

# Cognitive processing and the stroop effect



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The area of study was cognitive processing. The aim of the experiment was to determine if there was a positive cognitive skill difference when a participant was given a matching variable of colours and words compared with a non-matching variable of colours and words. This is related to the Stroop Test published in 1935.

The experimental hypothesis of the study was “ There will be a decrease in processing time of congruent words and colours compared with incongruent words and colours”. The null hypothesis of the study was “ There will be no significant difference between the matching and non-matching variables and any difference would be down to chance”.

This was a laboratory experiment using the repeated measures design.

There were 10 participants, half male and half female. The sampling used was opportunity sampling.

The results showed there was a significant difference in cognitive processing skills ( $p < 0.05$ ). Conclusions drawn were that given primed information people can process data easier.

## Introduction

Cognitive processing can be described a process of the mind by which we become aware of objects of thoughts and perception, including all aspects of perceiving, thinking, and remembering. The stroop effect looks in to this by determining how an interference effect can slow or distort a person’s thinking, this is done by using incongruent or opposing stimulus.

The aim of this experiment was to show a similar effect of the stroop. However more exactly that processing speed varied when the semantic value of the word varied to that of the actual colour shown to the participant through a priming effect.

Similar research in to this area includes Cheesman and Merikle (1986) which used a variation of the stroop effect. In which a word was shown on a computer screen in black text then a coloured rectangle was shown. It was shown that naming the colour of the rectangle was slowed if the previous word was different to the colour. The results of this study reinforced an idea of “ priming” this is when one stimuli helps the person to associate with another stimuli and therefore find it easier to process. This effect also applies to the original stroop test done in 1935 in which participants could form patterns as the test was done multiple times over several days.

The experimental hypothesis or H1 was that, “ There will be a decrease in processing time of congruent words and colours compared with incongruent words and colours” was used. This was a one tailed or directional hypothesis because the study was concerned mainly with showing a significant increase in cognitive processing skills when primed with corresponding stimuli as opposed to just showing that there was an effect on processing skills. This was so that it would be clearly evident of the direction of any change in skill and so that any statistical analysis. The null hypothesis or H0 was that “ There will be no significant difference between the matching and non-matching variables and any difference would be down to chance.”

## **Method**

### **Design**

A laboratory experiment was used. This type of design was used as it meant that most variables could be controlled, this includes the time which was approximately 1pm onwards and the place which was a secluded bland room to minimize other environmental stimuli. Furthermore experiments are reliable, this is because they are easily replicable, this means that anyone that my want to repeat the experiment would be able to in the exact same way that the original experiment was done. Also it is the only method that can determine the cause and effect between variables. This means that because all variables are controlled the independent variable can be directly linked to the dependant variable. In this case, the matched / un-matched words are the independent variable and the time taken to read them aloud is the dependant variable. Finally accurate readings can be taken, this is because you can easily use measuring equipment because the participant is aware that they are being used as part of a study and therefore won't be as distracted by for example a stopwatch as someone that was not entirely aware that they were being assessed.

The laboratory experiment was completed using the repeated measures design. This is when a participant is asked to complete the task twice but with the independent variable changed in each test. The advantage of this method is that individual difference is reduced as there would be no difference in the people that are doing each part of the test. Also it reduces the number of participants required for the experiment, this is useful where only a limited number of people can be found to complete the task.

## **Participants**

Participants were found using opportunity sampling. The advantage of this type of sampling is that you are easily able to get a large number of participants, however it becomes difficult to control differences within the groups of people. The participants of this study were found in an office environment. Each group consisted of 5 people who were assigned randomly, 2 groups were used to create a counter balancing effect, this means that 1 group completed the un-matched situation first and the others the matched situation. This helps to rule out if any patterns about which order of colours was likely to come up. Finally an equal number of men and women were used this mean that it would be easier to determine if there was any type of gender bias.

## **Apparatus/Materials**

Materials required for this experiment included, a stopwatch to keep times, a scorecard to collate the information, and 2 sheets with the matching and non-matching variables of the coloured words (see appendices).

## **Procedure**

Prospective participants were asked if they were willing to undertake an attention span test in which they would be timed, if a participant consented they were asked to enter a side room in which they were then asked to read the standardised instructions (see appendices), once read they were asked if they would like to continue. Once ready the candidate was given the first set of words. Depending on which group they were in would determine which word set they would see first. As soon as the participant was given the words the stop watch started. Once the participant had said stop the timer stopped

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and the result was recorded. The participant was then asked when they were ready for the next part of the test. When ready they were given the sheet that they were not given last time and the process started again. Again when the participant said stop the timer stopped and the results recorded. At this point the participant was then asked if they would like to see their times. Next the person was given a debrief(see appendices), this included that the person was lied to about the original purpose of the test and were told that the test was part of a psychology experiment, at this point they were assured that the test in no way kept any personal information of theirs. The participant was then given the right to withdraw their results again and ask any questions they had.

