Test Subjects

There are special considerations when designing an experiment involving human subjects. Fairs affiliated with Regeneron International Science and Engineering Fair (ISEF) often require an Informed Consent Form (permission sheet) for every participant who is questioned. Consult the rules and regulations of the science fair that you are entering, prior to performing experiments or surveys. Please refer to the Science Buddies documents Projects Involving Human Subjects and Scientific Review Committee for additional important requirements. If you are working with minors, you must get advance permission from the children's parents or guardians (and teachers if you are performing the test while they are in school) to make sure that it is all right for the children to participate in the science fair project. Here are suggested guidelines for obtaining permission for working with minors:

1. Write a clear description of your science fair project, what you are studying, and what you hope to learn. Include how the child will be tested. Include a paragraph where you get a parent's or guardian's and/or teacher's signature.
2. Print out as many copies as you need for each child you will be surveying.
3. Pass out the permission sheet to the children or to the teachers of the children to give to the parents. You must have permission for all the children in order to be able to use them as test subjects.

Note: there are two options to do this project. You can use a computer program that automatically generates randomly-colored words (Option 1), or you can print out paper flash cards (Option 2). Option 1 may be a better choice if you cannot get enough volunteers to do the experiment in person, since you can email them a link to the program.

Option 1: Computer Program



1. This option uses a beginner-friendly programming language called Scratch to generate sequences of words on the screen when you click a button. You read the words out loud and click a button when you are done. A built-in timer automatically measures how long it took you to read all the words. Scratch is a great way to learn coding for people with no previous coding experience. See Getting Started with Scratch from the Raspberry Pi Foundation to learn more about programming in Scratch.
2. We have prepared an example program to help you get started.
    a. Click the green flag to start the program on this page.
    b. Click the "start timer" button when you are ready to start the timer.
    c. Click either the "matched" (to generate words where the font color matches the word) or "non-matched" (to generate words where the font color does not match the word) button.
    d. Read the font colors of each word (not the words themselves) out loud.
    e. Click the "matched" or "non-matched" button again to generate a new list of words.
    f. Click the "stop timer" button when you are done with the last trial.
    g. The program will display your total time in seconds.
3. You can edit the code yourself if you want to change something.
    a. Read the comments (the yellow note boxes) to learn more about the code and how it works, and/or watch the video below.

b. Change the `trials` variable to change the total number of trials in each test.

c. To save a copy of the code, you must first create an account on the Scratch website. You can do this using the "Join Scratch" button in the top right.

d. After creating and logging in to your own account, click the "Remix" button at the top of the code page. This will create a "remixed" copy of the code that is saved in your own account.

https://www.youtube.com/watch?v=gcpyjQLqL9I

4. After you have made changes to the program, click the "See project page" button at the top of the Scratch page, then click "Copy link" in the bottom right. You can email this link to your volunteers.
5. You can now follow the procedure outlined under Option 2 using the computer program instead of physical flash cards (skip step 2).

Option 2: Printed Flash Cards

1. Do your background research so that you are knowledgeable about the terms, concepts, and questions, in the Background section.
2. Click the pdf file with four pages of color words that you can use for this project. Each page has the 20 sequences of five color words (red, blue, green, brown, purple) printed in pseudo-random order.
   a. Page one in the file has color words printed in matching color ink.
   b. Page two in the file has color words printed in different color ink (five examples of each different color).
   c. *Note:* Pages three and four have the color words printed in black ink. These can be used for a variation in the Make It Your Own section.
   d. Print the pages you need on card stock (for sturdiness), then cut them into horizontal strips.
   e. Keep the two sets in separate envelopes.
   f. Your volunteers will call out the ink colors as they read through the strips, one set at a time.
3. For each volunteer, instruct them on what they are supposed to do in the test:
   a. You will be given a set of cards where each card contains a word printed in colored ink.
   b. The ink colors used are red, blue, green, brown, and purple.
   c. The task is to call out the ink color of each word as quickly as possible without making a mistake.
   d. You will be given two sets of cards total (one set at a time).
4. Time how long it takes for the volunteer to name the colors in the set of cards with the non-matching words (timing how long it takes them to go through the entire set).
   a. You may want to make a data table in your lab notebook to collect your testing data.
5. Time how long it takes for the volunteer to name the colors in the set of cards with the matching words.
6. Repeat steps 4–5 with each volunteer, but for half of the volunteers, reverse the order and use the set with the matching words first.
7. Calculate the average time to name the colors for each set.
8. Calculate the time *difference* for each volunteer (i.e., non-matching word time minus the matching word time). Then

calculate the average difference for the group of volunteers.

9. Make bar graphs to illustrate your results.
10. Analyze your results. How noticeable is the time reaction delay due to the Stroop effect?

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