

# Stroop Effect: Team challenge guide

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## 1 The Stroop effect

In a Stroop test[1], participants are asked to name the colour in which a word (or a set of random characters) is written. The time it takes participants to name the colour of the word (or list of words) is recorded. There are usually three conditions:

- “Neutral” condition: The word shown is either a colour-neutral word or a meaningless string of characters (for instance, **house**, or **xxxxx**).
- “Congruent” condition: The word shown designates the same colour as the ink in which it is written (for instance, **red**)
- “Incongruent” condition: The word shown is the name of a different colour than the ink in which it is written (for instance, **red**)

Stroop found that the content of the word has an effect on how long it takes participants to complete the colour-naming task: In the congruent condition (**red**), participants tend to be able to name the colour faster than for neutral words (**house**). This effect is called facilitation. On the other hand, in the incongruent condition (**red**), the task takes participants longer than for neutral words. This effect is known as inhibition. The term “Stroop effect” encompasses both those effects: facilitation and inhibition.

Several explanations of the Stroop effect exist (reviewed in [2]). What they have in common is the idea that the brain requires resources (processing capacity and time) in order to process stimuli, and if several stimuli are processed at the same time, they can interfere with each other. In this case, reading the word calls on the same processing resources in the brain as naming the colour of the ink and can therefore interfere with it. There is also the idea of “automaticity”: We are so used to reading that reading a word is almost an “automatic” process. It is very hard not to read the word, even if that is not part of the task. What the Stroop effect shows is that even if a process is automatic (or nearly automatic), it still uses processing resources in the brain and can therefore interfere with other processing tasks.

Recent research has explored a range of aspects of the Stroop phenomenon, from investigating how performance in the Stroop task changes with ageing [3],

to exploring whether there are differences in Stroop effect in native vs non-native speakers [4], or whether, among native speakers of Japanese, there are differences depending on what script is used [5].

## 2 Experimental setup

Make sure the experimental setup is well described for each experiment you present. It should be understandable to other scientists who were not there during the challenge lab. Go back to the lab activity guides to remind you of how the experiments were set up. Consider the following questions:

- Which experiment(s) do you want to present?
- What was the sequence of events in the experiment? Why was it set up this way?
- How many data points did you collect?
- What controls were done? What was compared to what?
- Would a diagram or some other visual aid help explain the experimental setup? If so, is it well presented and easy to understand?
- Are there problems/concerns with this specific setup? Could it be improved?

## 3 Data analysis

There are several angles you can explore in more detail. Which direction your team decides to pursue is up to you. For instance, you might look into the effect of practice on the Stroop task or on whether there are difference in a Kanji-based Stroop task between proficient speakers and early-stage learners of Japanese. In either case, ask yourself the following questions:

- What is the research question? What is your hypothesis? What outcomes would you expect if your hypothesis were true?
- What data can you use? What is the test group, and what is the control group?
- What do you see? How can you summarise your findings and present them to others?
- Can you think of alternative explanations to what you see?
- Can you think of interesting avenues for future research?

You can choose how to do your data analysis. A quick guide to R is provided on the course website: [http://melaniestefan.net/OIST\\_workshop.html#software](http://melaniestefan.net/OIST_workshop.html#software). But if you are familiar with a different software, please feel free to use that. The content of your data analysis is more important than the technical implementation.

## 4 Presentation

On Friday, you will present your results to the other students and faculty on the summer school. Please prepare a presentation of around 20 minutes in length. The presentation should include a brief explanation of the neuroscience behind the experiment, a presentation of the experimental setup, your data analysis, and conclusions and/or directions for future research you have identified. What media you use for presenting your work is up to you. There will be a projector, in case you have slides to show.

Your group is also asked to participate in a 20-30 minute panel discussion. Because two groups have been working on the same topic, we will first hear the presentations from both groups, followed by a panel discussion, where you will be asked to discuss similarities and differences between the work of both groups, and to answer questions from the audience.

We want all members of the group to be involved in the presentation and/or discussion - how you divide up the task is up to you.

## 5 Team work

During this assignment, you will be working as a team. How you organise your team work is up to you. Our TAs will observe how your team works together and give you feedback in the middle of the course, so you can improve the team working process if you need to. This is going to be an assessment of the team as such, not of individual team members, and it is meant as a way of helping you learn and grow. These are the things that we think make a successful team:

### Planning

- Team members understand and agree on goals and objectives.
- Team members try to gather information to understand the task/problem.

### Resource Management

- The team tries to sort and organise the information collected.
- The team tries to identify the skills needed for their goal.
- The team tries to divide responsibility and makes use of the team members' strengths.

### **Monitoring**

- The team meets periodically to check their understanding about the task/problem with each other.
- The team meets to discuss the usefulness of strategies and information for achieving their goal and make adjustments accordingly.

### **Evaluation**

- The team evaluates the strategies/solutions used. (More specifically, the team summarises the strengths and limitations of these possible strategies and solutions.)

### **Responsibility**

- Team members are responsible for their own part of jobs.
- The team tries alternative strategies and solutions to achieve their goals in the face of obstacles.

### **Team communication (social regulation)**

- Communication between members is open and participative.
- Team members try to take others' perspective when they have different opinions.
- There is a high degree of trust among members and conflict is dealt with openly and worked through.
- The team has agreed-on approaches to problem solving and decision making.

## **6 Getting help**

Feeling lost? Refer back to the materials from the quantitative workshops and the software guides on [http://melaniestefan.net/OIST\\_workshop.html](http://melaniestefan.net/OIST_workshop.html).

In addition, your group will be followed by two teaching assistants. Their job is to facilitate your work, not to tell you what to do. If you run into problems, approach your TAs and they will help you reason through them. They will also be able to answer questions you might have and to point you to helpful readings or resources.

Consider also using the message board on the course's facebook page to discuss issues with other participants: <https://www.facebook.com/groups/715195365275854/>

## References

1. Stroop, J. R. Studies of Interference in serial verbal reactions. *Journal of Experimental Psychology* **18**, 643–662 (1935).
2. MacLeod, C. M. Half a century of research on the Stroop effect: an integrative review. *Psychol Bull* **109**, 163–203 (Mar. 1991).
3. West, R. & Bell, M. A. Stroop color-word interference and electroencephalogram activation: evidence for age-related decline of the anterior attention system. *Neuropsychology* **11**, 421–427 (July 1997).
4. Coderre, E. L., VAN Heuven, W. J. B. & Conklin, K. The timing and magnitude of Stroop interference and facilitation in monolinguals and bilinguals. *Biling (Camb Engl)* **16**, 420–441 (Apr. 2013).
5. Coderre, E. L., Filippi, C. G., Newhouse, P. A. & Dumas, J. A. The Stroop effect in kana and kanji scripts in native Japanese speakers: an fMRI study. *Brain Lang* **107**, 124–132 (Nov. 2008).