

A study to investigate the existence of the Stroop effect and the significance of attention

University of Wales Trinity Saint David

Abstract

This study was a partial replication of John Ridley's (1953) Stroop test. The aim of this study was to investigate the role of automaticity in relation to attention and the impact that interruption can have on reaction time. The Stroop test has been a key topic of experimental psychology since its founding and is regarded as influential as one of the preliminary experiments of attention (MacLeod, 1992). The hypothesis predicts that the incongruent list of words will take longer than the congruent word list. For this study a related-subjects design was used, 33 participants of 27 were female, and 6 were male. A related t-test using SPSS was carried out and revealed average recall scores for congruent words substantially faster than that for incongruent words, therefor supporting the hypothesis.

A study to investigate the existence of the Stroop effect and the significance of attention

Introduction

The ability to actively process specific information in the environment while filtering out other details is referred to as attention. Simple tasks demand attention and learning, without this ability, it is impossible to focus on everyday tasks such as navigating traffic while driving or walking or listening to music while conversing (Tatler & Land, 2016). There is a process by which people select information for further processing from a broad variety generated by social settings, which if practised frequently, can lead to automatic processing (Bargh, 1982). This entails withdrawing from certain factors in order to effectively deal with others, as well as taking control of the mind (James et al., 1890). There are various theories that support attention and several conclusions have developed over time as a result of enhanced research within this area. Cherry (1953) investigated the human ability to focus attention on one stimulus while filtering out all others, Cherry used a straightforward method of playing two separate communications to people at the same time, under a variety of conditions, resulting in gathering information relating to the capacity to differentiate one conversation from another (Arons, 1992). Cherry's original findings are important in cognitive psychology, allowing researchers to collect data on how good individuals are at screening, focusing attention, and switching attention back and forth. Using this data, Cherry discovered that people dismiss everything except which they are interested in (Wood & Cowan, 1995).

Partly following on from Cherry's cocktail party study, Broadbent's (1958) selective attention theory suggests that individuals have a filtration system, this enables someone to select significant information they are wanting to attend to. Broadbent argued that the information content would be critical in determining how many stimuli could be perceived (Treisman, 1969). As a result, the selective filter is designed to allow specific stimuli, such as colour, tone, and volume, to pass through the filter for further processing. Unattended stimuli are diffused out and lost if determined to be irrelevant to the subject's current concerns, based on its materialistic structural qualities, supporting previous research findings by Cherry (1953) (Conway et al., 2001). Another theory surrounding attention was revised by Shiffrin & Schnieder (1977), investigating the possibility of automatic processing they were capable of distinguishing between controlled processing (in which heavy demands are made requiring a large amount of sorting), and automatic processing, (which is a quick conversion that is not affected by limitations and occurs at an unconscious level). A learning to read activity, for example, can be difficult to master at first, but with practise, this challenge becomes automatic,

needing no commitment on the cognition's part and becomes resistant to change (Schneider & Shiffrin, 1977). Automaticity is frequently defined as processing without focusing or using attention, this design has continued to play an essential role in the advancement of existing theories, such as the Stroop effect (Logan, 1992).

Stroop's (1935) speed of processing theory is related to how quickly a person understands and reacts to data they receive. The Stroop test therefore designed for participants to look at a word list that are produced in various colours than the word's meaning. Participants are challenged to name the colour of the word, rather than the word itself, as quickly as possible. Because the mind reads words faster than what it takes to recognise colours, evidence suggests that the brain's ability to identify the colour of the word is delayed, implying that word processing is much faster than visual input (Stroop, 1938).

The rational of this study will be to determine whether automatic processing interferes with controlled processing by evaluating the Stroop test (1935) with a replicated method and gaining an understanding of the critical functions of information processing. The aim of this study is to help clarify findings and the importance of automaticity in relation to attention. This study will look into whether previous research was correct in its conclusion that word processing is significantly faster than colour processing.

Hypothesis

Colour naming times will be significantly longer during the incongruent condition.

Method

Design

A related-subjects design was used for this study. There was one independent variable with two conditions: Congruent and incongruent. The Independent variable was the congruency of the words and their colours. There was one dependant variable: the time taken to name the colours in minutes. Participants took part in both conditions of the experiment, on the same day one list directly after the other. A related t-test on SPSS was used for the results (See appendix 7).

Participants

An opportunity sample of 33 participants completed both conditions of this study: 27 female and 6 males. Ages ranged from 18-49 years ($M=29.42$ years, $SD=3.79$ years). Participants were undergraduate students from West Wales who took part in the study. All participants were made aware to the purpose of the experiment.

Materials

- 1 piece of white A4 paper, font Times New Roman size 26 in Bold.
One side of the paper with colour names identified by their correct colours, the other side of the paper with colour names identified by conflicting colours e.g., blue word in colour blue, other side of paper with blue word presented in colour Red (See appendix 1).
- Stimuli: 15 colour words presented in condition 1 were congruent- Ink and words the same. 15 colour words presented in condition 2 were incongruent- Ink and words not the same. Chosen by chief researcher Charlotte Greenway.
- A Stopwatch
- A pen and paper to record results.

Procedure

(See appendix 3)

Results

The table below presents the Mean and SD results for the Stroop test study of attention.

Table 1

Median and SD scores for congruent and incongruent words

Conditions	Mean	SD
Congruent	6.7	1.65
Incongruent	11.2	1.59

The median for congruent words is shorter than the median for incongruent words, as shown in Table 1. A related t-test was performed to see if the median scores for both conditions were less than the probability of .05.

A related t-test indicated a statistically significant difference between the two conditions ($t(32) = 14.49$, $p < .001$, Cohen's $d = 2.52$) The effect size was large (Cohen 1998).

