

Title: The effects of levels of processing on memory recall.

Abstract:

Psychologists have investigated individuals' levels of processing for many years it has become increasingly popular due to its implications towards educational institutions, students repeatedly need to be able to recollect information on a regular basis, research in this field can help enable tutors to ensure their students, are able to learn in the best possible way to ensure that recollection is possible. There is a great deal of research on the levels of processing for individuals, it has a very simplistic approach towards explaining the way an individual uses their memory to recollect information previously retained. Whilst it has implications towards learning and educational institutions this has caused it to grow increasingly popular. The research for the levels of processing theory shows that individual's taking part in this type of test are highly influenced by the words due to the way in which individuals process the meaning of each word. There were twenty-one participants in this study, four males and seventeen females. A one-way repeated measures analysis of variance (Anova test) was carried out to evaluate the reliability of the hypothesis whilst also comparing the data collected. The experiment was related, with a one-tailed hypothesis. There was a significant difference expected between the two conditions within this study. The hypothesis states that there will be a significant difference between the conditions due to the different learning levels of processing within each condition.

Introduction:

The levels of processing theory, is based upon the notion that retention, of an item is perceived on the level or depth of processing, that is carried out by an individual for it to be material that is remembered. Superficial processing leads only to shallow levels of processing occurring for short-term retention, whilst deep processing leads to an individual being able to create efficient and durable retention, that is simply recollecting without using the phonological loop system associated with most memory models. The experiment used to collect the data, was a partial repetition of the experiment created by Craik & Lockhart (1972). They proposed that the inputs of stimuli undergo different levels of processing. The first stage of the processing levels is perceived as "shallow" and is said to involve the coding of the visual characteristics of the letters in which a word is printed. "Deep" processing involves the coding of the stimuli more hypothetically in terms of its meaning. Visual coding is perceived to be shallow, but semantic coding is perceived to be of a deep level of processing. Whilst Craik and Lockhart, (1972) centred their focus on the levels of the depth of the processing involved in memory, they predicted that the longer a memory trace is stored then deeper levels of processing must be used by an individual. Whilst it can be said that LOP is similar to the multi-store model of recall, LOP is a not a structured approach to the use of memory. It can be said that memory models are based on a primary idea of the results of information being processed by an individual. LOP does not concentrate on the long- or short-term memory processes, it only concentrates on the involvement of processes of memory.

Rationale:

The above theory predicts that due to the meaning of the word, words that are deeply processed will have a better chance of being remembered, compared to those that are processed for intermediate processing. It is also predicted that the words processed intermediately will be recollected better than the words that are only shallow processed due to their superficial meaning i.e. descriptive words. During everyday life, humans use memory without effort, so an explanation of memory is extremely useful in many aspects, with an explanation of the levels of processing required for certain recollection by individuals this can enable further researchers to confirm the results. The LOP approach has a basic prediction of the quantity of details individuals can recollect, this is ultimately determined by the depth of processing initially processed on the experimental stimuli by individuals. (Bellezza, et al, 1976.) Whilst there have been many previous results of similar research over the past 50 years, which shows that intricate rehearsal aids the recollection of words/memories. The research shows that without a link of importance to words the less likely the words will be able to be recollected by the participants. (Lockhart and Craik, 1990). Tulving, (2001) states that the processing during the encoding stage is critical to gain recollection of information, creating the notion that the memory process is perceived as a structural process constantly evolving.

Aims:

The experiment was a recognition task, during this experiment 3 conditions were tested (condition 1- shallow, condition 2- intermediate and condition 3- deep.) This was to see whether there was a significant difference between the levels of processing regarding the different conditions. With recognition having various important implications towards education, due to students being regularly expected to re-call information that they have previously studied. Students need to be able remember information regarding their education, on a continual basis, this can be during exams, essay writing and during discussions in the class. The aim of this study was to explore the recognition of words. The hypothesis is, that there will be a significant difference between the conditions due to the different learning levels within each condition (a one-tailed hypothesis). This study is a recognition task not a recall task.

