

Module: Research Methods II

Module code: ECPS5003

Assignment Title: 'Effects of distraction on free recall of similar and dissimilar words in undergraduate students.'

Abstract

Previous research in free recall has produced mixed results regarding the effects of distraction on recall performance (Craig, 2014). The present study examined whether participants would exhibit any differences in the recall performance of similar and dissimilar words, and whether the distraction would affect the recall performance. For this purpose a free recall paradigm was employed, using a 2 (Distraction; 'No', 'Yes') by 2 (Type of words; 'Similar', 'Dissimilar'), mixed, factorial design. Semantically similar and dissimilar words were serially presented through a computer programme, and recall performance was measured for all the participants in the 'Distraction' and the 'No Distraction' condition. Although differences in the recall performance between similar and dissimilar were noticed, the results were not significant. Additionally, there was no significant effect of the distraction on recall performance. Further research is required in order to determine the effects of distraction on recall performance.

Introduction

Previous research in free recall has not produced a clear explanation regarding the effects of distraction on recall performance (Craig, 2014). Glenberg, Schroeder, and Robertson (1998) found that visual distraction had a negative impact on the retrieval of mid-list items from a recently presented list of words. However, Rae and Perfect (2014), failed to replicate the results from the study of Glenberg et al. (1998). Instead they suggested that there is no clear evidence that environmental distractors could have any impact on recall performance for items from lists (Rae & Perfect, 2014). Free recall experimental designs, which involves recalling stored information in any order, are often employed in studies that attempt to assess recall performance (Eysenck & Keane, 2010). A factor that could affect performance in a free recall task is the presence of a recency effect, where the last few items of a list are better remembered compared to the other items, during an immediate free recall task (Eysenck & Keane, 2010). Peterson and Peterson (1959), in two verbal retention experiments, demonstrated that the duration of the stimuli in short-term memory, lasts less than 20 seconds.

To further assess memory performance, Hanczakowski, Beaman, and Jones (2016), examined the impact of semantically related and unrelated auditory distractors. The results showed a benefit on recall performance, when presenting related rather than unrelated distractors, during cued recall tasks; however, no benefit was found when a free recall task was employed (Hanczakowski et al., 2016). Logie, Della Sala, Wynn, and Baddeley (2000), explored the role of visual working memory in the retention of verbal information. In four experiments on immediate serial recall of words and letters that varied in visual similarity, it was found that similarity of stimuli had a negative impact on the recall performance (Logie et al., 2000). Logie

et al. (2000), argued that individuals employed visual encoding during the experiment, and suggested the presence of two codes; a visual one for the retention of visually information, and a phonological one used in the rehearsal of stored information. They argued that this indicates the use of a visual temporary storage mechanism (a 'visual cache') during serial recall tasks (Logie et al., 2000).

In the light of the previous theoretical and practical work, the present study was designed with the aim of investigating differences on the recall performance between similar and dissimilar words, as well as assessing the impact of distraction on recall performance. For this purpose, the study employed a free recall paradigm, where the participants were presented semantically similar words in one task, and semantically dissimilar words in a second, and were instructed to write down all the words they could recall. Half of the participants experienced a distraction during the presentation of the stimuli. The specific aims of the study were first, to evaluate whether there would be any differences in the recall performance between similar and dissimilar words, and second, whether the distraction would affect the recall performance.

Method

Participants

Twenty-two participants took part in the study. There were 15 females and six males aged between 18 and 52 ($M = 34.80$; $SD = 7.56$). All were undergraduate students studying one of the Level Five Psychology related degree courses at the University of Wales Trinity Saint David (UWTSD), SA1 Swansea campus. The participants were able to take part in the study via a qualtrics link on the Psychology department's Experiment Management System (EMS). Participants were recruited as part of a module assessment task. Their participation was completely voluntary.

Design

A 2 (Distraction; 'No', 'Yes') by 2 (Type of words; 'Similar', 'Dissimilar'), mixed, factorial design was employed. The first independent variable was 'Distraction', which was the between subjects factor; the two levels of the variable were 'No' or 'Yes'. The second independent variable was 'Type of words', which was the within subjects factor; the two levels of the variable were 'Similar' and 'Dissimilar' words. The dependent variable in the experiment was the number of 'Recalled words', which was measured for all the participants, across the different experimental conditions.