Median recall scores for congruent words were quicker than for incongruent words (7 and 11, retrospectively), Indicating that the hypothesis was supported for the replication study of the Stroop test.

Discussion

This study's findings show that the median scores for the congruent words are lower than those for incongruent words, supporting the hypothesis that colour naming times will be significantly longer during the incongruent condition. As a result, these findings corroborate previous research such as Stroop's (1953) speed of processing theory that the mind reads words faster than it takes to recognise colours. Shiffrin and Schneider's (1977) automatic processing theory tested whether differences exist between controlled and automatic processing, the results of this study indicate that there is a possibility that this theory is relevant to the Stroop test, as reading the congruent words was quicker than identifying the incongruent words. Broadbent's 1952; Cherry's, 1953; theories have shown that whenever a person attempts to deal with competing communications, there is a limit at which effectiveness will dissolve, because although reading has become an automatic process, the procedure of filtering the data with colour characteristics, as shown with conflicting words, takes longer in the filtration system (Treisman, 1964). The current study has some flaws, such as the fact that there were fewer male participants than females, which may have influenced the outcome of the results, The Stroop task carried out on the other hand, demonstrated good strength, and provided a clear indication of people's ability to process attention.

The current study has limitations; despite the overall findings, no participants were screened for colour blindness or impaired vision; consequently, the Stroop test is questionable for the study of colour blindness. The room was loud at times, these conditions may have interfered with participants' attention, hence the results may be limited as a result of this. Studies have discovered Aerobic exercise and increased cardiovascular activity have been shown to have a significant impact on improving executive function that involves problem solving, such as incongruent words, when performed immediately after physical activity. This bodes well for future research to see if it can aid in effective cognition, specifically in improving attention (Tam, N, 2003).

To summarise the study's findings, evidence supports previous theories of attention, demonstrating that the Stroop test can be used to estimate a person's selective attention, abilities, and processing speed in order to evaluate overall cognitive performance. There are insights into essential mental processes and their neuro-cognitive engineering, which is frequently used to study various mental health and neurological disabilities (Sahinoglu, B. & Dogan, G. 2016), concluding that the Stroop effect is an essential part in future medical research.

References

- Arons, B. (1992). A review of the cocktail party effect. *Journal of the American Voice I/O Society*, 12(7), 35-50.
- Bargh, J. A. (1982). Attention and automaticity in the processing of self-relevant information. *Journal of Personality and Social Psychology*, 43(3), 425.
- Broadbent, D. E. (1957). A mechanical model for human attention and immediate memory. *Psychological Review*, 64(3), 205.
- Cohen, J. (1988). Set correlation and contingency tables. *Applied Psychological Measurement*, 12(4), 425-434.
- Conway, A. R., Cowan, N., & Bunting, M. F. (2001). The cocktail party phenomenon revisited: The importance of working memory capacity. *Psychonomic Bulletin & Review*, 8(2), 331-335.
- James, W., Burkhardt, F., Bowers, F., & Skrupskelis, I. K. (1890). *The principles of psychology*. Macmillan London.
- Logan, G. D. (1992). Attention and preattention in theories of automaticity. *The American Journal of Psychology*, , 317-339.
- MacLeod, C. M. (1991). John Ridley Stroop: Creator of a landmark cognitive task. *Canadian Psychology/Psychologie Canadienne*, 32(3), 521.
- MacLeod, C. M. (1992). The Stroop task: The "gold standard" of attentional measures. *Journal of Experimental Psychology: General*, 121(1), 12.

Sahinoglu, B., & Dogan, G. (2016). Event-Related Potentials and the Stroop Effect. *The Eurasian journal of medicine*, 48(1), 53–57.

<https://doi.org/10.5152/eurasianjmed.2016.16012>

Schneider, W., & Shiffrin, R. M. (1977). Controlled and automatic human information processing: I. Detection, search, and attention. *Psychological Review*, 84(1), 1.

Stroop, J. R. (1938). Factors affecting speed in serial verbal reactions. *Psychological Monographs*, 50(5), 38.

Tam, N. (2013). *Improvement of Processing Speed in Executive Function Immediately following an Increase in Cardiovascular Activity*. Hindawi Publishing Corporation, Cardiovascular Psychiatry and Neurology Volume 2013, Article ID 212767, 6 pages
<http://dx.doi.org/10.1155/2013/212767>

Tatler, B. W., & Land, M. F. (2016). Everyday visual attention. *The Handbook of Attention*, , 391-422.

Treisman, A. M. (1964). Selective attention in man. *British Medical Bulletin*, 20(1), 12-16.

Treisman, A. M. (1969). Strategies and models of selective attention. *Psychological Review*, 76(3), 282.

Wood, N. L., & Cowan, N. (1995). The cocktail party phenomenon revisited: attention and memory in the classic selective listening procedure of Cherry (1953). *Journal of Experimental Psychology: General*, 124(3), 243.

Appendices

1. Stroop Test words
2. Raw Data
3. Standardised Instructions
4. Information sheet & Informed consent form
5. Debrief sheet
6. Ethics form
7. SPSS results

Appendix 1
Stroop Test words
Congruent Words

Pink

Blue

Black

Green

Brown

Blue

Red

Pink

Orange

Black

Green

Purple

Grey

Yellow

Red

Incongruent word list**Green****Blue****Black****Pink****Brown****Blue****Red****Pink****Orange****Purple****Green****Black****Grey****Yellow****Red**

