What is the Stroop Effect?

The Stroop effect is a demonstration that reaction times are longer for stimuli that require resolving a conflict between a word and its colour.

Online Experiment (2-8 April, 2025)

Participants were shown twenty words displayed either congruent or incongruent. They had to select the correct colour as quickly as possible.

RED
Congruent

RED
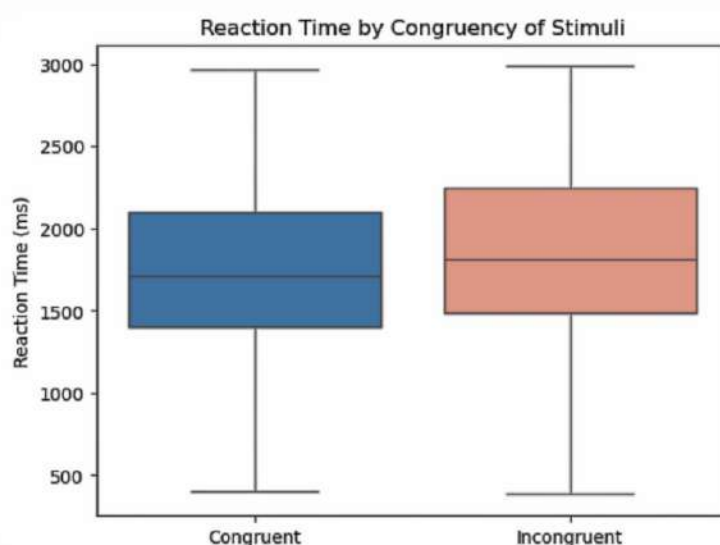Incongruent

Results

Reaction times were significantly slower for incongruent stimuli.

Example:

RED

Answer "Blue"

Reaction time by Congruency

Reaction Time by Congruency of Stimuli

Wilcoxon p = 0.004

Legend:
- Incongruent
- Congruent

MADE BY NIHARIKA MOHAPATRA

Exploring the Stroop Effect: A Reaction Time Study Using an Online Test

Background and Motivation

The **Stroop Effect**, first described by John Ridley Stroop in 1935, is a classic demonstration of cognitive interference. When the meaning of a word conflicts with the font color (e.g. "RED" printed in blue), individuals typically exhibit delayed reaction times. This delay arises from the automaticity of reading versus the more effortful process of color naming.

This phenomenon has been extensively studied in laboratory settings, but with the growing accessibility of web-based experiments, simple cognitive tasks like the Stroop test can now be deployed and studied remotely.

Procedure

Test Description:

To explore the Stroop effect in a real-world setting, an online Stroop test was developed and hosted at https://stroop-test.onrender.com. Participants were instructed to respond as

quickly as possible to the **colour of the word** displayed on screen, **not the word itself**, by selecting the matching colour button. Each session consisted of 20 trials, including both congruent (word meaning = font colour, e.g. RED) and incongruent (word ≠ font colour, e.g., RED) conditions. No personal information was collected, and participants could complete the test in under a minute. The test recorded reaction time (in milliseconds) and response accuracy for each trial.

Data Collection:

Data was gathered between April 2 and April 8, 2025, from voluntary participants (a total of 1387 trials). The downloaded dataset contained timestamped records for each trial, including:

- Word displayed
- Font colour
- Participant's response
- Reaction time (ms)
- Whether the response was correct

Initial cleaning involved filtering out responses with implausibly fast (<200 ms) or excessively delayed (>3000 ms) reaction times. All subsequent analysis was restricted to filtered responses only. After filtering, 1153 data points remained. The modified data is depicted in Table 1.

	word	color	response	reaction_time	is_correct	time	participant_id	is_congruent
0	RED	red	red	2124.0	1	Apr 02, 2025 08:44 AM	0	1
1	RED	yellow	yellow	2326.0	1	Apr 02, 2025 08:44 AM	0	0
3	RED	yellow	yellow	2004.0	1	Apr 02, 2025 08:44 AM	0	0
4	RED	yellow	yellow	2924.0	1	Apr 02, 2025 08:44 AM	0	0
6	GREEN	red	red	1804.0	1	Apr 02, 2025 08:44 AM	0	0
7	BLUE	red	blue	1968.0	0	Apr 02, 2025 08:44 AM	0	0
8	BLUE	yellow	yellow	1944.0	1	Apr 02, 2025 08:44 AM	0	0
10	RED	green	green	1912.0	1	Apr 02, 2025 08:44 AM	0	0

Table 1: Filtered data, with "is_congruent" column added to show whether the stimulus provided was congruent or not

Reaction Time Analysis

To assess whether participants responded differently to congruent and incongruent stimuli, **reaction times** across both conditions were compared. Reaction times for all congruent vs. incongruent trials (across all participants) was collected, treating each trial as an independent observation. The distribution of reaction times was not normal, which was confirmed via Shapiro–Wilk test (p-values of congruent and incongruent reaction times were < 0.05). Therefore, a **Wilcoxon rank-sum test** was used to compare reaction times across trial types.

