# Self reference and memory recall

Word count: 1934

## Introduction

There are many theories as to what factors may affect our ability to recall information. The Levels of Processing theory was developed by Craik & Tulving (1975). The researchers proposed that the depth to which we process information determines the likelihood that we will recall it. In their classic study, the researchers presented participants with a series of words; each word was followed by a simple yes or no question. Some of the questions led to shallow processing - for example, did the word start with the letter "s"? At the deep level of processing, participants were asked if words fit within the context of a sentence. Following the task, participants were asked to read a list of words and determine which words were part of the original list and which words were new. Results of the study indicated that participants' memories were more accurate for words that they had processed at a deeper level.

Rogers, Kuiper and Kirker (1977) took Craik & Tulving's study a step further by proposing "the self-reference effect" - that is, "the tendency for individuals to have better memory for information that relates to oneself in comparison to material that has less personal relevance" (Mandernach). In their study they replicated the study done by Craik & Tulving (1975), using a sample of 32 first year psychology students. Participants were shown a list of forty words and then asked either a shallow processing question or a question that would lead to self-referent encoding, such as "Does this describe you?" After answering the questions about the words, the participants were given a piece of paper and asked to recall the words in any order. The findings showed that participants in the self-reference condition remembered 8.35 times as many words as those in the structural condition.

The aim of this study is to determine whether the self-reference effect increases the recall of a list of words among international, multi-lingual teenagers. It is an interesting question to investigate as it potentially supports the idea that if what we learn in school is relevant to our own identity, then we should be able to recall it better than if there is no personal relevance attached to it. This evidence could be used to support changes in both what is taught in schools - and how it is taught.

The null hypothesis is that there will be no significant difference in the number of words recalled from a list of 40 words whether the participant engages in shallow processing or self-referent encoding.

The research hypothesis is that participants who use self-referent encoding will recall significantly more words from a list of 40 words than participants who engage in shallow processing. Self-referent encoding will be accomplished by asking participants if a word describes them. Shallow processing will be accomplished by asking participants the structural question, is the letter "e" in the word.

The independent variable is the level of encoding (structural or self-referent); the dependent variable is the number of words recalled from the original list.

**Commented [A1]:** The theory upon which the research is based is stated and then described through the use of the original study.

**Commented [A2]:** Link between the theory above and the study to be replicated.

**Commented [A3]:** Description of the study on which the experiment was based.

**Commented [A4]:** The aim is stated.

**Commented [A5]:** The relevance of the investigation is explained.

**Commented [A6]:** The null hypothesis is stated with identification of the IV and DV.

**Commented [A7]:** The research hypothesis is correctly stated and the DV is operationalized.

**Commented [A8]:** The IV is operationalized.

## Exploration

This experiment used an independent samples design where two sets of participants were used, one for each condition. This design will ensure that participants do not benefit from practice which could affect the results. The sample was made up of two IB English classes. There were 32 participants - with 15 in the shallow processing condition and 17 in the self-referent condition. A sample of opportunity was used, guaranteeing that the sample was easily organised. All participants were IB first year students between the ages of 16 and 17. In this case, it also meant that the participants had a relatively similar level of English proficiency, which is important when asking participants to recall vocabulary. Also, by using IB students we were hoping that we would have a more motivated sample, seeing as how they understood the importance of the internal assessment. Each group was either given questions that would lead to shallow processing or to self-referent encoding.

In order to create the list of words, we first consulted websites for lists of positive and negative personality adjectives (EnglishClub). We chose 20 positive and 20 negative words. In addition, we chose only words with more than one syllable in order to avoid word length effect having an influence on our data. Additionally, we made sure that only half of them had the letter "e." We then took the list of words to our IB Psychology class and asked them if they knew all of the words. Words which were unfamiliar to any member of our class were replaced with words that were more familiar.