Method:**Design:**

The design of the experiment was a related one-way Anova. It was a recognition task. There was one independent variable, with three conditions (presumed levels of processing.) The dependent variable was the amount of words recollected. The list of questions and answers were presented via a power point. Participants were asked to answer yes/no during the power point, they were then asked to recollect as many words as possible from the list provided. Participants took part in all 3 conditions. The first condition was perceived to be of a shallow level learning process, the second condition was presumed to be of an intermediate level learning process and

lastly, the third condition was presumed to be of a deep level learning process. This experiment was in a controlled environment due to the lecturer posting a note stating nobody was to enter due to the experiment being underway by participants.

Participants:

There were 21 participants, 4 were male the remaining 17 were female. Ages ranged from 19 years of age to 53 years of age. Participants were all undergraduate students from West Wales who took part in a class experiment. All participants were naive to the purpose of the experiment. All participants were fully de-briefed after the experiment had been carried out.

Materials:

(Refer to appendices 1)

Procedure:

(Refer to appendices 5)

Results:

Table 1:

This result section shows the std and means deviation

Condition	mean	SD
Shallow	2.86	2.707
Intermediate	4.19	2.358
Deep	11.00	2.258

Table one, shows that the means for all 3 conditions were different to each other however this still supports the hypothesis significantly. There is a significant difference between condition 1 (shallow) and condition 3 (deep). Even so the conditions 1 and 2 showed no significant difference.

To examine whether the difference between the three conditions was significant, a one-way repeated measures analysis of variance (Anova test) was carried out to evaluate the reliability of the hypothesis. That there would be significant differences between conditions of the recognition of words measured. (N=21 significant effect of processing. $F = (2.40) = 129.057$, $p < .05$) (N= number of participants).

Discussion:

Whilst the results of the experiment supported the hypothesis, there were limitations. There was only a significant difference between condition 1 (shallow) and condition 3 (deep). There was not a significant difference seen between condition 1 and condition 2 (intermediate). The same can be said for the difference between

condition 2 and condition 3. There was an uneven gender sample obtained, this does not show equal representation between both sexes, if more males had been involved different results may have been obtained. The age ranges between participants was varied, if the age range was closer from youngest to oldest there may have been less of a significant difference between conditions, thus altering the results. Dietary and lifestyle implications were not taken into account, as this experiment was a class task. More future research would be needed to ascertain whether this could also affect the results. The levels of processing cannot be measured correctly and only presumed to, be used due to this fact, it is only presumptive of the levels of processing actually, occurring there is no scientific way of measuring them at the moment (Eysenck, 1978).

This experiment shows that there is a need for more in-depth research that should be under taken in the future to take all of the listed implications into account. This research can have implications towards education, it could benefit teachers and their pupils, for the way their education levels are tested as well as being delivered throughout education centres. As this research shows the importance of rehearsal being elaborated for the information to be retained for ease of recollection when needed. Semantic processing can be used by students to revise, this should create a deeper processing due to the use of rehearsal. Once more research has been conducted initiatives can then be put in to place to help combat the implications and limitations that have been discussed within education.

References:

Bellezza, F. S., Richards, D. L., & Geiselman, R. E. (1976). Semantic processing and organization in free recall. *Memory and Cognition*, 4, 415-421.

Craik, F. I. M., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal behaviour*, 11, 671-684.

Eysenck, M.W. (1978a). Levels of processing: A critique. *British Journal of Psychology*, 69, 157-169.

Eysenck, M. W. (1978b). Levels of processing: A reply to Lockhart and Craik. *British Journal of Psychology*, 69, 177-178

Eysenck, M. W. & Keane, M. T. (1990). *Cognitive psychology: a student's handbook*, Lawrence Erlbaum Associates Ltd., Hove, UK.

Lockhart, R. S., & Craik, F. I. M. (1990). Levels of processing: A retrospective commentary on a framework for memory research. *Canadian Journal of Psychology*, 44(1), 87-112.

Tulving, E. (2001). Episodic memory and common sense: How far apart? *Philosophical Transaction of Royal Society London B*, 356, 1505-1515.

