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Psychology Internal Assessment

An experiment into the effect of concrete and abstract words on recall

Psychology Higher Level

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Word count*: *1902

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Abstract

The aim of this experiment was to investigate whether the concreteness or abstractness of a word influences recall. The hypothesis predicted that more concrete words would be recalled than abstract words because previous research by Paivio (1975) shows that imagery is often used when remembering concrete words. The DV was number of words recalled and the IV was the concrete/abstract wordlists. The repeated measures design was chosen. An opportunity sample of 14 participants (N=14) participated. A list of concrete words were read out to participants in condition one. Then a filler task was given to be completed before being asked to recall the words. Then the abstract words were read out followed by another filler task, before being asked to recall the words. This procedure was repeated in condition two where abstract words were read out first. Lastly, participants were asked to report what strategies they used to remember.

The Wilcoxon test showed that results were significant at a 5% level of significance so the research hypothesis that participants remember more abstract than concrete word was accepted. Participants reported the use of imagery when remembering concrete words. This supported Paivio's Dual-code theory.

Word count: 192

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Introduction

Cognitive processes such as memory and encoding are based on mental representations which are ways in which we store information and images in our memory. Baddely and Hitch (1974)[1] suggested *the working memory model (WMM)* to demonstrate that the short-term memory (STM) is dealing with the mind's inner visual features such as size and colour in the visual-sketchpad. The reason why imagery is a powerful memory strategy could be explained by the Dual-coding theory suggested by Paivio (1975)[2]. This theory can explain how we form mental images by the level of "concreteness". According to Paivio memories are formed by two codes, one specialized in non-verbal objects and another semantic. Since concrete words are often connected with an image and abstract words are not, concrete words are presumably easier to remember. This assumption is corroborated by Richardson (1974)[3] who found that a significantly higher number of concrete words were retrieved from LTM than abstract words, compared to no difference from STM.

Researchers have discussed whether strategies of encoding influence recall. One such study was suggested by Brenda Kirchoff (2006)[4] who investigated whether differences in strategies were related to differences in brain activity when viewing interactive objects. Kirchhoff found that the two main strategies scoring highest were visual inspection and verbal elaboration. Furthermore, different areas of the participant's brains were active during encoding during MRI scans. This indicates that specific strategies may enhance recall. Futhermore, this supports the dual-coding theory by Paivio (1975) because participants performed better when using imagery.

On the same line, Paivio, Smythe and Yuille (1968)[5] studied the effect of imagery on learning. Paivio et al. (1968)[6] asked students to learn a list of paired associates consisting of 16 pairs of words.[7] The participants were university students aged between 18-54 years. The pairs of words to be remembered were equally divided into groups of High-imagery (H) words such as *dress* and *juggler*, and low-imagery words (L) such as *duty* and *effort*. The pairs were combined in 4 different combinations: HH, HL, LH and LL investigating stimulus. The participants were not told what memory strategy to use. The results showed an evident effect of imagery on memory. The H-H pairs resulted in the significantly best scores of recall and the L-L

[1] In Crane & Hanibal (2009), p.73
[2] In Reed (1996), p. 183
[3] In Gross (2001) p. 257
[4] University in St. Louis (2006, August 10). Brain Imaging Identifies Best Memorization Strategies. *ScienceDaily*.
[5] Paivio et. Al.(1968) In Reed (1996), p. 182
[6] In Reed (1996), p. 182
[7] In Paivio, Smythe and Yuille (1968) p. 431

pairs the worst. After the experiment the participants were asked to report what strategy they had used to remember the words. It appeared that imagery was the most reported use of strategy for the H-H pairs and the lowest for the L-L pairs. This demonstrates the effectiveness of imagery. The researchers argued that the high scores of recall of High- imagery words was due to the automatic formation of images to create an interactive memory code that is independent from the verbal code.