We flipped a coin to randomly allocate the classes to structural or self-referential conditions. In each condition, participants were read the standardised directions (see Appendix ii). Participants were given an "answer sheet" to fill in while they watched the 40 words projected in a power point slideshow. The slides were timed for 15 seconds so that the amount of time that they saw the word was standardized. Following the presentation of each word, participants answer one of two questions: "Does this word have an "e"?" (structural encoding) or "Does this word describe you?" (self-referent encoding). After the list was complete, participants were shown the video "Funny Animal Videos" as a distractor task. This was to make sure that words were not still in their short term memory, so avoiding the recency effect.

After the distractor task, the answer sheets were collected and new paper was distributed; participants were asked to write down as many words as they could recall. They were given 2 minutes to complete the task. New paper was distributed to make sure that no one had written down some of the words, anticipating that they would be asked to recall them.

**Commented [A9]:** The research design is explained.

**Commented [A10]:** The sampling technique is explained.

**Commented [A11]:** Control of variables

**Commented [A12]:** The choice of participants is explained.

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**Commented [A14]:** The choice of materials is explained.

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**Commented [A17]:** Control of variables

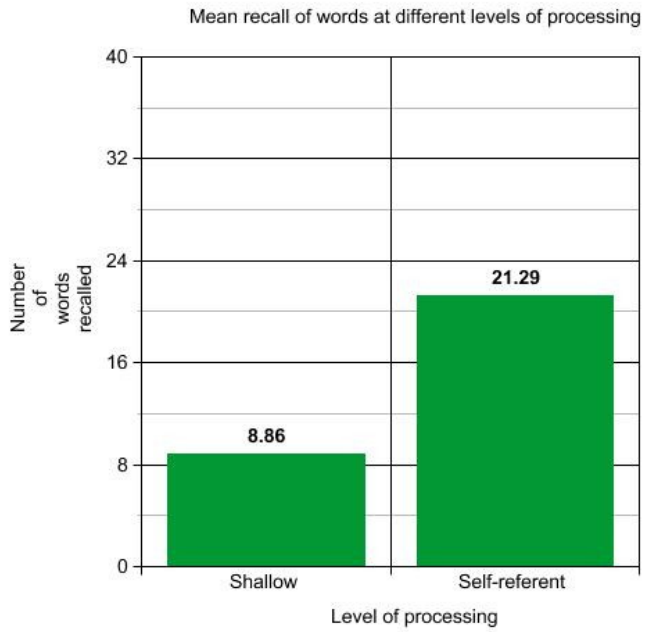
## Analysis

In order to provide a richer interpretation of our data, I have analysed the number of correct responses for each condition, but also words that were incorrectly recalled, but that would be considered synonyms and words that were incorrectly recalled that were not at all relevant to the words on the list at all. (For raw data see app iv). This was also done in the original experiment and I thought it would be interesting to see if there is any link here too. The results were as follows.

**Table 1. Descriptive analysis of data**

| | Shallow processing | Self Referent processing |
|---|---|---|
| Average & SD recall from list | $\bar{x}$ = 8.86; σ = 4.33 | $\bar{x}$ = 21.29 ; σ = 7.96 |
| Average & SD synonyms | $\bar{x}$ = 3.6; σ = 2.33 | $\bar{x}$ = 2.05; σ = 2.23 |
| Average & SD irrelevant words | $\bar{x}$ = 1.46; σ = 1.20 | $\bar{x}$ = 0.82; σ = 0.92 |

**Graph 1. A comparison of the mean recall of words at different levels of processing**




As can be seen from the data above, it appears that on average the group that used self-referent encoding remembered 2.4 times as many words as the group that used shallow

**Commented [A18]:** Descriptive and inferential statistics are appropriately and accurately applied.

**Commented [A19]:** This graph correctly addresses the hypothesis.

Given that the student decided to look for trends in the recall of synonyms it would have been interesting to see graphed data for that phenomenon. This does not however detract from the marks.

processing. Both groups had roughly the same number of synonyms, where words were recalled that had the same meaning as words that were read. In the shallow processing group there were more irrelevant words than in the self-referent group. In the self-referent group there was a greater variance of the data. This can also be seen in the range of the data. In the shallow processing group the range was from 3 - 19; whereas in the self-referent group there was a range from 8 - 33.

