PSYCHOLOGY INTERNAL ASSESSMENT

AFFECT OF COLOUR ON MEMORY RETENTION

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Introduction:

If colour can increase arousal, and arousal can increase memory, then it is possible that we could find that colour can increase memory. This hypothesis was in fact, proved by Spence et al. (2006). Faber Birren (1950) proposed that warm colours (such as red and measuring emotional response, personal feelings, and quality of place. They then were seated in a small room with one of ten different colours mounted on the walls. And once again they were asked to fill out the scale to measure boredom. Greene et al found that warm colours elicited more arousal than other colours. It was found by Roozendaal (2002), that arousing events have the ability to increase memory. This hypothesis was further proved by Wolters and Goudsmit (2005), Otani et al (2007). Spence et al. (2006) found that colour increased the recognition of the natural scenes by approximately 5%. In their study, 120 participants viewed a sequence of images of natural scenes on a computer monitor. The participants were either shown coloured scenes or greyscale scenes. The same scenes were then shown again, either in colour or in greyscale. The yellow increases arousal more than cool colours (such as green and blue). Birren's proposal was supported by Greene et Al, participants were issued three different scales participants were asked to rate the scenes as old or new. On the other hand, McConnohie (1999) proved the exact same hypothesis to be true using alphanumeric characters. He showed the slideshow to a classroom of middle schoolers and asked them to recall as many characters as they could immediately after seeing the slideshow and then again, an hour later. He repeated this three times, each time using a different colour for the background of the slideshow (white, blue, or green). The character colour for all three slideshows was black. McConnohie found that the slideshow with the white background resulted in higher retention rates both immediately, and one hour after viewing the slideshow. This would be an expected result since blue and green are both cool colours and therefore won't have as much of an arousing effect as white would.

In this study, we aim to find the find the effect that colour has on memory retention within the ages of 16-18.

The study is important because it addresses many questions that many researchers have about the relationship between colour and the ability to recall stimuli presented. Using various colour tones, it demonstrates the impact of different colours on memory preservation. The results of this study can be used as a valuable tool for students who have difficulty memorising.

The *independent variable* for the study is the colour of the visual stimuli.

The *dependent variable* for the study was as to how many words the participants can recall.

Experimental Hypothesis (H1):

According to the study hypothesis, the number of words remembered by participants in the warm colour condition will be significantly higher than those in the other colour conditions.

Null hypothesis (H0):

The null hypothesis states that there would be no significant difference in the number of correct words recalled by the participants with respect to the different colour tones. The results will be the same in all warm, cold, or neutral conditions, with the words remembered.

Exploration:

Experimental design:

Both repeated and independent measures were used in this study. People were evaluated in such a way that the participant variable was minimised by putting them through a pair of similar and separate conditions. The experiment consisted of three conditions (Warm, Cold, and Neutral), which were all experimented on the participants. The 18 participants were divided into four groups (Control, Warm, Cold, and Warm/Cold), with each group receiving the conditions in a different order in order to obtain more accurate results. Each group had four members, each of whom was shown a different set of words for

each of the two- colour conditions. With the exception of the control group, which consisted of six participants who were exposed to all three colours conditions. The participants were given 10 minutes to memorise the first list, followed by 5 minutes to write down everything they remembered; the same procedure was followed for the other colour conditions.

To ensure that the findings were concrete, we first chose three sets of words that were unfamiliar to the majority of participants. Opportunity sampling was used to select the participants. We asked those who were available to take part in our experiment, but the groups were assigned at random. We assigned a number to each participant at random, with no changes allowed.

Sampling Technique:

We used both purposive and convenient sampling in this experiment because the participants were selected at random according to our convenience; if they had characteristics that the researchers were interested in, they were chosen. As a result, the chosen approach saved time and was effective, but it was not generalizable and was biased.

Choice of Participants:

Participants were IBDP students aged 16 to 18 who had a good grasp of the English language, which was crucial because the experiment would deal with English vocabulary. Purposive sampling was used to pick them, and they were divided into four groups at random. A total of 18 participants were chosen, with each condition consisting of four participants (except for the control group, which had six). Number of participants in each category was determined based on the counterbalancing method's requirements.

Controlled variables:

The three background colour tones, as well as three separate lists of terms, are the independent variables in this experiment, while the number of words recalled by the participants is the dependent variable.