The above findings are important since they have given cognitive researchers an insight into memory processes and the effect of level of concreteness and abstractness in relation to behaviour (recall of words) which is essential to the science of psychology.
This experiment is a partial replication of Paivio, Smythe and Yuille (1968)[8] since it is modified by using a filler task, to ensure that the words reach LTM. Furthermore, only two variables were compared, namely LL and HH. The aim was to investigate the effect of high imagery words (concrete) and low imagery words (abstract), on recall and to investigate memory strategies used. Based on Paivio, Smythe and Yuille (1968) a one-tailed hypothesis was chosen.

Experimental hypothesis (H_1): Participants in the concrete words condition will have a higher mean recall of words than participants in the abstract words condition.

Null hypothesis (H_0): There will be no significant difference between recall of abstract words compared to concrete words or any difference will be due to chance.

Method

Design:

The repeated measures design was chosen in order to minimize participant variability such as capacity of memory. One possible disadvantage of this design is order effects such as boredom and fatigue. To avoid order effects, counterbalancing was used. Participants were randomly allocated to start with either condition 1 or 2. Condition 1 (concrete wordlist[9] was read out first for half of the participants) and Condition 2 (abstract words were read out first) for the second half[10]. To assure that our equipment and time estimates were suitable the researchers conducted a pilot study.

[8] Paivio et. Al. (1968)
[9] See appendix 3.
[10] See appendix 3.

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Ethical considerations were followed, in the sense that each participant was briefed before the experiment, and debriefed after it. We made it clear that they at any time had the right to withdraw from the experiment and that their anonymity would be protected. The participants were not harmed physically or psychologically. Finally, all participants signed an informed consent form[11].

Independent variable: Whether concrete or abstract word lists were used.

Dependent variable: Amount of words recalled.

Participants:

The participants were found by "opportunity sampling" because this was the most convenient and saved time. The target population was IB students at Nørre Gymnasium with fluency in English. Participants were asked to participate and those who accepted were invited to meet in front of the classroom where the experiment took place. The participants were required to have specific English abilities because the experiment was conducted in English and they had to remember English words. The sample consisted of 7 boys and 7 girls (N=14) who were between 17 and 18 years old which was convenient as they were all able to sign the consent form.

Materials:

- Consent form[12]
- Standardized briefing and debriefing instructions[13]
- List of 10 abstract words and 10 concrete words[14]
- Sheet of filler task[15]
- Blank piece of paper
- 7 pencils
- Strategy for encoding form[16]

Procedure:

The first group of participants from condition 1 (N=7) were welcomed in a quiet classroom. They were asked to sit at desks that had been prepared with a pen, a blank piece of paper and a filler task[17]. One of

[11] See appendix 1.
[12] See appendix 1.
[13] See appendix 2.
[14] See appendix 3.
[15] See appendix 4.
[16] See appendix 5.

the researchers read the standardized briefing[18] out loud. Then the informed consent forms[19] were handed out to be signed.

The participants were informed that the words would be read out twice, slowly (concrete words[20]). Then the participants were instructed to solve the filler task (to assure that the words were stored in their LTM) for 1 minute and to write all the words they could recall on the blank paper in front of them for 1 minute and 40 seconds. Immediately after this, one of the researchers prepared the participants for the second word list and read it out (abstract words[21].) Once again the participants were asked to solve the filler task before recalling the words. Finally, one of the researchers handed out 2 slips of papers to be ticked off regarding strategies of remembrance[22]. Then the questionnaires were collected together with the filler tasks and the slips of papers. Lastly, the researcher read the standardized debriefing[23] out loud. Before the participants left, they were thanked and instructed not to talk with anyone about their participation of this experiment to avoid revealing the aim of the experiment.

The second condition of this experiment took place 10 minutes afterwards in the same way. Before the second group of participants (N=7) arrived, the researchers quickly prepared the desks once again. When they arrived, the same procedure was followed except from the difference that the abstract words were read out first.

Results - descriptive

The experiment collected interval data. Therefore, the mean and SD were chosen as descriptive statistics. From the mean measures on table 1. it can be deduced that the concrete words resulted in a higher mean recall of words than the abstract. The results were dispersed fairly close to the mean with standard deviations (SD) being quite low (1.6 and 1.4)

Table 1: Mean recall and Standard deviation of respectively abstract and concrete words.

