An Experiment to Test for the Stroop Effect
(Adapted from *Statistics: Learning from Data 2nd Edition*, Peck and Short, Cengage)

Background
In 1935, John Stroop published the results of his research into how people respond when presented with conflicting signals. Stroop noted most people are able to read words quickly and that they cannot easily ignore them and focus on other attributes of a printed word, such as text color.

For example, consider the following list of words:

green blue red blue yellow red

It is easy to quickly read this list of words. It is also easy to read the words even if the words are printed in color, and even if the text color is different than the color of the word. For example, people can read the words in the list

green blue red blue yellow red

as quickly as they can read the list that isn't printed in color.

However, Stroop found that if people are asked to name the text colors of the words in the list above (red, yellow, blue, green, red, green), it takes them longer. Psychologists believe that this is because the person responding has to inhibit a natural response (reading the word) and produce a different response (naming the color of the text).

If Stroop is correct, people should be able to name colors more quickly if they do not have to inhibit the word response, as would be the case if they were shown the following

Design an experiment to compare times to identify colors when they appear as text to times to identify colors when there is no need to inhibit a word response. Answer the following questions:

What is your response variable? How will you measure it?

How many subjects will you use in your experiment and how will they be chosen?

How is randomization incorporated into your design?

Give examples of two possible extraneous variables and indicate how your design addresses them. (Use the back of the page for your answer).

Two “Colorful” Classroom Experiments

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Collecting Data Sensibly

- Topics in the Introductory Statistics course
  - Collecting data via sampling
    - Random sampling
    - Other sampling methods

  Goal is to use sample data to learn about a population.

  - Collecting data via experimentation to compare two or more “treatments”
    - Random assignment of treatments to experimental units
    - Other aspects of “good” experimental design
      - Blocking, use of a control group, blinding
      - Potential confounding variables

  Goal is to assess the effect of treatments on a response

Culminating Activities for Design of Experiments

- Would you drink blue soda?
- Testing the Stroup effect

- Activities ask student to think carefully about how to design an experiment, collect data, and analyze data from an experiment. I would typically do one of these as part of a wrap-up of the collecting data section of the course.

- We only have 15 minutes, so will “talk” through these two activities.

Would You Drink Blue Soda?

- Adapted from *Making Sense of Statistical Studies*, Peck and Starnes, American Statistical Association, 2009

2002 Pepsi introduced a berry flavored cola drink called Pepsi Blue.

Pepsi Blue was NOT a success in the U.S. and was taken off the market in 2004.

Was the “fail” berry or blue???

Interesting side notes: Pepsi Blue is popular and continues to be sold in Indonesia and the Philippines. In 2015 a petition to bring back Pepsi Blue in the U.S. with over 4000 signatures was submitted, but it was politely rejected by Pepsi.

Testing for the Stroop Effect

The Value…

- These activities provide students with the opportunity to apply what they have learned about designing experiments and to think carefully about
  - The role of random assignment in experimental design (Blue, Stroop)
  - Selection of subjects in an experiment (Blue, Stroop)
  - Blinding (Blue)
  - Potential confounding variables (Stroop)
  - The need for careful planning before collecting experiment data (Blue, Stroop)
  - Using data from a well-designed experiment to reach a conclusion (Blue)
  - Generalizing the results of an experiment (Blue)

Thanks for attending this session!

- Questions?
- Comments?

- Questions or comments after this session?
  Email to rpeck@calpoly.edu

Would you drink blue soda?

Adapted from *Making Sense of Statistical Studies*, Peck and Starnes, American Statistical Association, 2009

Does what you see affect your perception of how it tastes? If color can influence how people think a food tastes, what implications does this have for companies that make and market food and beverages?