The controlled variables are:

1. Time given to the participants for remembering the words
2. Number of participants
3. Order of visuals shown

The participants were shown an animated cartoon video for 4 minutes after each text.

Table 1.1 Random grouping of participants

Warm group	Cold group	Warm and cold group	Control group
N1, W2	N1, C2	W1, C2	N1, W2, C3
W1, N2	C1, N2	C1, W2	N2, C3, W1
N2, W1	N2, C1	W2, C1	W1, N3, C2
W2, N1	C2, N1	C2, W1	W3, C2, N1
			C2, N1, W3
			C3, W1, N2A

Neutral- N	**Text1- 1**
Cold - C	Text2- 2
Warm - W	Text3 - 3

Choice of materials:

1. Consent form – to certify that ethical considerations are followed For various situations, a list of words with various coloured backgrounds is given.
2. Laptop/cell phone/tablet- due to the pandemic, the experiment was performed remotely.

3. An online network for video calls will be used to communicate with participants while the experiment is being conducted.
4. WI-FI is needed for internet access.
5. Timer – to ensure that the time is accurate.

**briefing and debriefing instructions can be found attached in appendices*

Procedure:

1. The participants were chosen by chance sampling prior to the experiment. They were then briefed on the experiment, the method, and the target. They were also asked to complete and sign a consent form.
2. We followed the ethical principles by keeping the identities of the participants anonymous.
3. Each participant was given a google meet link and timings.
4. Participants were divided into four groups, each with a different set of conditions for each group and participant.
5. To ensure the accuracy of the findings, each participant was shown various presentations with different texts and background colours shown in different order. The participants had 10 minutes to memorise the texts and 5 minutes to jot down what they remembered. After each text was shown, the participants were shown a 4-minute cartoon video to keep them relaxed before presenting the next slide.
6. Participants were told of their right to withdraw from the experiment at any time and that their privacy would be protected before and after the experiment, according to ethical guidelines. The participants were free of any physical or psychological harm. They were also made to sign a consent form before the experiment.