An unpaired T-test for independent samples was carried out. The t-test assesses whether the means of two groups are statistically different from each other. This analysis is appropriate because I want to compare the means of two groups by taking into account the spread of results. The test showed that the data was significant at $p < 0.0001$. This means that we can reject the null hypothesis. Since the computed t exceeds the critical t at $p < 0.0001$ , we reject the null hypothesis and conclude the alternative.
That is, it appears that self-referential encoding leads to a greater recall than shallow processing when asked to recall a list of adjectives.

**Commented [A20]:** The statistical findings are interpreted with regard to the data and linked to the hypothesis.

## Discussion

As can be seen by the results stated above, we were able to support the findings of Rogers, Kuiper & Kirker (1977). They found a much greater increase in the number of words recalled by the participants than we did. This could be because our participants were younger and may not have identified as strongly with some of the words. It could also have to do with participant variability; maybe our participants did not have the same level of memory recall in general as the participants in the original study.

The results are supported by the theory of levels of processing. Self-referential encoded is reflective and gets the participants to make personal links between themselves and the word. This gives the memory meaning.

**Commented [A21]:** The findings of the student's investigation are discussed with reference to the background theory or model.

One of the strengths of our study was that we tried to adapt our list of adjectives for our own community. This did not, however, prevent us from having words that participants did not recognize some of the words. During the debriefing we asked our participants whether there were any words that they did not know. We found that two participants did not know the meaning of *flirtatious* and three did not know *gullible*. If we were to replicate this, we would replace these words with something more common. In hindsight, it may have been better to test the words on a younger group, with the hope of avoiding having a lack of understanding as a confounding variable.

There are relational considerations here too. We may have asked questions we thought were shallow processing, but perhaps deeper processing could have been sparked off by our questions. For example, if we asked them to look for a letter S and their name started with an S we may have accidently started some deep processing. Some words may have been similar to words in their native language, this too might have sparked off deeper processing. The same may have been true for things we thought were deep processing. It could be possible that the questions were dismissed instantly and didn't even result in any more in depth thought.

Another strength was that we had the Power point set up to show the words for the same amount of time. This controlled for human error and guaranteed that there was no variation between the two groups.

A limitation of the study was that we used an independent measures design. Our differences may be due to participant variability. It would be appropriate to do this as a repeated measures design, with different words processed at either the shallow or self-referent level. This would eliminate any difference between the participants' skill of recall, since all participants would be compared to themselves in each condition.

Another limitation is that there may have been expectancy effect - that is, the participants may have guessed that we were going to ask them to recall the words that they were being shown. In our school students are participants in many experiments and many experiments ask students to recall the words. This may mean that in anticipation of having to recall the words, the participants rehearsed the words.

There were also variables that could not be well controlled because of the nature of our sample. The level of English proficiency was not controlled, so this could have had an effect on the level of recall - although participants admitted to not knowing only two of the words on the list. Secondly, it is not possible to know whether the group that was asked to do shallow processing actually did so, or if they used deeper processing - for example, visual imagery. It is not possible to control for this, but we did ask the participants during the debriefing. None of them said that they did, but this is self-reported information. Although it may be what the participants believe to be true, it may not represent what actually happened. Finally, it is difficult to generalize our findings as the sample was made up of only high school students. High school students may be more or less reflective about themselves than the average population. In addition, students are asked to recall lists more frequently than the general population. This may make their rates of recall higher than the average person.

For a future experiment, it would be interesting to test some other facet of memory than simply recall of a list of words. For example, if shown a series of photos of a home, if asked to note in which ways is the home similar or different from their own, would they remember recall more items from the images than someone who was asked to do shallow process - for example, count the number of objects in each photo. If so, this would show that self-referential encoding had greater application than simply as seen in the replicated study. Some further investigation using alternative methods to gage the level of language of participants or understand the cognitive processes of the participants when they are using self-referential processing, may also shed more light on the more complex underlying mechanisms.