As illustrated in Fig, 1, **incongruent trials tend to have slightly higher reaction times than congruent trials**. This difference was statistically significant (Wilcoxon $W = 701, p = 0.004$).
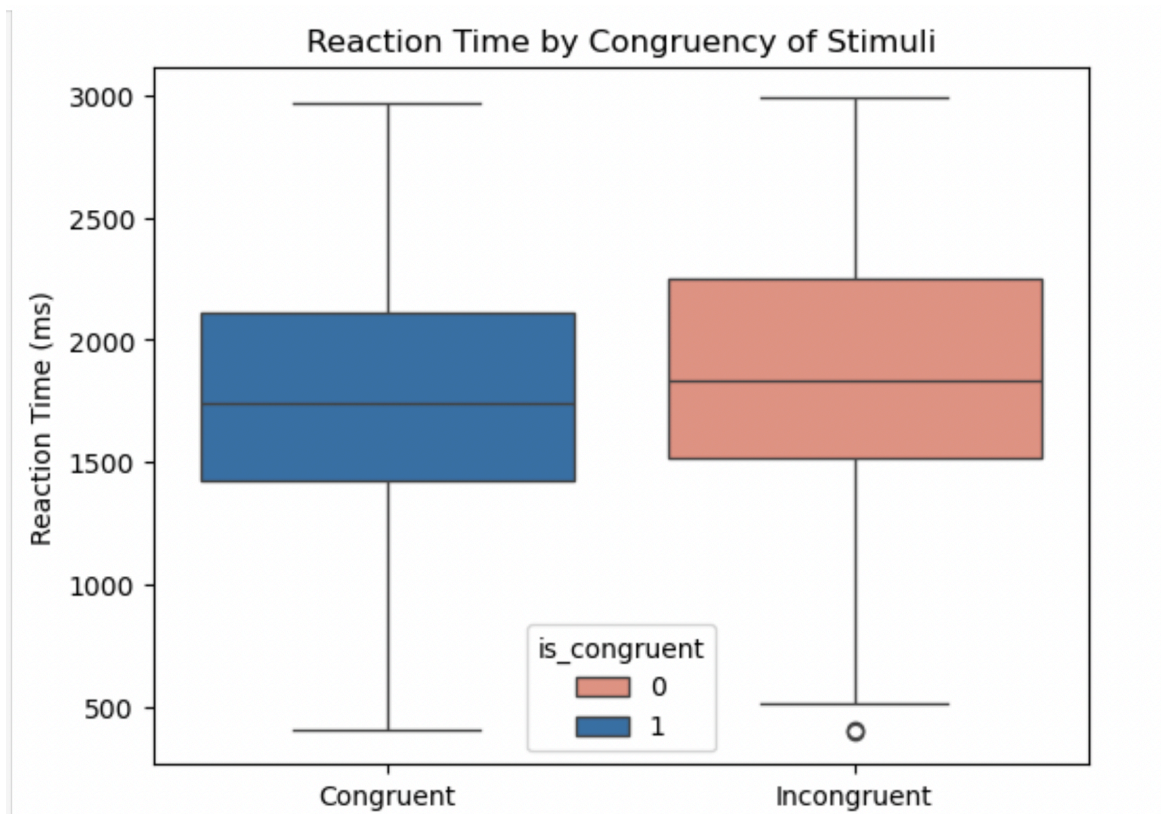
Fig. 1: Boxplot showing median and interquartile spread of reaction times for Congruent and Incongruent trials (Note the upward shift for incongruent responses)

Conclusion

This small-scale online implementation of the Stroop test successfully reproduced the well-known Stroop effect: **participants were slower to respond when word meaning and font colour conflicted**. This supports the notion that automated cognitive processes (like reading) interfere with tasks requiring controlled processing (like colour identification).