   **Appendix iii. Briefing Instructions*

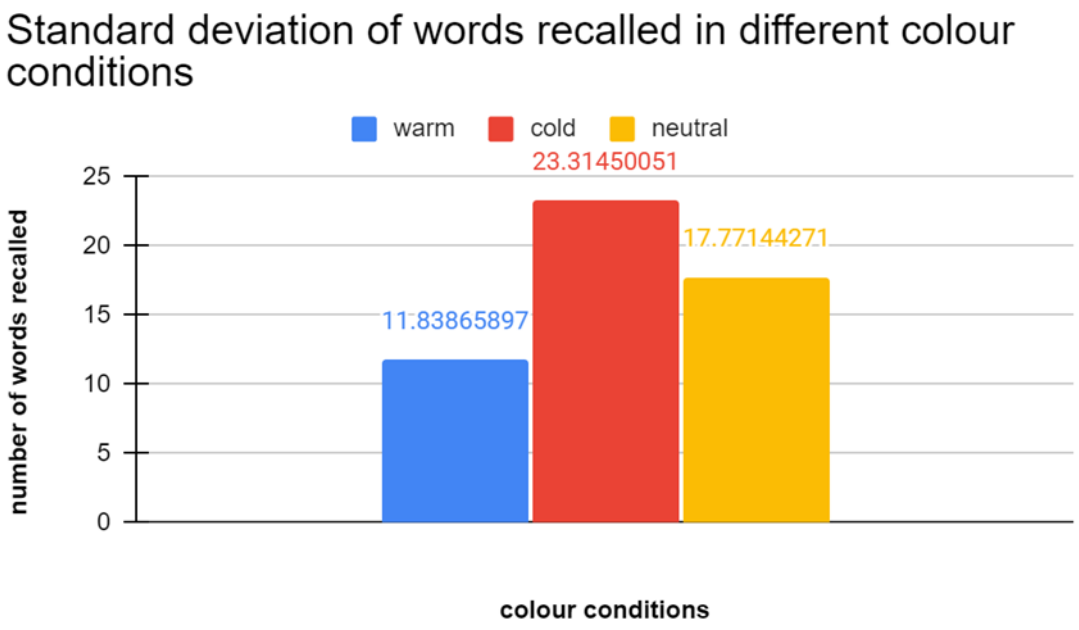
- **Analysis:**

Descriptive Data-

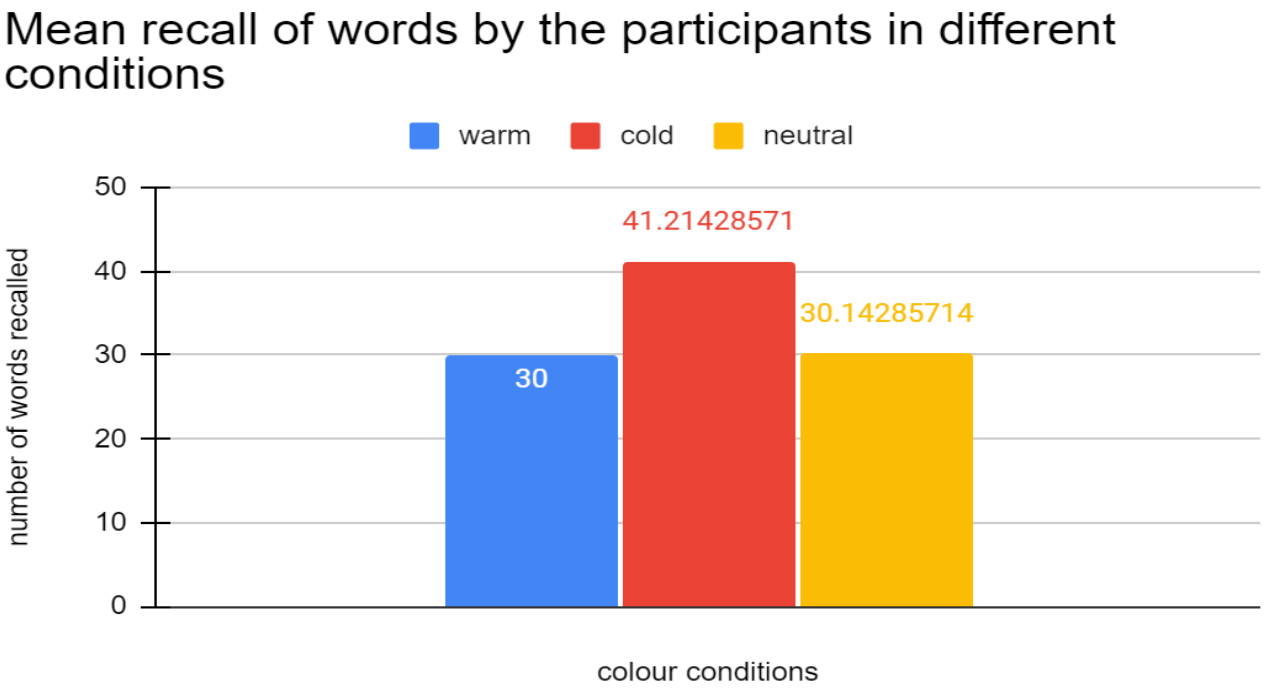
The results of this experiment were analyzed by taking out the mean and standard deviation.

The results were as follows-

Graph 1.1 Standard deviation of words recalled in different colour conditions by participants



Graph 1.2 Comparison of the mean recall of words in different color conditions



Average	30	41.21428571	30.14285714
Standard Deviation	11.83865897	23.31450051	17.77144271

As it is very evident from the graph above that the color differences had very little impact in the number of words recalled by the participants. It is presented that the words recalled are only 1.37% higher in the cold condition than the warm condition. We also see that the words recalled with the warm background which is the orange color on an average are not more than neutral (white color) and cold (blue color), which implies that the warm color in this experiment does not help the individuals to recall words in a better way. However, there was a huge difference noted within all the conditions which were from 3 to 63 in neutral, 13 to 84 in cold and 11 to 47 in warm. The justification of the variety in recall could be language skill or the earnestness/level of inspiration towards the test. The absence of sincerity can also be a significant

explanation. Additionally, for more profound analysis, different tools are likewise used to decipher the information.