Appendix 2

Raw Data

Participant	Age	Gender	Condition 1	Condition 2
1	21	F	6.78	9.20
2	21	F	8.10	12.66
3	18	F	10.02	11.98
4	29	F	7.09	8.56
5	31	F	11.00	14.07
6	46	F	8.33	11.50
7	31	F	4.34	10.27
8	41	F	7.61	10.71
9	42	F	7.43	13.75
10	18	F	7.87	9.52
11	19	F	6.47	10.81
12	20	F	6.79	12.48
13	19	F	6.90	13.63
14	18	M	4.21	11.37
15	19	F	6.69	10.46
16	19	F	6.44	10.34
17	21	F	3.97	11.00
18	24	F	7.44	9.00
19	26	M	6.76	11.75
20	34	M	5.30	12.99
21	37	F	7.11	12.70
22	44	F	4.92	10.31
23	37	F	5.31	9.30
24	21	F	5.49	9.12
25	22	M	6.91	11.00
26	24	F	8.32	13.10
27	24	F	9.41	12.36
28	26	F	7.29	14.36
29	32	F	8.29	10.31
30	33	M	5.11	9.76
31	29	F	4.73	10.11
32	28	M	6.21	11.37
33	22	F	4.96	9.99

Appendix 3

Standardised procedures



To ensure that all participants have the same experience, researchers should ensure that they are all tested:

1. In the same place, with the same equipment and materials placed in the same way.
1. Under the same conditions, so the level of lighting, noise and heat remains the same for all participants.
1. At the same time of day, as people may behave differently if tested at nine o'clock in the morning rather than five o'clock at night.
1. Given identical standardised instructions in exactly the same way

Standardised Instructions: these are given in the chosen location and there may be more than one set for different (IV) conditions of the investigation. The standardised instructions are important, as each participant must receive the same instructions, so they understand what to do in the study. Also, it ensures that each participant is treated the same and should help eliminate experimenter effects. You can read the instructions to the participant(s) or let them read the instructions themselves.

Standardised procedure for the Stroop effect study

An opportunity sample of students was used. Presumptive consent was gained. The following instructions were presented verbally:

1. You will be presented with two lists of words.
1. Your task for this experiment is to state the colour of ink in which each word is presented regardless of the word.
1. You will need to start naming the colours (not reading the words) starting at the top of the list and ending at the bottom.
1. Your performance on each list will be timed.
1. Please remember that if at any time during the proceedings of this experiment you wish to withdraw, you have the right to do so.
1. No personal information will be taken from you.
1. If you have any questions, please ask them now.
1. I will give you the first list now. Please turn it over when I instruct you.
1. Participants were fully debriefed regarding the aim and hypotheses of the experiment.

Following the making of the accuracy of recalled words during this study of attention, raw data was analysed using a t.test on SPSS 26.

Appendix 4

Study Information sheet



Study Information Sheet

This document provides key information regarding the study and provides details about what will be expected of you as a participant. Therefore, please read this information carefully before providing consent to take part.

During this study you will be required to do the following:

- Complete a demographics form detailing your age and gender
- You will be sat in pairs facing each other in a classroom setting.
- You will take part in a short attention task.
- Please ensure that a copy of the Stroop test words are in front of you.
 - Please ensure you have a stopwatch or alternative timer at hand.
- You will be presented with 2-word lists- consisting of congruent 15 words and 15 incongruent words. Their task is to state the colour of the ink in which each word is presented regardless of the word.
- You will start naming the colours (not reading the words) starting at the top of the list and ending at the bottom. Performance on each list will be timed. The time taken to state the colour of each word (across the two separate conditions will be measured in milliseconds.
 - Words were presented on a white A4 piece of paper.
 - The font was Times New Roman font size 26 bold, mixed colours e.g., Blue, Pink.
 - Times will be recorded for both Conditions. (Congruent & Incongruent word list). Results will be placed in the form of a table, (1) participant Number (2) congruent times recorded (3) Incongruent time recorded (4) Age (5) Gender
- Each pair will take part in both conditions of the study.
- At the end of the study, you will be debriefed by the researcher, and you will be provided with the study debrief sheet.

If you feel you would be uncomfortable answering personal questions about your anxiety levels, you are advised not to take part in this study.

If you have any questions, please ask the researcher now.

If you are happy to take part in this study, please read and sign the consent form.

Appendix 4

Study consent form



Study Consent Form

I understand that this research study is being carried out by a 1st year Psychology Student for a study assessment and that taking part in this study will involve a study of attention relating to the Stroop test.

This study will take approximately 5 minutes to complete.

I understand that participation in this study is voluntary, and I am free to withdraw participation during or at the end of the study without giving a reason. I understand that once I leave the study, I will not be able to withdraw my data, as it will be anonymised. I am aware that if I have concerns about the study, I can discuss these concerns with the researcher at any time during or after the study. I understand that I will be provided with the contact details of the research supervisor at the end of the study, should I have any concerns.

I understand that the information provided by me will be held confidentially, with a code assigned in place of my name. These data will be stored indefinitely in accordance with the Data Protection Act.

I also understand that at the end of the study I will be provided with a debrief form and the opportunity to discuss any issues with the researcher.

I, _____ (NAME) consent to participate in the study conducted by Centre for Psychology and Counselling, University of Wales Trinity Saint David, under the supervision of Charlotte Greenway.

Participant Signature:

Date: _____

Name and signature of researcher taking consent

Appendix 5

Debrief Sheet



Study Debrief Sheet

A study to investigate the existence of the Stroop effect and the significance of attention.

Thank you for taking part in the study.

The aim of this study was to *explore whether the Stroop effect truly exists and whether it affects attention*. We specifically wanted to find out whether *participants would recall congruent words quicker than incongruent words*.

If you wish to withdraw your data from the study, you must tell the researcher now. After this point, all of your data will be anonymised and we will not be able to trace it back to you.

If taking part in this study has raised any questions, please speak to the researcher on or contact the academic supervisor Charlotte Greenway, c.greenway@uwtsd.ac.uk.

Thank you once again for taking time to participate in this study.