Materials

The experiment was designed through the Qulatricks computer programme, which was used for the visual presentation of all the stimuli. All stimuli remained for two seconds in the centre of the screen, with a 1 second delay between each presentation. The experiment consisted of two tasks; in the first task, participants were presented, through a serial presentation, a list of ten semantically similar words, and in the second task a list of ten semantically dissimilar words. For the 'No Distraction' condition, all the words were presented individually. In the 'Distraction' condition, the word to be recalled was presented in a list, amongst other nine words acting as distractors. The word to be recalled appeared in uppercase letters, while the distractor words appeared in lowercase letters. The position of the word to be recalled in the list was randomized for each presentation.

The words used in the experiment were randomly selected from an online database of English nouns. All words to be recalled were presented in black, upper-case letters on white background, and in bold, 36 font size. The list of similar words contained words semantically similar amongst them (e.g. *TEACHER*, *SEMINAR*, *LECTURE*) (Appendix 1). The list of similar words contained words semantically dissimilar amongst them (e.g. *NUCLEAR*, *ORCHARD*, *ELEPHANT*) (Appendix 2). The recall sheets used were A4 paper sheets, where the participants were instructed to write all the words they could recall, in any order, under the respective titled space for the two experimental recall conditions (Appendix 3).

Procedure

The researchers approached the participants, individually or in small groups, around the campus of UWTSD. They were asked if they were willing to take part in a study regarding the

effects of distractions on cognitive performance. If the participants agreed to participate, they followed the participant in a computer laboratory room. There they were asked to fill in a consent form (Appendix 4). Participants were given a recall sheet, and were instructed to follow the instructions that appeared on the computer screen. They were told that after the presentation, they would be given 30 seconds to write down the words they could recall, in any order they wished, on the recall sheet. The participants were informed that their anonymity is ensured and that they had the opportunity to withdraw from the study if they felt uncomfortable about it. Successively the researcher exited the room, and each participant completed the two experimental tasks. After the end of each presentation, participants were informed through a message on the screen, to wait before starting to write down the words they could recall. This lasted for 30 seconds, and the delay was employed in order to eliminate any storage of stimuli in the short term memory (Peterson & Peterson, 1959). The procedure was replicated for all the participants, and to avoid confounding due to order effects, each time the experimental conditions were counterbalanced between different subjects. At the end of the session, all participants were debriefed (Appendix 5), and thanked for their participation to the study. The completed recall sheets and the consent forms were returned to the principal researcher. Anonymity was ensured by the researchers, by keeping separately all the completed recall sheets, from the consent forms.

Results

The data collected was the scores of the recalled words for each participant, for Similar and Dissimilar items, across the two experimental conditions (Appendix 6). The means (and standard deviations) of these scores are displayed in Table 1.

Table 1

Means and standard deviations of the scores for Similar and Dissimilar words, across the two experimental conditions, for all the participants.

Type of words	Distraction		Total
	No	Yes	
Similar	6.55 (2.16)	5.91 (1.76)	6.23 (1.95)
Dissimilar	5.55 (1.44)	6.18 (1.47)	5.86 (1.46)
Total	6.05 (1.8)	6.05 (1.62)	

An inspection of the means (and standard deviations) in Table 1, suggests that overall, and especially in the ‘No Distraction’ condition, participants recalled a higher number of similar words than dissimilar. However, in the ‘Distraction’ condition, the number of the dissimilar words recalled was higher than the number of similar words. Also, the results show that overall participants recalled the same number of words, in each experimental condition.

A 2 (Distraction; No, Yes) by 2 (Type of words; Similar, Dissimilar), mixed design analysis of variance (ANOVA) was carried out on these scores. There was no significant main effect for Distraction ($F(1, 20) = 0, p = 1, \eta^2 = 0$). There was no significant main effect for the Type of words ($F(1, 20) = .88, p = .36, \eta^2 = .04$). There was no significant interaction between Distraction and Type of words ($F(1, 20) = 2.69, p = .116, \eta^2 = .12$). Appendix 7 consists of the output for the above statistical test.

Discussion

The aim of the present study was to investigate differences in the recall performance between similar and dissimilar words, and to examine the effects of distraction on the recall performance. The results showed that the distraction had no effect on the recall performance, and no significant differences were noticed between the recall of similar and dissimilar words.

The findings did not replicate those of previous studies (Glenberg, et al., 1998), which suggest that distractors can impair recall performance. However, the results were consistent with the study by Rae and Perfect (2014), that failed to find evidence that environmental distractors could have any impact on recall performance for items from lists. Rae and Perfect (2014), suggested that an explanation for the inconsistency of the distraction on recall performance can be attributed to the interference of the current environment in the ability to reconstruct a past context, rather than the ability to directly access memories (Rae & Perfect, 2014). Thus, the distraction could have a negative impact on memories that benefit from the recreation of a past context, while memories that can be accessed without context cues could benefit from the presence of a distraction (Rae & Perfect, 2014).