From our study we are able to conclude that self-referential encoding lead to greater recall of words than shallow processing

**Commented [A22]:** Strengths and limitations of the design, sample and procedure are stated, relevant and explained.

Modifications are explicitly linked to the limitations of the student's investigation and fully justified.

**Commented [A23]:** The student could have analysed this further as information on language proficiency was given by the participants, see appendix i. However, the limitations covered are sufficient and of a very good standard to qualify for full marks even without further analysis.

**Commented [A24]:** Modifications are explicitly linked to the limitations of the student's investigation and fully justified. Interesting ideas for further research and triangulating the findings.

## Works cited

Craik, F. I. M., & Tulving, E. (1975). Depth of processing and the retention of words in episodic memory. Journal of Experimental Psychology: General, 104, 268-294.

Dailymotion. Funny Animal Videos. http://www.dailymotion.com/video/x19a02g_funny-animal-videos_animals

EnglishClub. (n.d.) Negative Personality Adjectives List. https://www.englishclub.com/vocabulary/adjectives-personality-negative.htm

EnglishClub. (n.d.) Positive Personality Adjectives List. https://www.englishclub.com/vocabulary/adjectives-personality-positive.htm

Mandernach, Jean. (n.d.) Self Reference. Online Psychology Laboratory. Accessed January 1, 2015. http://opl.apa.org/Experiments/About/AboutSelfReference.aspx

Rogers, T. B., Kuiper, N. A., & Kirker, W. S. (1977). Self-reference and the encoding of personal information. Journal of Personality and Social Psychology, 35, 677-688.

## Appendix i. Letter of consent

Hello, we are performing an experiment for our Psychology class. We are doing a study on the perception of vocabulary words. In our experiment, we are going to read to you a list of words and then ask you questions about them. We would like to ask you to take part in our experiment.

If you agree to take part in our experiment, you should know that:

- All data will be kept confidential and anonymous.
- You may stop participating in this experiment at any time.
- You will receive information about the nature of this experiment and our results after our analysis is complete.

I, _____, understand the nature of this experiment and I agree to participate voluntarily. I give the researchers permission to use my data as part of their experimental study.

Signature: _____ Date: _____

Native English Speaker (circle one): Yes No

Gender (circle one): Male Female

### Appendix ii. Standardized directions & "answer sheet."

Good afternoon and thank you once again for agreeing to take part in our experiment.

We are now passing out a letter of consent. Please read the letter and if you agree to participate, please sign the form and fill out the relevant information.

*After forms are collected, pass out the answer sheet to all participants.*

Group 1.

You are about to see a series of words projected on the screen in front of you. Each word will be projected for 20 seconds. During that time, decide if the word contains the letter "e." If the word contains the letter "e", please write the letter Y on your answer sheet for "yes." If it does not contain the letter "e", please write no. Once we begin showing the words to you, you may not talk or ask any questions. If there is a word that you do not know, that is ok. If you miss a word, please be sure to skip a line on your answer sheet.

Are there any questions?

Group 2.

You are about to see a series of words projected on the screen in front of you. Each word will be projected for 20 seconds. During that time, decide if the word describes you. For example, if the word is "shy" - if you are shy, write yes on your answer sheet. If you are not shy, then write "no" on your answer sheet. Once we begin showing the words to you, you may not talk or ask any questions. If there is a word that you do not know, that is ok. Simply leave the blank on your answer sheet with no response. If you miss a word, please be sure to skip a line on your answer sheet.

Are there any questions?