Put your name here

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Appendix 6 Ethics form

Ethics Form PG2 / E1 FORM



APPLICATION FOR ETHICAL APPROVAL

In order for research to result in benefit and minimise risk of harm, it must be conducted ethically. A researcher may not be covered by the University's insurance if ethical approval has not been obtained prior to commencement.

The University follows the OECD Frascati manual definition of **research activity**: "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications". As such this covers activities undertaken by members of staff, postgraduate research students, and both taught postgraduate and undergraduate students working on dissertations/projects.

The individual undertaking the research activity is known as the "principal researcher".

Ethical approval is not required for routine audits, performance reviews, quality assurance studies, testing within normal educational requirements, and literary or artistic criticism.

Please read the notes for guidance before completing ALL sections of the form.

This form must be completed and approved prior to undertaking any research activity.
Please see Checklist for details of process for different categories of application.

SECTION A: About You (Principal Researcher)

Full Name:	Charlotte Greenway				
Tick all boxes which apply:					
Member of staff:	☒	Student:	☐	Honorary research fellow:	☐
Faculty/School/Centre:	Psychology				
Campus:	Carmarthen				
E-mail address:	c.greenway@uwtsd.ac.uk				
Contact Telephone Number:	01267676923				
For students:					
Student Number:		Undergraduate	☐		
Programme of Study:		Taught Postgraduate	☐		
Director of Studies/Supervisor:		Research	☐		

SECTION B: Approval for Research Activity

Has the research activity received approval in principle? (please check the Guidance Notes as to the appropriate approval process for different levels of research by different categories of individual)		YES	☒	NO	☐
					Date
If Yes, please indicate source of approval (and date where known):	Research Degrees Committee		☐		
	Faculty Research Committee		☐		
	Other (write in) School ethics board		☒	03.09.18	

Approval in principle **must** be obtained from the relevant source prior to seeking ethical approval.

SECTION C: External Ethical Guidance Materials

Please list the core ethical guidance documents that have been referred to during the completion of this form (including any discipline-specific codes of research ethics, and also any specific ethical guidance relating to the proposed methodology). Please tick to confirm that your research proposal adheres to these codes and guidelines.	
Code of Ethics and Conduct (2018)	☒
BPS Code of Human Research Ethics (2nd edition, 2014)	☒
The General Data Protection Regulation (GDPR)	☒

SECTION D: External Collaborative Research Activity

Does the research activity involve collaborators outside of the University?	YES	☐	NO	☒
If Yes, please provide the name of the external organisation and name and contact details for the main contact person:				
Institution				
Contact person name				
Contact person e-mail address				

Where research activity is carried out in collaboration with an external organisation

Does this organisation have its own ethics approval system?	YES	☐	NO	☐
If Yes, please attach a copy of any final approval (or interim approval) from the organisation				

SECTION E: Details of Research Activity

Indicative title:	The stroop effect		
Proposed start date:	January 2021	Proposed end date:	February 2021
Purpose of research activity (including aims and objectives) Outline the purpose, aims and objectives of the research activity, including key research questions. Show briefly how existing research has informed the proposed activity and explain what the research activity will add and how it addresses an area of importance. (Maximum 300 words)			
The Stroop (1935) task is a colour naming task that requires an individual to identify the print colour of a word and ignore what the word says. This has proved to be difficult if the word meaning and print colour are in conflict e.g. BLUE			

There are a number of reasons behind this. One is the intrusion of meaning from an unattended channel. The attended channel: the colour in which the word is presented vs. the unattended channel: what the word is. Normally when we see a word, we are required to read it. Reading can be considered an automatic process (Shiffrin and Schneider, 1977).

Therefore, it is beyond conscious control. In the Stroop task, participants are effectively told not to read the word, so they have to suppress an automatic process. It doesn't really matter in the congruent condition (words and their colours match), but in the Incongruent condition there is conflict between the information about colour and its name (words and their colours do not match)

The difficulty of removing the interference effect of the Stroop task has led some researchers to claim that the brain is wired to recognize words without effort. This explanation is called the "automatic word recognition hypothesis" (or automaticity hypothesis). According to this theory, reading is an automatic process, which cannot be turned off. In other words, people see the meaning of words without much effort or consciousness. On the other hand, naming colours is not automatic. It requires more effort than reading, thus creating interference in the Stroop task.

This research will help to confirm previous findings and the importance of automaticity relating to attention.

(this box should expand as you type)

Proposed methods

Provide a brief summary of all the methods that **may** be used in the research activity, making it clear what specific techniques may be used. If methods other than those listed in this section are deemed appropriate later, additional ethical approval for those methods will be needed. (Maximum 600 words)

In-class experiment using presumptive consent followed by an opportunity sample carried out by the students.

The task at hand – name the print colour; The automaticity - read colour word
Hence longer colour naming times in incongruent condition.

The design of the study was related/within-subjects design.

The independent variable - The congruency of the words and their colours

The dependent variable - Time taken to name the colours

Hypothesis: Colour naming times will be significantly longer in the incongruent condition

Students will be presented with congruent 15 words and 15 incongruent words. Their task is to state the colour of the ink in which each word is presented regardless of the word. They will start naming the colours (not reading the words) starting at the top of the list, and ending at the bottom. Performance on each list will be timed. The time taken to state the colour of each word (across the two separate conditions) will be measured in milliseconds.

All data will be collated and analysed using SPSS. A related t-test will be used to analyse the mean scores.