PepsiCo might be interested in your answer to these questions, since they have had two marketing failures based on introducing non-traditional colored beverages. In the early 1990's PepsiCo introduced Pepsi Clear, a cola-flavored drink that was clear instead of brown in color. Pepsi Clear was later discontinued because sales were low. In 2002, PepsiCo tried again with Pepsi Blue. Pepsi Blue was a berry flavored cola drink that was blue in color. The Pepsi web site (www.pepsi.com) says that Pepsi Blue was "created by and for teens. Through nine months of research and development, Pepsi asked young consumers what they want most in a new cola. Their response: Make it berry and make it blue."

Unfortunately for PepsiCo, Pepsi Blue, like Pepsi Clear, was not a successful product, and it was discontinued a few years later. So what happened? Was the mistake adding a berry flavoring to cola or making the cola blue, or a combination of both?

In this activity, you'll investigate whether teens have a preference for or a dislike for blue colored soda.

Getting started
To decide whether coloring a soda blue is a good or bad strategy if the drink is going to be marketed to teenagers, your group will design and conduct an experiment, collect and analyze the data, and then make a recommendation.

For this experiment, you can start with a clear colored soda, like 7-Up or Sprite. Experiment with adding blue food coloring to the soda to create a "recipe" for a blue version of the soda. Food coloring is tasteless, so the addition of food coloring will not change the actual taste of the soda.

Once your group has developed your new product, think carefully about how you would design an experiment to determine if teens have a preference for the clear soda or for the blue soda.

Once your group has a plan in mind, answer the following questions. Be as specific as possible in your answers. It is OK to modify the design of your experiment if any of these questions reveal a weakness in your original plan. Now is the time to revise, before you actually carry out the experiment and collect the data!

1. In taste test experiments like the one you are designing, it is usual to randomize the order in which subjects taste the two drinks. That is, some subjects should taste the clear drink first and then the blue drink, while others should taste the blue drink first and then the clear. A random mechanism would be used to determine the order for each subject. Why do you think it is important to randomize the order in which the drinks are presented in an experiment of this type?

2. What would be a good way to determine the order (clear then blue or blue then clear) for each subject?

3. What are the two treatments for this experiment?

4. Explain why it is not possible in this experiment to "blind" the subjects with respect to which experimental group they are in.

5. How will you select the subjects for your experiment, and how many subjects will participate? Be specific!

6. To what group, if any, will you be able to generalize the results of your experiment? Explain why you think it is reasonable to generalize to this particular group.

7. What question will you ask each subject after he or she has tasted the two sodas? Make sure that you will be able to determine from the response which of the two drinks was preferred.

8. After considering your answers to questions 1 through 7 and modifying your group's plan as needed, write a summary of your plan for conducting the experiment *on separate paper*. Include enough detail that someone who has not been part of your design team could read the summary and be able to carry out the experiment as you intended.

After your instructor has approved your experimental plan, carry out the experiment and collect data. Be sure to record the order in which the two drinks were tasted and the response for each subject.

Once you have collected the data, use it to fill in the four cells of the table below.

		Order	
		Clear then Blue	Blue then Clear
Preference	Clear		
	Blue		

9. Construct a graphical display that allows you to compare the preferences for the two different experimental groups (clear then blue and blue then clear).

10. Based on your display, do you think there is a difference in preference for the two experimental groups? That is, do you think that the order in which the drinks were tasted makes a difference? Explain.

11. Based on the data from this experiment, do you think there is a preference for one of the drinks (clear or blue) over the other? Explain, justifying your answer using the data from the experiment.

12. Write a report that makes recommendations to a soft drink company that is considering introducing a blue soft drink that will be marketed to teens. Include appropriate data and graphs to support your recommendations.

Sources:

The page entitled "Does the Color of Foods and Drinks Affect the Sense of Taste?" on the Neuroscience for Kids website http://faculty.washington.edu/chudler/coltaste.html has a list of references to studies that have examined how color affects perceived taste.

You can find an announcement describing the launch of Pepsi Blue at http://money.cnn.com/2002/05/07/news/companies/pepsi/.