	Mean	Standard deviation	N
Concrete words	7.8	1.6	14
Abstract words	6.6	1.4	14

[17] See appendix 4.
[18] See appendix 2.
[19] See appendix 1.
[20] See appendix 3.
[21] See appendix 3.
[22] See appendix 5.
[23] See appendix 2.

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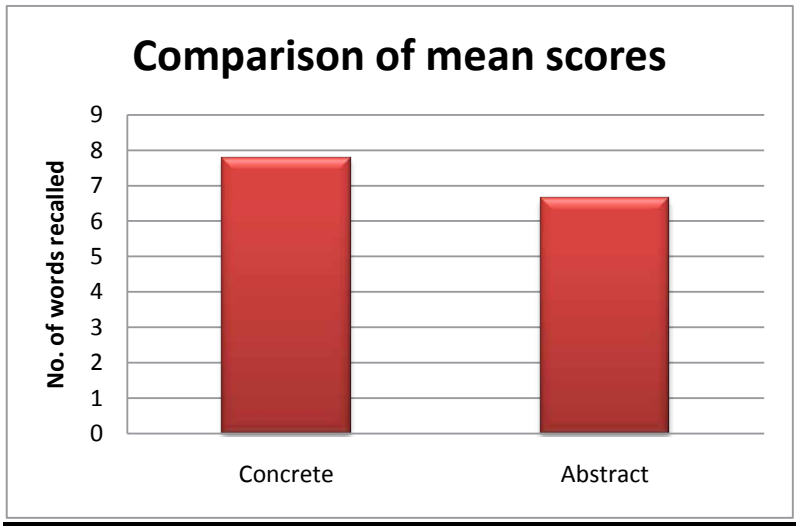
Figure1[24]: Difference in mean recalls of abstract and concrete words



Inferential

A Wilcoxon test was chosen since the experiment tested a difference, repeated measures design was chosen and the data was interval but reduced to ordinal by ranking. Looking up the T value (12) in the table for critical values of the Wilcoxon sign test for a 'one-tailed test' gives a critical value of 14. Since T (12) is smaller than 14, the level of significance chosen was P= 0.05. Therefore we rejected the null hypothesis and accepted the experimental hypothesis.

Discussion

This experiment showed that it is easier to remember concrete words since it scored a mean recall of 7.8 compared to 6.6 in abstract words and a Wilcoxon test showed that there was a significant difference between recalls of the two word lists at P=0.05[25]. It was reported that most participants used imagery as a strategy when remembering the concrete words[26]. These findings are consistent with the predictions of Paivio's (1975) Dual-coding theory[27] in that participant's use of imagery led to higher recall. This supports the hypothesis[28] of this experiment and the findings of the original experiment[29].

[24] See appendix 6
[25] See appendix 8
[26] See appendix 7
[27] In Reed (1996), p. 183
[28] See p. 5
[29] In Paivio, Smythe and Yuille (1968)p.430

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Paivio et al (1968)[30] had a higher difference in the mean total recalls of abstract and concrete words namely, 5 than this experiment with result of 1.2. This might be because this experiment's word lists only consisted of 10 words which are too few compared with Paivio's (1975) 32 words[31]. More words could be used in a future experiment to achieve a better demonstration of the effect of concreteness on memory. Still, we obtained similar results since there was a significantly high recall of concrete words, implying that imagery is an effective memory strategy to store words with. This corroborates findings of Kirchhoff (2006)[32] who brain scanned participants while they were using different memory strategies and found that the most used strategy was visual inspection, which is related to imagery. Additionally, we discovered that individual participants used multiple strategies[33] to learn the information read out loud which is also in concordance with Kirchoff's (2006) findings. This indicates that people use different and multiple methods so it may be too simplistic to consider strategies in isolation.