Inferential Data:

Name of the participant	words recalled in warm	words recalled in cold	words recalled in neutral
Subject 1	-	84	62
Subject 5	-	34	18
subject 10	-	13	3
Subject 11	-	40	25
Subject 2	47	48	34
Subject 15	36	33	-
Subject 16	35	44	-
Subject 9	32	21	-
Subject 8	42	91	-
Subject 3	44	47	63
Subject 7	11	32	28
Subject 12	40	54	30
Subject 13	13	21	42
Subject 14	27	15	21
Subject 6	35	-	23
Subject 4	20	-	46
Subject 17	20	-	13
Subject 18	18	-	14
Average	30	41.21428571	30.14285714
Standard Deviation	11.83865897	23.31450051	17.77144271

Table 1.3

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
words recalled in warm	14	420	30	140.1538462		
words recalled in cold	14	577	41.21428571	543.5659341		
words recalled in neutral	14	422	30.14285714	315.8241758		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1159	2	579.5	1.739293194	0.1889921431	3.238096135
Within Groups	12994.07143	39	333.1813187			
Total	14153.07143	41				
CANNOT REJECT NULL as F-value<F-crit (p-val is too high)						

A single factor ANOVA test was carried out for the data results. Since there are 3 sets of data samples and both repeated and independent measure design was implied in the experiment. The ANOVA test results show that the p value is more than the significant level that is 0.05($p>0.05$).

So, the null hypothesis cannot be rejected. According to this test, the variety of words recalled in different situations isn't always considerably exceptional and the retention

level in different color tones extra or less similar mentioning that unique color tones do not enhance or lessen memory retention in IBDP students. Therefore, our null hypothesis is rejected.

Evaluation:

We were unable to endorse McConnohie's conclusions, as shown by the above results (1999). In contrast to our results, he found that the white backdrop slideshow had higher retention rates than the cold colors. This may be due to the fact that, with the increased use of technology, our participants are less likely to choose brighter colors over dull colors**.**

One of our study's strengths was that we made sure the participants didn't cheat by giving them a 10-minute gap to memorize, which puts them under pressure, and a 5-minute time limit to write. We changed the presentation to a blank page when the participants were told to write so they couldn’t cheat. Since the participants were teenagers, they were more likely to try to cheat.

Another strength was that we made every effort to ensure that no spelling errors were made and that the number of words provided to the participants did not vary significantly, but this did not stop us from putting in few words that the participants did not know about.

One research drawback was that we did not ensure that all participants used their laptop as a screen, which makes reading the words on the screen more difficult. It would have been more convenient for them to read a text on their laptops because the words are larger. It was discovered that those who used their phones were less efficient than the ones who used their laptop.

Another drawback was that the time limit prevented them from fully reading the essay, which influenced the vocabulary used in the participants' texts. This led to most people writing the summary of the texts.

Since the experiment was performed via Google Meet, there were variables that could not be controlled, such as Wi-Fi issues, which caused a few connectivity problems

with a few participants, impacting the time limit provided to them. Secondly, external causes such as being disturbed by a family member or background noises.

Finally, since the research only included high school students, it is difficult to extrapolate our findings. In comparison to adults, high school students have a preference for the color of paper or background they read on. Students are often asked to recall a list more frequently than the general public. Therefore, their recollection power is more than an average person’s.

We may infer from this study that different color tones have an effect on a person's memory retention.

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APPENDIX

Appendix I. Internal Assessment Proposal Form

Study to be used- McConnohie (1999)

Material required:

- Consent form
- Laptop/mobile phone/tablet
- Wordlist with different background-color
- Access to an online platform for video call
- Wi-Fi
- Timer
- Word list