(this box should expand as you type)

Location of research activity

Identify all locations where research activity will take place.
D003 – computer lab and Carmarthen campus. (this box should expand as you type)
Research activity outside of the UK If research activity will take place overseas, you are responsible for ensuring that local ethical considerations are complied with and that the relevant permissions are sought. Specify any local guidelines (e.g. from local professional associations/learned societies/universities) that exist and whether these involve any ethical stipulations beyond those usual in the UK (provide details of any licenses or permissions required). Also specify whether there are any specific ethical issues raised by the local context in which the research activity is taking place, for example, particular cultural sensitivities or vulnerabilities of participants.
N/A (this box should expand as you type)

SECTION F: Scope of Research Activity

Will the research activity include:	YES	NO
Use of a questionnaire or similar research instrument?	☒	☐
Use of interviews?	☐	☒
Use of diaries?	☐	☒
Participant observation with their knowledge?	☐	☒
Participant observation without their knowledge?	☐	☒
Use of video or audio recording?	☐	☒
Access to personal or confidential information without the participants' specific consent?	☐	☒
Administration of any questions, test stimuli, presentation that may be experienced as physically, mentally or emotionally harmful / offensive?	☐	☒
Performance of any acts which may cause embarrassment or affect self-esteem?	☐	☒
Investigation of participants involved in illegal activities?	☐	☒
Use of procedures that involve deception?	☐	☒
Administration of any substance, agent or placebo?	☐	☒
Working with live vertebrate animals?	☐	☒
Other primary data collection methods, please explain in this box Experiment (see above)	☒	☐

If NO to every question, then the research activity is (ethically) low risk and **may** be exempt from **some** of the following sections (please refer to Guidance Notes).

If YES to any question, then no research activity should be undertaken until full ethical approval has been obtained.

SECTION G: Intended Participants

Who are the intended participants:	YES	NO
Students or staff at the University?	☒	☐
Adults (over the age of 18 and competent to give consent)?	☒	☐
Vulnerable adults?	☐	☒
Children under 18?	☐	☒
Prisoners?	☐	☒
Young offenders?	☐	☒
Those who could be considered to have a particularly dependent relationship with the investigator or a gatekeeper?	☐	☒
People engaged in illegal activities?	☐	☒
Others (please identify):	☐	☒

Participant numbers and source

Provide an estimate of the expected number of participants. How will you identify participants and how will they be recruited?

Level 4 research methods cohort and two participants per student (approx. 90 participants)

(this box should expand as you type)

Information for participants:	YES	NO	N/A
Will you describe the main research procedures to participants in advance, so that they are informed about what to expect?	☒	☐	☐
Will you tell participants that their participation is voluntary?	☒	☐	☐
Will you obtain written consent for participation?	☐	☐	☒
Will you explain to participants that refusal to participate in the research will not affect their treatment or education (if relevant)?	☐	☐	☒
If the research is observational, will you ask participants for their consent to being observed?	☐	☐	☒
Will you tell participants that they may withdraw from the research at any time and for any reason?	☐	☐	☒
With questionnaires, will you give participants the option of omitting questions they do not want to answer?	☐	☐	☒
Will you tell participants that their data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs?	☒	☐	☐
Will you debrief participants at the end of their participation, in a way appropriate to the type of research undertaken?	☒	☐	☐
If NO to any of above questions, please give an explanation			
This is an in-class experiment and is part of their first assessed report. If they do not take part – they will not understand how to complete their assignment.			
(this box should expand as you type)			

Information for participants:	YES	NO	N/A
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Will participants be paid?	☐	☒	☐
Is specialist electrical or other equipment to be used with participants?	☐	☒	☐
Are there any financial or other interests to the investigator or University arising from this study?	☐	☒	☐
Will the research activity involve deliberately misleading participants in any way, or the partial or full concealment of the specific study aims?	☐	☒	☐
If YES to any question, please provide full details			
(this box should expand as you type)			

SECTION H: Anticipated Risks

Outline any anticipated risks that may adversely affect any of the participants, the researchers and/or the University, and the steps that will be taken to address them.	
If you have completed a full risk assessment (for example as required by a laboratory, or external research collaborator) you may append that to this form.	
Full risk assessment completed and appended?	
Yes	☐
No	☒
Risks to participants For example: emotional distress, financial disclosure, physical harm, transfer of personal data, sensitive organisational information	
Emotional distress. Students may be upset if their times are slow. In the debriefing I will reiterate what the task entails, and reassure them that this is no way linked to academic prowess or intelligence.	
(this box should expand as you type)	
If research activity may include sensitive, embarrassing or upsetting topics (e.g. sexual activity, drug use) or issues likely to disclose information requiring further action (e.g. criminal activity), give details of the procedures to deal with these issues, including any support/advice (e.g. helpline numbers) to be offered to participants. Note that where applicable, consent procedures should make it clear that if something potentially or actually illegal is discovered in the course of a project, it may need to be disclosed to the proper authorities	
N/A (this box should expand as you type)	
Risks to investigator For example: personal safety, physical harm, emotional distress, risk of accusation of harm/impropriety, conflict of interest	
The risks to the investigator are minimal as this is an in-class experiment with students that the researcher already knows. The only risk may be researcher bias, but as the students will be writing up their own lab reports, this should not be an issue in the interpretation of results.	
(this box should expand as you type)	
University/institutional risks	

For example: adverse publicity, financial loss, data protection
Minimal as I will follow BPS and University guidelines.
Whilst this is an undergraduate module research project and so contains no plans for wider dissemination beyond the university, should this be considered it will be through the supervisor (module lead) who is conversant in university regulations regarding dissemination and media engagement. However, there is the potential for researcher or participant conduct, should it be of a nature unbecoming of the UWTSD Student Code of Conduct, to behave in a way that may be a risk to the university please see point 5 in the 'Adverse outcomes' box below). (this box should expand as you type)
Adverse outcomes List measures put in place to limit any adverse effects or outcomes of research activity where appropriate. Include any emergency protocols. I will follow the University's emergency protocols if need be (as the experiment will take place on the premises). 1. Data collected from participants will be anonymised so that no identifying features regarding the participant are linked to the data stored for analysis purposes. 2. Prior to the commencement of data collection the supervisor (module lead) will sign off the consent and debrief if they are satisfied that adequate information has been provided for participants. In addition, contact details are provided on the consent and debrief for the supervisor (module lead) and either the participant or the researcher can contact the supervisor for clarification or to raise concerns. 3. All students in the academic discipline of Psychology are expected to adhere to the UWTSD Student Code of Conduct and all researchers and participants are provided with contact details for the supervisor (module lead) who is an experienced researcher and who has set out clear guidance for this study regarding ethical and code of conduct expectations. (this box should expand as you type)