One limitation could be that most participants were IB-diploma students so they were probably trained in remembering abstract terms. Additionally, generalization could be a problem because of the participant's age range of 17-18 years compared to the original experiment with the age range of 18-54 years.[34] The low SDs (1.4 and 1.6) indicates that participants performed relatively similar, since the data was spread close to the mean. This may be because students were similar in age and were all IB students. An improvement in a future experiment is to use a larger age range such as Paivio Smythe and Yuille (1968). Another limitation occurring was that some participants completed the filler task before time was up so they might have revised the words before they entered LTM which is important in the processing of the words in the visuospatial sketchpad, according to Baddely and Hitch (1974)[35]. This could easily have been prevented if the filler task was longer. However, as there was a significant difference between concrete and abstract words on recall it can be assumed that the words reached the LTM.

Lastly, artificiality is a problem because of the experimental method. However, seeing as the experiment was conducted in a classroom, this can be considered a natural environment. Researchers are discussing to what extent results on memory like these can be relied on. One modification to this problem is to use words that the sample is more familiar with such as *party,* and *cell-phone,* instead of *alligator* and *rock*. Nonetheless, many replications of the study by Paivio (1975) [36] have demonstrated the clear effect of

[30] In Paivio, Smythe and Yuille (1968)p. 430
[31] In Paivio, Smythe and Yuille (1968) p. 429
[32] University in St. Louis (2006, August 10). Brain Imaging Identifies Best Memorization Strategies. *ScienceDaily*.
[33] See appendix 7.
[34] In Paivio, Smythe and Yuille (1968) p. 431
[35] In Crane & Hanibal (2009), p.73
[36] In Reed (1996), p. 183

using concrete words on recall and thus we can rely on these results.

In conclusion, the results attained in this experiment are consistent with cognitive theories about memory processes such as the *WMM*[37] and Dual-coding theory[38]. Therefore this experiment concluded that concrete words are better recalled than abstract words and this is probably due to the use of imagery. However, the researchers did not study whether people would perform better if they could easily associate with the words. This could be a topic for further research.

References

Crane, John and Hannibal, Jette (2009) Psychology: Course Companion. Oxford: Oxford University Press.

Gross, Richard (2001) Psychology: The Science of Mind and Behaviour Hodder & Stoughton, London.

Paivio, A., Smythe, P., Yuille, J. *Canadian Journal of Psychology*: *Revue canadienne de psychologie*. Vol 22(6), 1968, 427-441.

Reed, S.R. (1996) Cognition. Theory and application. 4th edition. Pacific Grove: Brooks/Cole Publishing Company

Washington University in St. Louis (2006, August 10). Brain Imaging Identifies Best Memorization Strategies. S*cienceDaily*. Retrieved March 5, 2011, from http://www.sciencedaily.com/releases/2006/08/060809082610.htm

[37] In Crane & Hanibal (2009), p.73
[38] In Reed (1996), p. 183

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Appendices

Appendix 1.

Confirmed consent:

Consent Form.

· I have been informed about the nature of the experiment

· I understand that I have the right to withdraw from the experiment at any time, and that any information/data about me will remain confidential

· My anonymity will be protected as my name will not be identifiable.

· The experiment will be conducted so that I will not be demeaned in any way.

· I will be debriefed at the end, and have the opportunity to find out the results.

I give my informed consent to participating in this experiment

NAME and date_____

Contact number_____

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Appendix 2.

STANDARDISED BRIEFING:

Welcome everyone!

Thank you for allowing time to participate in this experiment on memory.

The other researcher will distribute an informed consent form that we will ask you to signal your agreement. If at anytime you should change your mind do know that you are entitled to withdraw from this experiment. Please listen carefully and do not talk to any of the other participants. Furthermore, do not look at any papers on the table until instructed to do so.

You will then be read the same list of 10 words twice, slowly. A task has been distributed for you to carry out. Then you will be asked to write down all the words you recall on the paper in front of you. Turn the paper over when instructed to. The same procedure will be repeated one more time with a new list of words.

If you have any questions you are more than welcome to ask one of the researchers.