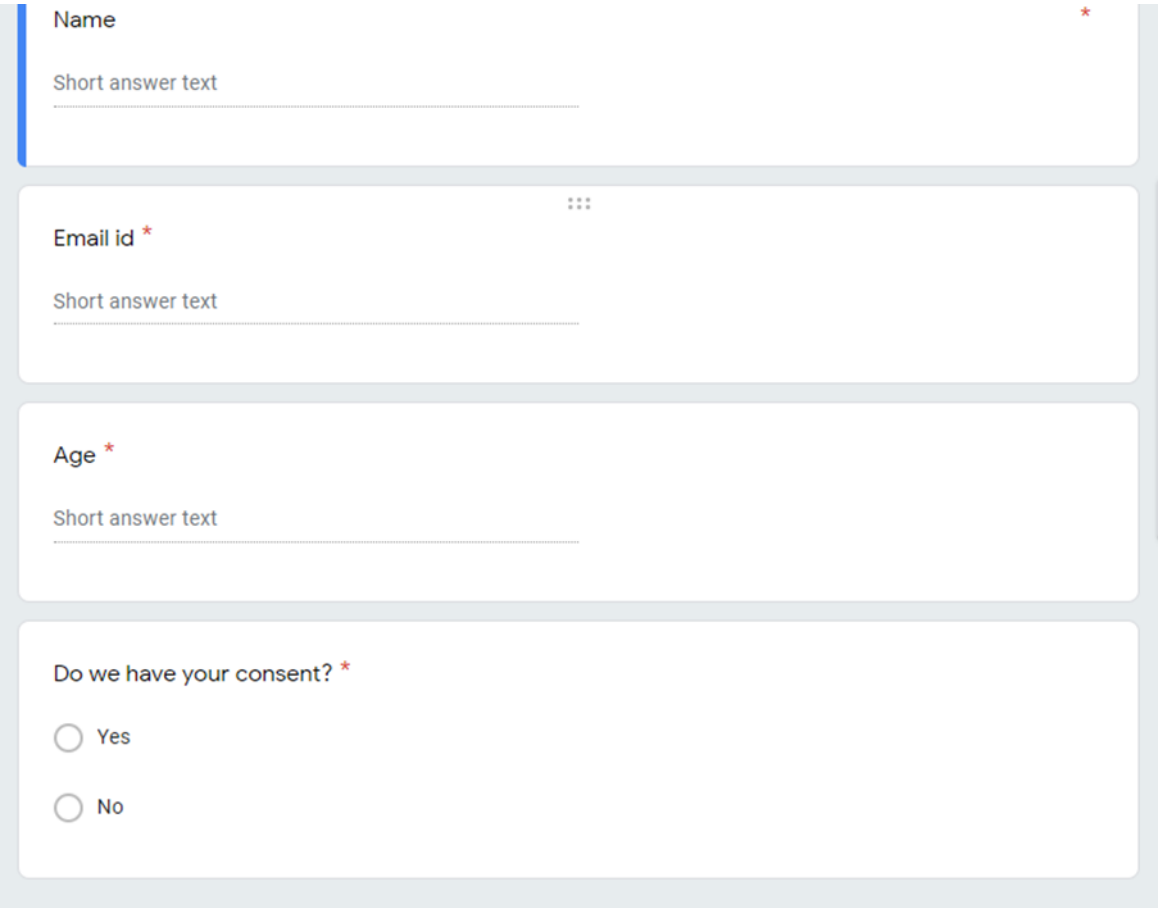
Procedure:

There will be three groups of four participants each, as well as a monitoring group of six. They will be issued consent forms to sign to confirm their willingness to participate in the study. Before and after the exercise, they will be briefed and debriefed, and a list of words with different colour tone backgrounds will be shown, with them being asked to retrieve and write the words they recall in a blank slide. The entire process will be presented in a Google slides presentation (experiment may not be carried out in person due to the latest pandemic situation).

Ethical consideration:

Every researcher's informed consent will be obtained prior to the experiment. The anonymity of the participants will be maintained. They were informed that they had the right to withdraw at any time. Much as they are asked to remember and recall English vocabulary, the study cannot cause harm or detrimental effects to the participants, either mentally or physically.

Appendix ii. Consent Form



Appendix iii. Briefing Instructions

Good morning to one and all present here! Firstly, I would like to thank everyone present here for taking out time to participate in our experiment. We would like to inform you that all of you have been divided into 4 groups consisting of 4 participants in 3 of them and 6 in one. As we are about to start our experiment soon, I would like to remind you all that you had been sent a consent form earlier on WhatsApp or email which you all need to read carefully and fill properly. This consent form will guarantee you your confidentiality and also your right to withdraw from this study at any time.

You are free to ask any questions, in case of any doubt.

Post Submission of Consent forms-

Groups 1-3

As you're done with filling out the forms, we'd like to begin our experiment. We will show you two texts that we have taken from various sources. They're written in various background colours. During the exercise, you will need to read the content for 10 minutes and then write everything you know from the text in the blank slides of the

presentation for 5 minutes that will be shared with you by us on your respective email IDs. There should be no distraction in your room during the experiment.

If you have any questions, you may ask.

Group 4

As you're done with filling out the forms, we'd like to begin our experiment. We're going to send you three texts that we've taken from various outlets. They're written in various background colours. During the exercise, you will need to read the content for 10 minutes and then write everything you know from the text in the blank slides of the presentation for 5 minutes that will be shared with you by us on your respective email IDs. There should be no distraction in your room during the experiment.

In case of any doubts, you are free to ask any question.