Disclosure and Barring Service			
If the research activity involves children or vulnerable adults, a Disclosure and Barring Service (DBS) certificate must be obtained before any contact with such participants.	YES	NO	N/A
Has a DBS certificate been obtained?	☐	☐	☒

SECTION I: Feedback, Consent and Confidentiality

Feedback What feedback will be provided to participants, how will this be done and when? Participants will be provided with a debrief form to outline the objectives of the study, and to reiterate the individuals rights to withdraw their data, and to also provide our contact details for any further questions. Debriefing – verbal following the experiment (this box should expand as you type)
Informed consent Describe the arrangements to inform potential participants, before providing consent, of what is involved in participating. Describe the arrangements for participants to provide full consent before data collection begins. If gaining consent in this way is inappropriate, explain how consent will be obtained and recorded. Presumptive – in-class experiment

Participants will be provided with a consent form, where they will be required to provide their consent to take part in the study. The consent form will give a brief description of the purpose of the study, whilst providing information about their right to withdraw from the study, and how their information will be held under the Data Protection Act.

(this box should expand as you type)

Confidentiality / Anonymity

Set out how anonymity of participants and confidentiality will be ensured in any outputs. If anonymity is not being offered, explain why this is the case.

No names/personal information will be attached to the individual scores.

(this box should expand as you type)

SECTION J: Data Protection and Storage

In completing this section refer to the University's Research Data Management Policy and the extensive resources on the University's Research Data Management web pages (<http://uwtsd.ac.uk/library/research-data-management/>).

	YES	NO
Does the research activity involve personal data (as defined by the Data Protection Act)? "personal data" means data which relate to a living individual who can be identified— (a) from those data, or (b) from those data and other information which is in the possession of, or is likely to come into the possession of, the data controller, and includes any expression of opinion about the individual and any indication of the intentions of the data controller or any other person in respect of the individual.	☐	☒
If YES, provide a description of the data and explain why this data needs to be collected: (this box should expand as you type)		
Does it involve sensitive personal data (as defined by the Data Protection Act)? "Sensitive personal data" means personal data consisting of information as to – (a) the racial or ethnic origin of the data subject, (b) his political opinions, (c) his religious beliefs or other beliefs of a similar nature, (d) whether he is a member of a trade union (within the meaning of the Trade Union and Labour Relations (Consolidation) Act 1992), (e) his physical or mental health or condition, (f) his sexual life, (g) the commission or alleged commission by him of any offence, or (h) any proceedings for any offence committed or alleged to have been committed by him, the disposal of such proceedings or the sentence of any court in such proceedings.	☐	☒
If YES, provide a description of the data and explain why this data needs to be collected: Data on participant age and gender will be collected as this forms a standard reporting measure in psychology laboratory reports participant subsections. According to the UWTSd Research Data Management Policy (2016) Table 1 this constitutes personal data; however, these data will be not be attached to any further identifying data about the participant. In addition, these data are collected only for the purpose of providing descriptive data and upon completion of data collection a mean age score will be calculated and the individual data will be stored as an encrypted file by the supervisor (module lead) on a secure laboratory computer; any hard copies of these data will be destroyed at this point as this is a module experiment. (this box should expand as you type)		
Will the research activity involve storing personal data on one of the following:	YES	NO

Manual files (i.e. in paper form)?	☒	☐
University computers?	☒	☐
Private company computers?	☐	☒
Home or other personal computers?	☐	☒
Laptop computers/ CDs/ Portable disk-drives/ memory sticks?	☐	☒
"Cloud" storage or websites?	☐	☒
Other – specify:	☐	☒
For all stored data, explain the measures in place to ensure data confidentiality, including details of password protection, encryption and anonymisation:		
There is no personal data – just scores (raw data). Data, in its full anonymised form only, may be transferred from the laboratory laptops to other computers within the university for the purpose of transferring data into a statistical data analysis package (to do this in the laboratory would reduce experimentation time for other researchers). This data transfer will be carried out using password-encrypted USB sticks and data will be deleted from the stick as soon as it has been entered into the statistical package. (this box should expand as you type)		
Will the research activity involve any of the following activities:	YES	NO
Electronic transfer of data in any form?	☐	☒
Sharing of data with others at the University?	☐	☒
Sharing of data with other organisations?	☐	☒
Export of data outside the European Union or importing of data from outside the UK?	☐	☒
Use of personal addresses, postcodes, faxes, emails or telephone numbers?	☐	☒
Publication of data that might allow identification of individuals?	☐	☒
Use of data management system?	☐	☒
Data archiving?	☐	☒
If YES to any question, please provide full details, explaining how this will be conducted in accordance with the Data Protection Act (and/or any international equivalent):		
•In the case of consent forms containing participant names, these will be stored for the duration of the data collection and handed in to the supervisor (module lead) upon completion of data collection for storage in a secure filing cabinet until the module has been reviewed by the external examiner, at which point they will be sent to confidential waste. Hard copy questionnaires to assess levels of sensation seeking will also be used and the protocol will be the same as for the consent forms for any and all manual files produced. •Storage of participant data will only be achieved on university computers and personal data will not be stored in any form outside of these computers. Once data has been transferred to SPSS it is in a format that no longer contains personal data and so this is acceptable for use outside of these computers. Memory sticks (USBs) will be used to transfer data between the laboratory and computers. (this box should expand as you type)		