DEBRIEFING:

The aim of this experiment was to investigate which types of words were easier to remember, concrete or abstract. Previous research has shown that concrete words were easier to recall than abstract words due to high-imagery. If you wish to know the full results of the experiment or have any further questions you are more than welcome to leave your e-mail.

Thank you once again for your participation.

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Appendix 3.

Concrete and abstract word lists

(Concrete)

Alligator

Window

Pencil

Shoes

Butterfly

Rock

Car

House

Flower

Hammer

(Abstract)

Truth

Belief

Faith

Mood

Chance

Mercy

Effort

Interest

Theory

Necessity

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***Appendix 4*.**

FILLER TASK:

100/ 25 = __

100/ __ = 4

15 + __ = 3

__ + 35 = 234

69 + 19 = __

11 – 7- 2 =___

40 × 5 = __

80 × 5 = __

100 / 4 = __

88 / 2 = __

102 / 2= ___

60 / 5= ___

12 + 13 + 1 = __

600 - 555 = __

456 + 19 = __

126 – 7 =___

200× ½ = __

80 × ½ = __

14

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Appendix 5.

(1) WHAT STRATEGY DID YOU USE TO REMEMBER THE WORDS? (Tick one of the options)

- ○ None
- ○ Repetition (rehearsal)
- ○ Verbal (A phrase or rhyme connecting two words)
- ○ Imagery (Mental pictures that include the items)
- ○ Other

(2) WHAT STRATEGY DID YOU USE TO REMEMBER THE WORDS? (Tick one of the options)

- ○ None
- ○ Repetition (rehearsal)
- ○ Verbal (A phrase or rhyme connecting two words)
- ○ Imagery (Mental pictures that include the items)
- ○ Other

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Appendix 6

	Condition 1							Condition 2							Scores
Concrete:															
Alligator	1	1	1	1	1	1	1	1	1	1	1		1	1	13
Window	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14
Pencil	1	1		1	1		1	1	1	1	1	1	1		11
Shoes	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14
Butterfly	1			1	1	1		1	1	1	1	1	1	1	11
Rock	1	1		1	1	1	1	1	1	1	1		1	1	12
Car		1	1	1	1	1	1		1	1	1		1	1	11
House	1			1	1			1	1	1	1	1	1	1	10
Flower	1	1	1	1	1	1			1			1	1		9
Hammer	1			1					1				1		4
Total word count	9	7	5	10	9	7	6	7	10	8	8	6	10	7	
Mean:							7,57	8							**8**
Abstract:															
Truth	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14
Belief	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14
Faith	1	1	1	1	1		1		1	1	1		1	1	11
Mood	1	1	1		1	1		1	1	1	1		1	1	11
Chance		1	1					1	1	1	1	x	1	1	8
Mercy				1	1			1		1			1		5
Effort		1							1		1			1	4
Interest					1		1		1			1	1	1	6
Theory		1		1	1	1			1			1		1	7
Necessity	1		1	1	1	1	1		1	1	1	1	1	1	12
Total word count	5	7	6	6	8	5	5	5	9	7	7	6	8	9	
Mean:							6	7							**7**

Summarized:

															Mean
Concrete	9	7	5	10	9	7	6	7	10	8	8	6	10	7	**7.8**
Abstract	5	7	6	6	8	5	5	5	9	7	7	6	8	9	**6.6**

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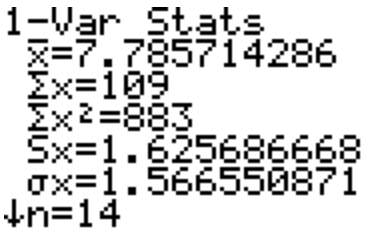
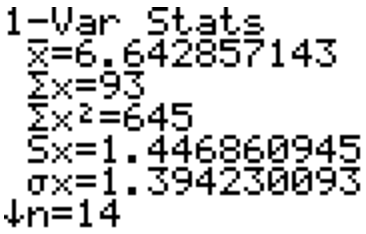
The calculator was used to find the mean and the standard deviation:

Screen shots from calculator:
For concrete wordlist



For abstract word list



Where mean= ∑x/N
When
∑ = total of scores
x = each score
N=number of scores in the set

$\bar{x}$ = mean
σ = standard deviation

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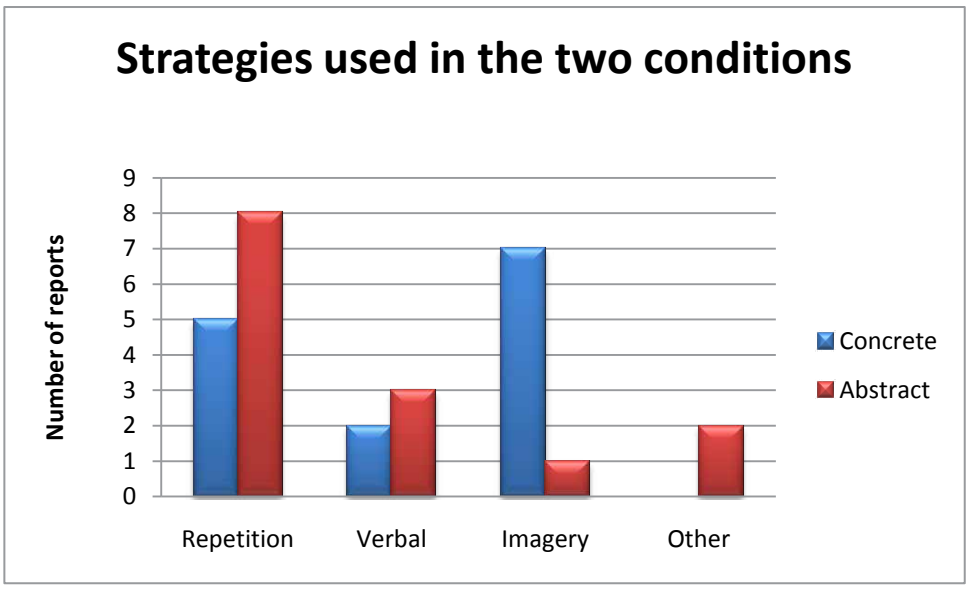
Appendix 7

Table 2. Overview of the number of participants using repetition, verbal, imagery or other strategies in remembering the concrete and abstract words.

Strategies:

	Concrete	Abstract
Repetition	10	11
Verbal	4	3
Imagery	7	2
Other	0	3

Figure 2.Number of participants using different strategies in the two conditions



From the graph it is clearly illustrated that most participants reported the use of imagery in the concrete word condition whereas most participants used repetition as a strategy in the abstract condition.

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Table 3.

Calculations of the statistical test, Wilcoxon Sign test:

First, the scores are tabled. Then the difference of the scores is calculated.

Participant	A Concrete words	B Abstract words	A-B Difference *d*
1	9	5	4
2	7	7	0
3	5	6	-1
4	6	5	1
5	7	5	2
6	10	9	1
7	8	7	1
8	8	7	1
9	6	6	0
10	10	8	2
11	7	9	-2
12	10	6	4
13	9	8	1
14	7	5	2

Table 4: The data is ordered in ascending order and ranked by averaging the orders of each difference. The plus and negative signs are ignored as well as the zeroes (0). The signs of the sorted differences are identified.

Difference	Order	Rank	Signs of difference,
1	1	3.5	-
1	2	3.5	+
1	3	3.5	+
1	4	3.5	+
1	5	3.5	+
1	6	3.5	+
2	7	8.5	-
2	8	8.5	+
2	9	8.5	+
2	10	8.5	+
4	11	11.5	+
4	12	11.5	+

The sum of all positive differences (R^+) is then calculated.

$R^+ = 3.5 + 3.5 + 3.5 + 3.5 + 3.5 + 8.5 + 8.5 + 8.5 + 11.5 + 11.5 = 66$

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The sum of all negative differences, (R^-) is calculated:
$R^- = 3.5 + 8.5 = 12$

From the two values (66 and 12) 12 is the smallest and hence the test statistic T = 12.