## **Ethical Issues**

There were several ethical issues that came up in this experiment, these included, informed consent, a right to withdraw, and deception. At the beginning of the experiment the participants were deceived about the actual nature of the experiment, this is because the phrase “ psychology experiment” can carry a stigma with it and the person is more likely to not want to get involved in the start. This issue was mitigated through the use of a debrief with the right to withdraw, which would have meant finding replacement participant if the original was unwilling to carry on.

## **Results**

### **Descriptive Statistics**

Summary tables and graphs for matching and non matching times are shown below, a line of best fit was used to best demonstrate the difference between the time taken in the matching an non matching variables.

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Participant

Matching

(Seconds)

Non-Matching (Seconds)

Gender

Absolute Time Difference

1

19.68

24.26

Male

4.58

2

18.96

21.58

Male

2.62

3

12. 39

14. 70

Female

2. 31

4

13. 91

13. 90

Female

-0. 01

5

24. 23

29. 87

Male

5. 64

6

10. 87

13. 16



Female

2. 29

7

15. 14

12. 68

Female

-2. 46

8

22. 43

31. 36

Male

8. 93

9

17. 35

18. 65

Male

1. 3

10

14. 12

14. 89

Female

0. 77

Line Of Best Fit (Matching)

Line Of Best Fit (Non-Matching)

## **Inferential Statistics**

The scatter graph shows that there is a positive difference between processing speed when the participant is given the matching variable, this can be seen in the lines of best fit which have little overlay. The results were analysed using the Wilcoxon Signed Ranks test, this was to test whether my results were significant, this is done by setting a minimum level of statistical significance, which is ( $p < 0.05$ ). If the results are within this boundary it means that anyone who repeats the experiment should 95% of the time come out with similar results. The experiment met this level and therefore shows it is significant.

Using the Wilcoxon test it was possible to determine that the critical value by determining the  $n$ th. This is done by removing any results where the absolute difference = 0, in this case there were none which means there was an  $n$ th of 10. Using this I was able to see that the critical  $t$  value of this  $n$ th is 11. Once the critical value of  $t$  is determined it is possible to check that the <https://assignbuster.com/cognitive-processing-and-the-stroop-effect/>

observed t value is equal to or less than it. To determine the observed t value you need to rank the absolute value of difference. Depending if there are less negative or positive ranks add the rank values together (in this case 6 and 1). If the sum is less than the critical t value the p value is less than 0.05.

## **Discussion**

This study, like the stroop test that it was based on showed that the experimental hypothesis (H1) was to be accepted because it achieved statistical significance. The results also showed interesting results that were not expected. It appears that women performed better at the task than men, the expected result was that times would be similar for both, men and women, Another surprising observation of the results was the range of the results. It seemed that the women had a relatively small range of within 4 seconds however for the men it ranged 14 seconds, this could mean that cognitive processing is more organised in a female mind than a males.

Furthermore, because the experimental hypothesis was accepted it shows that there is a type of priming effect, this could mean that the way we perceive things could be influenced by environmental interference that we may not be aware of as seen in the Cheesman and Merikle (1986) study.

However while the study can be seen as valid there were limitations. These included the type of sampling, because it was opportunity sampling and within an office environment the population was not representative of the general population and therefore further research would be required to determine if this study can be generalised to the entire population. Another

limitation of the study was that it was a repeated measures design. This primes the participant to be more prepared for the second time completing the task, while there was a counterbalance effect used there is no way of telling if this was 100% effective. This is because participants were aware that this was a test and therefore there is an effect of participants trying to “please” the experimenter.

If this experiment was to be repeated, the following changes would be recommended. More participants should be selected; these participants should then try to be representative of the population to allow for more detailed and broader conclusions to be drawn. Finally each test should be done with a substantial time gap so as to lessen any preparation the participant would have to the task.

The main conclusion that can be drawn from this study is that presenting the participant with a the congruent stimuli (the word and the colour of the text) will mean that the participant can process the information faster than when given incongruent information.

Further research could focus on priming and interfering within the educational system. If possible it could help to determine which are the most helpful and harmful influences within the classroom, this in turn would help young children to develop easier, and could make learning a simpler experience for all ages. However this would depend on more complex priming methods which would be another important area in which to focus research.

Word Count: 2104

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