**Answer Sheet for Psychology Experiment**

| | |
|---|---|
| 1. _____ | 21. _____ |
| 2. _____ | 22. _____ |
| 3. _____ | 23. _____ |
| 4. _____ | 24. _____ |
| 5. _____ | 25. _____ |
| 6. _____ | 26. _____ |
| 7. _____ | 27. _____ |
| 8. _____ | 28. _____ |
| 9. _____ | 29. _____ |
| 10. _____ | 30. _____ |
| 11. _____ | 31. _____ |
| 12. _____ | 32. _____ |
| 13. _____ | 33. _____ |
| 14. _____ | 34. _____ |
| 15. _____ | 35. _____ |
| 16. _____ | 36. _____ |
| 17. _____ | 37. _____ |
| 18. _____ | 38. _____ |
| 19. _____ | 39. _____ |
| 20. _____ | 40. _____ |

**Appendix iii. Word list**

arrogant, ambitious, adventurous, aggressive, careless, moody, charming, sarcastic, selfish, boring, careful, intelligent, fussy, loyal, bossy, jealous, honest, thoughtful, hard-working, lazy, flirtatious, diplomatic, courageous, patient, optimistic, quick-tempered, romantic, stubborn, creative, funny, greedy, energetic, grumpy, practical, polite, inflexible, generous, gullible, nervous, sneaky.

## Appendix iv. Raw data & inferential statistics

**Shallow processing (n = 15)**

| Participant # | # of correctly recalled words | # of incorrectly recalled words (synonyms) | # of incorrectly recalled words (irrelevant) |
|---|---|---|---|
| **1** | 5 | 6 | 2 |
| **2** | 3 | 4 | 1 |
| **3** | 6 | 2 | 0 |
| **4** | 12 | 7 | 0 |
| **5** | 4 | 0 | 3 |
| **6** | 7 | 4 | 2 |
| **7** | 6 | 2 | 1 |
| **8** | 9 | 8 | 3 |
| **9** | 7 | 4 | 0 |
| **10** | 8 | 5 | 2 |
| **11** | 19 | 2 | 1 |
| **12** | 11 | 5 | 4 |
| **13** | 15 | 0 | 2 |
| **14** | 7 | 4 | 0 |
| **15** | 14 | 1 | 1 |
| **Mean** | 8.86 | 3.6 | 1.46 |
| **Standard Deviation** | 4.33 | 2.33 | 1.20 |

**Self-referent encoding (n = 17)**

| Participant # | # of correctly recalled words | # of incorrectly recalled words (synonyms) | # of incorrectly recalled words (irrelevant) |
|---|---|---|---|
| **1** | 22 | 8 | 0 |
| **2** | 26 | 4 | 1 |
| **3** | 14 | 3 | 1 |
| **4** | 29 | 0 | 0 |
| **5** | 11 | 1 | 0 |
| **6** | 8 | 4 | 0 |
| **7** | 19 | 2 | 2 |
| **8** | 31 | 0 | 1 |
| **9** | 26 | 1 | 0 |
| **10** | 22 | 1 | 3 |
| **11** | 29 | 0 | 0 |
| **12** | 33 | 0 | 0 |
| **13** | 30 | 0 | 1 |
| **14** | 25 | 0 | 0 |
| **15** | 12 | 4 | 2 |
| **16** | 15 | 2 | 2 |
| **17** | 10 | 5 | 1 |
| **Mean** | 21.29 | 2.05 | 0.82 |
| **Standard Deviation** | 7.96 | 2.23 | 0.92 |

## t-Test for Independent or Correlated Samples

[Traducción en español]

The logic and computational details of two-sample t-tests are described in Chapters 9-12 of the online text *Concepts & Applications of Inferential Statistics*. For the independent-samples t-test, this unit will perform both the "usual" t-test, which assumes that the two samples have equal variances, and the alternative t-test, which assumes that the two samples have *un*equal variances. (A good formulaic summary of the unequal-variances t-test can be found on the StatsDirect web site. A more thorough account appears in the online journal *Behavioral Ecology*.)

*Setup*

Independent Samples

Correlated Samples

Independent Samples

*Data Entry*

| Sample A | Sample B |
|---|---|
| 5 | 22 |
| 3 | 26 |
| 6 | 14 |
| 12 | 29 |
| 4 | 11 |
| 7 | 8 |
| 6 | 19 |
| 9 | 31 |
| 7 | 26 |
| 8 | 22 |
| 19 | 29 |
| 11 | 33 |
| 15 | 30 |
| 7 | 25 |
| 14 | 12 |

Please be sure to perform the Data Check procedure.