Potential limitations of the present study should be considered. Hanczakowski et al. (2016), demonstrated that the type of distractors can have a significant impact on recall performance. However, the design of the present experiment did not account for the type of the distractors used in the tasks, since the distractor words, were selected randomly. The very small sample size of the participants, and the fact that all of them were university students, makes the study quite unrepresentative of the general population. Some technical details in the design of the experiment might have affected significantly the results. The viewing distance of the participants

from the computer monitor is a factor which is likely to influence performance (Navon, 1977). Additionally, no account was taken of potential mental condition, like dyslexia, that might have affected the performance of the participants.

In conclusion, the findings of the present study did not find any differences in the recall performance between similar and dissimilar words, and failed to account for any effects of distraction on recall performance. Future research should aim to take into account the effect of the types of distractors, and studies with larger and more representative samples, are needed in order to provide a better understanding of the effects of distraction on recall performance.

References

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Appendices

Appendix 1: List of the semantically similar words.

Appendix 2: List of the semantically dissimilar words.

Appendix 3: Recall sheet.

Appendix 4: Consent form.

Appendix 5: Debrief form.

Appendix 6: Raw Data.

Appendix 7: SPSS output.

Appendix 1

List of the semantically similar words:

TEACHER

SEMINAR

PROFESSOR

LECTURE

TEXTBOOK

UNIVERSITY

UNDERGRADUATE

WHITEBOARD

RESEARCH

STUDYING

Appendix 2

List of the semantically dissimilar words:

NUCLEAR

ORCHARD

ELEPHANT

DELIGHT

WHISKEY

EYEBALL

COCAINE

GUITAR

AUSTERITY

FACTORY

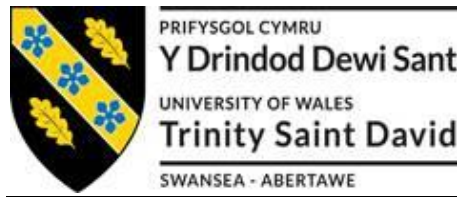
Appendix 3

Participant ID: _____

CONDITION 1:

CONDITION 2:

Appendix 4



School of Psychology
Townhill Campus
Swansea

Study Consent Form

I understand that this research study is being carried out by 2nd year Psychology Students for their course, and that taking part in this study will involve memorising a series of presented words and recalling them within a preset time. The aim of the study is to measure the potential effect of distraction on cognitive performance.

This task will take approximately 5 minutes to complete.

I understand that participation in this study is entirely voluntary and I am free to withdraw participation at any time without giving a reason. I am aware that if I have concerns about the study I can discuss these concerns with the researcher or academic supervisor at any time during or after the study.

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 researchers.

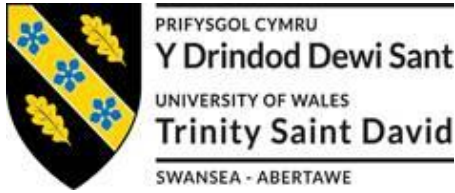
I, _____ (NAME) consent to participate in the study conducted by [student], School of Psychology, University of Wales Trinity Saint David, Swansea under the supervision of [supervisor]

Participant Signature: _____

Date: _____

Name and signature of researcher taking consent

Appendix 5



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Swansea

Study Debrief Sheet

Effects of distraction on recall of similar and dissimilar words.

Thank you for taking part in the study.

The aim of this study was to investigate whether there would be any differences in the effects of the distraction, on the recall performance between similar and dissimilar 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 remain confidential and anonymous and we will not trace it back to you.

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

BSc. Honours Psychology

University of Wales Trinity Saint David, Swansea

Appendix 6

Number of recalled words, for Similar and Dissimilar items, across the two experimental conditions for all the participants.

Participant	Distraction	Similar	Dissimilar
1	1	10	8
2	1	3	5
3	1	6	5
4	1	3	4
5	1	7	5
6	1	8	8
7	1	6	4
8	1	7	6
9	1	7	6
10	1	6	4
11	1	9	6

12	2	7	5
13	2	6	6
14	2	4	4
15	2	5	7
16	2	7	5
17	2	7	5
18	2	7	8
19	2	2	7
20	2	5	6
21	2	8	9
22	2	7	6

Appendix 7

General Linear Model

Within-Subjects Factors

Measure: MEASURE_1

Type of words	Dependent Variable
1	Similar
2	Dissimilar

Between-Subjects Factors

		Value Label	N
Distraction	1.00	No	11
	2.00	Yes	11

Descriptive Statistics

	Distraction	Mean	Std. Deviation	N
Similar	No	6.55	2.162	11
	Yes	5.91	1.758	11
	Total	6.23	1.950	22
Dissimilar	No	5.55	1.440	11
	Yes	6.18	1.471	11
	Total	5.86	1.457	22