Appendix IV. List of words

Text 1	Text 2	Text 3
world	color	Tide
Chance	animals	coming
virus	Means	Narrow
strong	matter	strip
Some	Chance	Firm
seen	depends	beach
coming	Many	Water
long time	Considerations	white,
Thomas’s	majority	stumbling
gaze	cases	Stuff
wandered	tends	near

Group	protect	palm
people	animal	Terrace
Approaching	danger	Ralph
Froze	rendering	chose
Aris	Less	needed
Minho	Conspicuous	Think
elbowing	Perhaps	only
Pointing	coloring	allow
boy	mainly	Feet
Group B	Protective	move
Already	ought	without
broken	brightly	watch
grin	Colored	Suddenly
jogging over.	Animals	pacing
Behind	cases	Water
Thomas	Vivid	overcome
couple	themselves	Astonishment
girls	protective	found
Maze	kingfisher	understanding
Whoever	Itself	wearisomeness
People	brightly	Life
taken	colored	where
good	easy	every
Job.	blue	Path

reached	harmonizes	improvisation
Thomas	Water	considerable
stood	bird	one’s
front	darts	waking
Hug,	stream	life
Hand	flash	spent
Instead.	sunlight.	watching
shook	Desert	Stopped
Glad	animals	facing
Guys	generally	Strip
okay.	Desert	remembering
You too	for instance	first
Seeing	Lion	enthusiastic
familiar	Antelope	exploration
face	wild donkey	part
realize	all sand-colored	brighter
bitterness	Indeed	Childhood
felt	Canon Tristram	smiled
about	Desert	Jeeringly
happened	neither trees	turned
between	Brushwood,	back
Scorch	undulation	towards
gone.	surface	platform
Where	afford	time

Everyone	slightest	come
Darkened	protection	assembly
Most	Foes	concealing
Aren't	modification	splendors
Anymore	assimilated	Sunlight
taken	surrounding	carefully
another	country	over
Before	Absolutely	points
Process	necessary	Speech
Teresa	without	lost
Appeared.	exception	himself
clear	upper	maze
throat	plumage	thoughts
rid	every	rendered
Lump	Bird	vague
suddenly	fur	lack
Formed	Smaller	words
Teresa	mammals	express
Felt	skin	tried
flurry	snakes	Frown
conflicted	Lizards	walked
Emotions	one	Faster
Barely	uniform	aware
Word	Sand	urgency

Tom	next	declining
stepped	point	little
close	mature	Created
eyes	Caterpillars	speed
sad.	Brown	breathed
Glad	probably	Face
okay	Caterpillar	wind
eyes	more	pressed
moistened	Conspicuous	grey
Tears	among	shirt
Yeah	Green	Against
	Leaves	chest
	otherwise	noticed
	case.	mood
		Comprehension
		folds
		stiff

Appendix v. Raw data and inferential statistics

23	Anova: Single Factor						
24							
25	SUMMARY						
26	*Groups*	*Count*	*Sum*	*Average*	*Variance*		
27	words recalled in warm	14	420	30	140.1538462		
28	words recalled in cold	14	577	41.21428571	543.5659341		
29	words recalled in neutral	14	422	30.14285714	315.8241758		
30							
31							
32	ANOVA						
33	*Source of Variation*	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
34	Between Groups	1159	2	579.5	1.739293194	0.1889921431	3.238096135
35	Within Groups	12994.07143	39	333.1813187			
36							
37	Total	14153.07143	41				
38							
39	**CANNOT REJECT NULL as F-value<F-crit (p-val is too high)**						

19	Subject 18	18	-	14
20	Average	30	41.21428571	30.14285714
21	Standard Deviation	11.83865897	23.31450051	17.77144271

Psych I.A Data Analysis

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	A	B	C	D
1	Name of the participant	words recalled in warm	words recalled in cold	words recalled in neutral
2	Subject 1	-	84	62
3	Subject 5	-	34	18
4	subject 10	-	13	3
5	Subject 11	-	40	25
6	Subject 2	47	48	34
7	Subject 15	36	33	-
8	Subject 16	35	44	-
9	Subject 9	32	21	-
10	Subject 8	42	91	-
11	Subject 3	44	47	63
12	Subject 7	11	32	28
13	Subject 12	40	54	30
14	Subject 13	13	21	42
15	Subject 14	27	15	21
16	Subject 6	35	-	23
17	Subject 4	20	-	46
18	Subject 17	20	-	13