Reset Calculate

*Procedure*

*Initial Setup:*
Click the button for either 'Independent Samples' or 'Correlated Samples' to indicate which version of the two-sample t-test you wish to perform. If the Setup operation is not performed, the programming will default to the independent-samples design.

*Entering Data Directly into the Text Fields:*
After clicking the cursor into the scrollable text area for sample A, enter the values for that sample in sequence, pressing the carriage return key after each entry except the last. (On a Macintosh platform, the carriage return key is labeled 'Return'; on a Windows platform it is labeled 'Enter.') Perform the same procedure for sample B.

*Importing Data via Copy & Paste:*
Within the spreadsheet application or other source of your data, select and copy the column of data for sample A. Then return to your web browser, click the cursor into the text area for sample A and perform the 'Paste' operation from the 'Edit' menu. Perform the same procedure for sample B.

*Data Check:*

*Data Summary*

| | A | B | Total |
|---|---|---|---|
| n | 15 | 17 | 32 |

12/01/15 0

t-Test: Independent or Correlated Samples http://vassarstats.net/tu.html

| | | | |
|---|---|---|---|
| $-\Sigma X$ | 133 | 362 | 495 |
| $-\Sigma X^2$ | 1461 | 8788 | 10249 |
| SS | 281.7333 | 1079.5294 | 2591.9688 |
| mean | 8.8667 | 21.2941 | 15.4688 |

*Results*

| $Mean_a - Mean_b$ | t | df | P | | |
|---|---|---|---|---|---|
| -12.4275 | -5.21 | 30 | P | one-tailed | <.0001 |
| | | | | two-tailed | <.0001 |

For independent samples, these results pertain to the "usual" t-test, which assumes that the two samples have equal variances.

*F-Test for the Significance of the Difference between the Variances of the Two Samples*

| $df_1$ | $df_2$ | F | P |
|---|---|---|---|
| 16 | 14 | 3.38 | 0.013540 |

*[Applicable only to independent samples.]*
P>.05 indicates no significant difference detected between the variances of the two samples.

*t-Test Assuming Unequal Sample Variances*
*[Applicable only to independent samples.]*

| $Mean_a - Mean_b$ | t | df | P | | |
|---|---|---|---|---|---|
| -12.4275 | -5.39 | 25.34 | P | one-tailed | <.0001 |
| | | | | two-tailed | <.0001 |

| | Observed | Confidence Intervals | |
|---|---|---|---|
| | | 0.95 | 0.99 |
| $Mean_a$ | 8.8667 | ± 2.4787 | ± 3.4516 |
| $Mean_b$ | 21.2941 | ± 4.2235 | ± 5.8172 |
| $Mean_a - Mean_b$ [Assuming equal sample variances.] | -12.4275 | ± 4.8679 | ± 6.5622 |
| $Mean_a - Mean_b$ [Assuming unequal sample variances.] | -12.4275 | ± 4.7471 | ± 6.4294 |
| | Independent Samples | | |

*For purposes of significance tests and calculation of confidence intervals, values of df associated with the unequal-variance condition are rounded to the nearest integer.*

Print this Window

### Appendix v. Debriefing notes

First we would like to thank you for taking part in our experiment. In our experiment we were trying to determine if the way that you processed information made a difference in your ability to recall it. In one group you were asked to say whether the letter “e” was in the word. In the second group, you were asked to think about whether the word described you. The first group was asked to do something we call “shallow processing”. The second group was doing “deep processing” - making a connection to the word. We found that the second group had a much higher rate of recall than the first group.

Are there any questions about our study?

We now have a few questions for you. Here are the words that we showed you (Project the list of words). Are there any words here that you do not know the meaning of ?

Secondly, is there anything you think we should know about the experiment?

Thank you once again for your time.