Box's Test of Equality of Covariance Matrices^a

Box's M	3.341
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F	.993
df1	3
df2	72000.000
Sig.	.395

Tests the null hypothesis
that the observed
covariance matrices of
the dependent variables
are equal across groups.^a

a. Design: Intercept +

Distraction

Within Subjects Design:

Typeofwords

Multivariate Tests^a

Effect		Value	F	Hypothesis df	Error df
Typeofwords	Pillai's Trace	.042	.879 ^b	1.000	20.000
	Wilks' Lambda	.958	.879 ^b	1.000	20.000
	Hotelling's Trace	.044	.879 ^b	1.000	20.000
	Roy's Largest Root	.044	.879 ^b	1.000	20.000
Typeofwords * Distraction	Pillai's Trace	.119	2.692 ^b	1.000	20.000
	Wilks' Lambda	.881	2.692 ^b	1.000	20.000
	Hotelling's Trace	.135	2.692 ^b	1.000	20.000
	Roy's Largest Root	.135	2.692 ^b	1.000	20.000

Multivariate Tests^a

Effect		Sig.	Partial Eta Squared
Typeofwords	Pillai's Trace	.360	.042
	Wilks' Lambda	.360	.042
	Hotelling's Trace	.360	.042
	Roy's Largest Root	.360	.042
Typeofwords * Distraction	Pillai's Trace	.116	.119
	Wilks' Lambda	.116	.119
	Hotelling's Trace	.116	.119
	Roy's Largest Root	.116	.119

- a. Design: Intercept + Distraction
 Within Subjects Design: Typeofwords
 b. Exact statistic

Mauchly's Test of Sphericity^a

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon ^b Greenhouse-Geisser
Typeofwords	1.000	.000	0	.	1.000

Mauchly's Test of Sphericity^a

Measure: MEASURE_1

Within Subjects Effect	Huynh-Feldt	Epsilon Lower-bound
Typeofwords	1.000	1.000

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.^a

- a. Design: Intercept + Distraction
 Within Subjects Design: Typeofwords
 b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square
Typeofwords	Sphericity Assumed	1.455	1	1.455
	Greenhouse-Geisser	1.455	1.000	1.455
	Huynh-Feldt	1.455	1.000	1.455
	Lower-bound	1.455	1.000	1.455

Typeofwords * Distraction	Sphericity Assumed	4.455	1	4.455
	Greenhouse-Geisser	4.455	1.000	4.455
	Huynh-Feldt	4.455	1.000	4.455
	Lower-bound	4.455	1.000	4.455
Error(Typeofwords)	Sphericity Assumed	33.091	20	1.655
	Greenhouse-Geisser	33.091	20.000	1.655
	Huynh-Feldt	33.091	20.000	1.655
	Lower-bound	33.091	20.000	1.655

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		F	Sig.	Partial Eta Squared
Typeofwords	Sphericity Assumed	.879	.360	.042
	Greenhouse-Geisser	.879	.360	.042
	Huynh-Feldt	.879	.360	.042
	Lower-bound	.879	.360	.042
Typeofwords * Distraction	Sphericity Assumed	2.692	.116	.119
	Greenhouse-Geisser	2.692	.116	.119
	Huynh-Feldt	2.692	.116	.119
	Lower-bound	2.692	.116	.119
Error(Typeofwords)	Sphericity Assumed			
	Greenhouse-Geisser			
	Huynh-Feldt			
	Lower-bound			

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	Typeofwords	Type III Sum of Squares	df	Mean Square	F
Typeofwords	Linear	1.455	1	1.455	.879
Typeofwords * Distraction	Linear	4.455	1	4.455	2.692
Error(Typeofwords)	Linear	33.091	20	1.655	

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	Typeofwords	Sig.	Partial Eta Squared
Typeofwords	Linear	.360	.042
Typeofwords * Distraction	Linear	.116	.119
Error(Typeofwords)	Linear		

Levene's Test of Equality of Error Variances^a

	F	df1	df2	Sig.
Similar	.151	1	20	.702
Dissimilar	.000	1	20	1.000

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.^a

a. Design: Intercept + Distraction

Within Subjects Design: Typeofwords

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	1608.091	1	1608.091	370.063	.000	.949
Distraction	.000	1	.000	.000	1.000	.000
Error	86.909	20	4.345			