Appendix 1

Materials:

- A pen
- 2 separate pieces of paper. (see appendix 3.)
- Questions were presented via a power point presentation. (see appendix 2 for question and answer list.)
- Font size 36 in Helvetica Neue was used with questions and answers placed in the middle of the screen.
- The power point was presented with a blue back ground and black words. (see appendices 2 for word list.)
- Questions and answers were created by the experimenter.

Appendix 2

Put a cross by all the original words that you saw when answering the questions.

Words given in the experiment

Practice trails

- Is the word in capital letters?
- Would the word fit in the sentence
- Does the word rhyme with ?
- Practice trail
- Would the word fit in the sentence
- Cats meow, dogs _____
- quack

- Is the word in capital letters?
- FUNNY

Practice trail

- Does the word rhyme with rude?
- mood

TRAILS

Does the word rhyme with mouse?

house

Is the word in capital letters

LOUD

Does the word rhyme with pool?

rule

Is the word in capitals letters?

Coat

Would the word fit in the sentence

The _____ is the king of the animal kingdom

elephant

Is the word in capital letter?

Desk

Does the word rhyme with boat?

Cheek

Is the word in capital letters?

Finger

Does the word rhyme with room?

broom

Would the word fit in the sentence

A rodent is another name for a _____

fish

Does the word rhyme with field?

jump

Is the word in capital letters?

LAMP

Does the word rhyme with dirt?

shirt

Does the word rhyme with riddle?

fiddle

Would the word fit in the sentence?

Bees produce _____

juice

Does the word rhyme with moan?

tone

Does the word rhyme with pack?

rack

Is the word in capital letters?

Hand

Would the word fit in the sentence?

Come, sit and warm by the _____

ladder

Does the word rhyme with news?

paint

Is the word in capital letter?

HELLO

Would the word fit in the sentence?

On valentine's day we give each other _____

roses

Does the word rhyme with plate?

pen

Would the word fit in the sentence?

A mortgage is a form of loan for a _____

pond

Is the word in capital letters?

Leg

Does the word rhyme with glass?

rice

Is the word in capital letters?

Cotton

Would the word fit in the sentence?

Put another lump of _____ on the fire

coal

Is the word in capital letters?

CLIP

Would the word fit in the sentence?

Measure another _____ of flour

ounce

Does the word rhyme with lake?

bake

Would the word fit in the sentence?

Pass the salt and _____ please

pepper

is the word in capital letters?

Rock

Would the word fit in the sentence?

Use a _____ to spread the butter
knife

Is the word in capital letters?

GLOVE

Would the word fit in the sentence?

A witch travels by _____
aeroplane

Does the word rhyme with monk?

tower

Would the word fit in the sentence?

The _____ made a hole in the wall
drill

Is the word in capital letter?

Cart

Would the word fit in the sentence?

When it rains, I take an _____ out with me
apple

Is the word in capital letters?

Clover

Would the word fit in the sentence?

The _____ was rusty
nail

Does the word rhyme with patch?

match

Is the word in capital letters?

CARROT

Would the word fit in the sentence?

A _____ can marry a couple
flower

Appendix 3:

Put a cross by all the original words that you saw when answering the questions

house	LOUD	rule
coat	lost	Fiddle
snail	elephant	muddle
desk	cheek	carrot
phone	tiger	mince
finger	fish	cream
lose	trowel	flower
rubber	juice	hose
throw	crowd	jumper
broom	match	grass
lion	skirt	last
shirt	frame	LAMP
text	rail	tank
glove	jump	sketch
knife	rope	coal
rest	tram	sweater
rice	rack	rock
tone	tack	towel
chair	HELLO	cotton
arm	rake	aeroplane
paint	hand	roses
time	mower	maze
leg	ladder	bake
train	chest	tower
book	rest	glass
clip	pen	play
pepper	pond	line

Appendix 3 cont:

pear	motor	ounce
neck	foot	hat
paper	Cart	apple
drill	lazer	priest
light	nail	farm
case	harm	clover
tablet	list	razor
knee	ice	race

Appendix 4 cont:

[illegible]

Appendices 5:

Results given by students

Condition 1	Condition 2	Condition 3
1	5	12
4	10	13
3	5	12
3	7	10
2	5	10
6	6	14
2	3	9
3	3	11
0	2	10
9	3	13
1	2	11
0	1	9
4	3	6
2	1	7
0	2	12
2	5	11
10	8	13
2	4	13
4	5	13
2	6	14
0	2	8

Appendix 6:**Anova results :**

GLM Shallow Intermediate Deep

/WSFACTOR=conditions 3 Polynomial

/MEASURE=score

/METHOD=SSTYPE (3)

/EMMEANS=TABLES (conditions) COMPARE ADJ (BONFERRONI)

/PRINT=DESCRIPTIVE ETASQ

/CRITERIA=ALPHA (.05)

/WSDESIGN=conditions.

General Linear Model

Within-Subjects Factors	
Measure: score	
conditions	Dependent Variable
1	Shallow
2	Intermediate
3	Deep

Descriptive Statistics			
	Mean	Std. Deviation	N
Shallow	2.86	2.707	21
Intermediate	4.19	2.358	21
Deep	11.00	2.258	21

Multivariate Tests^a							
Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
conditions	Pillai's Trace	.931	128.674 ^b	2.000	19.000	.000	.931
	Wilks' Lambda	.069	128.674 ^b	2.000	19.000	.000	.931
	Hotelling's Trace	13.545	128.674 ^b	2.000	19.000	.000	.931

	Roy's Largest Root	13.545	128.674 ^b	2.000	19.000	.000	.931
a. Design: Intercept Within Subjects Design: conditions							
b. Exact statistic							

Mauchly's Test of Sphericity^a							
Measure : score							
Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon ^b		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
conditions	.921	1.561	2	.458	.927	1.000	.500
Tests the null hypothesis is that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.							
a. Design: Intercept							

Within Subjects Design: conditions							
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 Between-Subjects Effects						
Measure: score						
Transformed Variable: Average						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	2280.016	1	2280.016	193.508	.000	.906
Error	235.651	20	11.783			

Estimated Marginal Means

conditions

Estimates				
Measure: score				
conditions	Mean	Std. Error	95% Confidence Interval	

			Lower Bound	Upper Bound
1	2.857	.591	1.625	4.089
2	4.190	.515	3.117	5.264
3	11.000	.493	9.972	12.028

Pairwise Comparisons						
Measure: score						
(I) conditions	(J) conditions	Mean Difference (I-J)	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b	
					Lower Bound	Upper Bound
1	2	-1.333	.558	.080	-2.791	.124
	3	-8.143*	.599	.000	-9.707	-6.579
2	1	1.333	.558	.080	-.124	2.791
	3	-6.810*	.466	.000	-8.027	-5.592
3	1	8.143*	.599	.000	6.579	9.707
	2	6.810*	.466	.000	5.592	8.027
Based on estimated marginal means						
*. The mean difference is significant at the .05 level.						
b. Adjustment for multiple comparisons: Bonferroni						

Appendices 7:**Study Consent Form**

I understand that this research study is being carried out by a 2nd year Psychology Student for their research report, and that taking part in this study will involve memory recognition.

This task will take approximately 30 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 this study, then 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 [Stacy Waldman], School of Psychology, University of Wales Trinity Saint David, Swansea under the supervision of [Charlotte Greenway.]

Participant Signature: _____

Date: _____

Name and signature of researcher taking consent

____ Stacy Waldman.

Appendices 8:**Study Debrief Sheet**

The effects of levels of processing on memory recall.

Thank you for taking part in the study.

The aim of this study was to explore the effects of levels of processing on memory recall. We specifically wanted to investigate whether an individual deeply processed words, then would it result in a better the recall/recognition later on of said 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/anonymous and we will not trace it back to you.

If taking part in this study has raised any questions, please speak to the researcher Charlotte Greenway or contact the academic supervisor

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

Stacy Waldman.

BSc Honours Applied Psychology

University of Wales Trinity Saint David, Carmarthen