List all who will have access to the data generated by the research activity:
The principal researcher (this box should expand as you type)
List who will have control of, and act as custodian(s) for, data generated by the research activity:
The principal researcher (this box should expand as you type)
Give details of data storage arrangements, including where data will be stored, how long for, and in what form. Will data be archived – if so how and if not why not.
Data storage will take place within the School of Psychology laboratory – manual paper copies will be stored in a secure filing cabinet whilst electronic data will be stored as password-protected files on a secure computer system. Because this is a module experiment that is not expected to produce research-standard data it is not intended to either archive the data for public use nor to maintain the data for a period required for data in the public domain; therefore, after review of the materials by the External Examiners regarding the research reports produced by each student and after the experiment assessment has been reviewed by the appropriate examination board, the data will be destroyed (in all but exceptional circumstances this will then mean within 10 months of data collection).
(this box should expand as you type)

SECTION K: Declaration

The information which I have provided is correct and complete to the best of my knowledge. I have attempted to identify any risks and issues related to the research activity and acknowledge my obligations and the rights of the participants. In submitting this application I hereby confirm that I undertake to ensure that the above named research activity will meet the University's Research Ethics and Integrity Code of Practice	
Signature of applicant:	Date:

For students:

Director of Studies/Supervisor:	Dr Charlotte Greenway
Signature:	
Date:	15.10.18

For staff:

Head of School/Assistant Dean:	
Signature:	
Date:	

Checklist: Please complete the checklist below to ensure that you have completed the form according to the guidelines and attached any required documentation:

☒	I have read the guidance notes supplied before completing the form.
☒	I have completed ALL RELEVANT sections of the form in full.
☒	I confirm that the research activity has received approval in principle
☒	I have attached a copy of final/interim approval from external organisation (where appropriate)
☐	I have attached a full risk assessment (and have NOT completed Section H of this form) (where appropriate)
☒	I understand that it is my responsibility to ensure that the above named research activity will meet the University's Research Ethics and Integrity Code of Practice.
☒	I understand that before commencing data collection all documents aimed at respondents (including information sheets, consent forms, questionnaires, interview schedules etc.) must be confirmed by the DoS/Supervisor, module tutor or Head of School.

RESEARCH STUDENTS AND STAFF ONLY

All communications relating to this application during its processing must be in writing and emailed to pgresearch@uwtsd.ac.uk, with the title 'Ethical Approval' followed by your name.

You will be informed of the outcome of your claim by email; therefore it is important that you check your University and personal email accounts regularly.

STUDENTS ON UNDERGRADUATE OR TAUGHT MASTERS PROGRAMMES should submit this form (and receive the outcome) via systems explained to you by the supervisor/module leader.

This form is available electronically from the Academic Office web pages:

<http://www.uwtsd.ac.uk/academic-office/>

Application Process

All staff research projects and all research students must submit the Ethical Approval Form to the **University Ethics Committee** via the Academic Office (pgresearch@uwtsd.ac.uk). Staff research directly in relation to personal study for taught undergraduate or Masters programmes should be submitted via the Faculty procedures explained below.

Taught masters and taught undergraduate research Ethical Approval Forms are considered **within Faculties**. Faculties will provide details of the specific processes for this. Where the Ethical issues within any single ethical application are of particular concern the Faculty will refer these to the University Ethics Committee. Any student activity that involves the collection of primary data needs to undergo Ethical approval, this includes assignment work as well as dissertations.

Notes for guidance in completion of this form

Section A: About You

Please complete all relevant sections

Section B: Approval for research activity

Research proposals must be approved in principle before applying for Ethical Approval. The proposal approval only becomes final when the ethical approval is received.

The process for proposal approval varies according to the individual and programme of study:

- Research students, by application on form PG1 to the Research Degrees Committee
- Taught students by review of research proposal within Faculties (Faculties provide specific details of these processes)
- Staff, by agreement by the Head of School/Assistant Dean

Section C: External Ethical Guidance materials

Many discipline areas are required to operate with the discipline specific codes of research ethics (for example health, psychology, education etc.), any such codes must be listed and you must tick to confirm that you have consulted with these.

Section D: External Collaborative Research Activity

Provide details of the external collaborative partners, where appropriate you might want to submit a copy of the external collaboration agreement with the Ethical Approval Form. If the partner requires the research to be subject to its own internal Ethical approval process then please provide details of that process and a copy of any final (or interim) approvals received from the organisation.

Section E: Details of Research Activity

Remember that the individuals reviewing this Ethical Approval Form may not have seen your research proposal, and also may not be experts in the specific area of your research. The information provided should therefore be jargon free and clearly stated.

Indicative Title: please use the same title as used on the research proposal.

Purpose: the Ethical approval process will want to ensure that the methods you propose are adequate and appropriate to address the research aims and objectives. Excessive additional data collection can be seen as unethical.

Proposed Methods: the Ethical approval process seeks to ensure that you understand the methods that are intended, and that the implementation of those methods will be appropriate and without unnecessary impact on respondents. Please be specific.

Location: this needs to mention geographical location and also local situation (for example, within Local Authority Offices in Cardiff, using a private room but close to other individuals). If you are collecting data within an organisational setting then you need to explain the permissions that you have obtained to do this.

Research Activity outside of the UK: please complete this section in detail, and note any guidance you have received. Also describe your own familiarity (or not) with the location that you will be utilising.

Section F: Scope of Research Activity

Please tick ALL of the research activities that might be undertaken. If any additional types of activity are intended then please add an extra box and describe these.

If you have answered no to all questions in F then sections G and J do not need to be completed. Section H should be considered, and may be completed. Signatures are still required in section K.

Section G: Intended Participants

Please tick all categories that might apply.

Numbers & Source: if you are using a series of different methods or research activities please list numbers for each stage/phase. Be clear about how you will find respondents. Will you use intermediaries, and if so how? How will you ensure compliance with your sampling strategy?

Information for participants: all participants should be appropriately informed about the research, what is expected of them and what will happen to the information that they provide. The Ethical review process does not ask to see this documentation, but requires this to be reviewed and approved by the Director of Studies in the case of research students, the supervisor/module tutor in relation to students on taught programmes and the Head of School/Assistant Dean in relation to staff research.

Section H: Anticipate Risks

All research carries some level of risk. The answers you provide to questions in this section will be reviewed to ensure that you have an appropriate understanding of the type of risks involved and how you can mitigate against these risks. If you have completed a full risk assessment, as required for example for laboratory work, field work, clinical tests, diving operations, or by a collaborative partner, you may append that to this form. In that case, please tick the box indicating this has been provided. You will not then be required to complete Section H.

Risk to participants Think very carefully about how your actions/questions/discussions might affect the people you are involving as participants. You might identify the risk as small but it would still be a risk. Many types of question have the potential to make respondents less content with their life / job; you need to recognise and try to ameliorate any such effects

If these are business owners, time with you may reduce profit.

In some locations physical risk is very real to both participants and yourself, please consider this.

Risk to you, the researcher Think about where you will meet people, if there are any dangers involved in the location. If you are meeting people as individuals think about using a public place. In general do not visit people in their own homes or remote locations. If you are talking to individuals about certain issues think about how their responses might affect you emotionally. What about the risk of collecting insufficient data?

Risk to the University When undertaking your research, you are acting as a member of the University (student or staff). Professionalism is important, so it is important to be well organised and well prepared. Punctuality, clarity etc. are all part of this. What will you do to ensure this? You must ensure you do not harm the good name of the University in any way and do nothing to undermine the reputation of the research it conducts and sponsors. Upholding high standards of conduct and integrity are vital in this regard. You must also conduct the research in such a way to minimise the potential for claims of negligence made against the University, its researchers and any collaborating individual or organisation. In this respect you should always comply with ethical, legal and professional frameworks, obligations and standards as required by statutory and regulatory authorities, as well as the university's Research Integrity and Ethics Code of Practice. Research misconduct in this respect can take many forms, including:

- fabrication: making up results or other outputs (eg, artefacts) and presenting them as if they were real
- falsification: manipulating research processes or changing or omitting data without good cause
- plagiarism: using other people's material without giving proper credit
- failure to meet ethical, legal and professional obligations: for example failure to declare competing interests; misrepresentation of involvement or authorship; misrepresentation of interests; breach of confidentiality; lack of informed consent; misuse of personal data; and abuse of research subjects or material
- improper dealing with allegations of misconduct: failing to address possible infringements such as attempts to cover up misconduct and reprisals against whistle-blowers

Adverse Outcomes. Think carefully about the possibilities, and cover here

Section I: Feedback, Consent and Confidentiality

Feedback to participants: outline your approach. Will interview transcripts be shared with respondents to check accuracy? Will summaries of questionnaire analysis be made available to respondents in some way? Will an overview report be provided? How and when?

Informed consent: Draft letter / e-mail / or heading (or footer) section of questionnaire must be approved by DoS/supervisor (if research student), supervisor/module tutor if taught student, or Head of School / Assistant Dean if a member of staff.

Confidentiality/Anonymity. Explain clearly how you will ensure confidentiality and anonymity.

Section J: Data Protection and Storage

Before completing this section it is necessary to read the University's Research Data Management information. The questions that follow are designed to ensure compliance with the Data Protection Act as well as established research protocols.

Many research activities will involve electronic transfer of data and use of data management systems in the summarisation and analysis of data. You will need to explain these in relation to compliance with the Data Protection Act.

Think carefully about who will have access to your data, this will include supervisors and examiners. Also that a thesis will be made available via the University library and the British Library system. If you are seeking an access bar for a period of time after completion then mention it here. If you will provide a copy of your findings, or intend to give a presentation, to a facilitating/ supporting/accessing organisation then explain that in this section. But also think about the general principle of data sharing, as explained in the Research Data Management information.

In terms of storage of data please ensure security, and also mitigate against loss of data.

Section K: Declaration

Ensure the appropriate countersignatures have been provided

Look carefully at the checklist and ensure that you comply with and tick all that are relevant to your research.

Appendix 7

SPSS Results

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	33	18	46	27.15	8.277
Valid N (listwise)	33				

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Congruent	6.7758	33	1.65859	.28872
	NonCongruent	11.2073	33	1.59461	.27759

Paired Samples Correlations

		N	Correlation	Significance	
				One-Sided p	Two-Sided p
Pair 1	Congruent & NonCongruent	33	.417	.008	.016

Paired Samples Effect Sizes

			Standardizer ^a	Point Estimate	95% Confidence Interval	
					Lower	Upper
Pair 1	Congruent - NonCongruent	Cohen's d	1.75731	-2.522	-3.220	-1.813
		Hedges' correction	1.79988	-2.462	-3.144	-1.771

a. The denominator used in estimating the effect sizes.

Cohen's d uses the sample standard deviation of the mean difference.

Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Paired Samples Test									
		Paired Differences				Significance			
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	
					Lower	Upper			One-Sided p Two-Sided p
Pair 1	Congruent - NonCongruent	-4.43152	1.75731	.30591	-5.05463	-3.80840	-14.486	32	<.001 <.001

A related t-test indicated that the difference in time taken to state the colour between the congruent and incongruent conditions was statistically significant ($t(32) = 14.49$, $p < .001$, Cohen's $d = 2.52$) The effect size was large (Cohen, 1988).