Subject: Psychology

RQ: How does priming affect decision-making by speed estimation?

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Contents

1 Introduction

When a memory is created, it is not stored like a file on a smartphone that can be played back, instead a memory construction process takes place, which works by encoding different senses (Iconic, Haptic, Echoic, Gustatory and Olfactory), together with emotions and semantics. When recalling an event, these memories are reconstructed from the fragments of information that were previously encoded (Stark et al., 2010).

But sometimes during the reconstruction of memories, the brain takes cognitive shortcuts to achieve efficiency, which leads to false memories. The false memories can be created before a recall or during recall of memories. The false memories created during recall use heuristics to achieve cognitive efficiency. Heuristics, first introduced by Daniel Kahneman (Tversky & Kahneman, 1974) are decision making rules that are used by people to efficiently make decisions, that is using minimal cognitive effort. Minimal cognitive effort results in not only faster decision-making but also conservation of energy to be utilized in other areas of the body. But, heuristics are the prime reason for the formation of biases in decision making. False memories created before the process of reconstructive memories are likely due to the misinformation effect. The misinformation effect is a cause of false memories that occurs due to the introduction of misleading information. This misleading information incorporates itself into the memory of a particular event in the past. Elizabeth Loftus studied false memories in great detail and in the study (Loftus & Palmer, 1974), she focused on the biases in decision-making that stems from false memories. The study contained 2 experiments and the aim of both experiments was to study the effects of use the misinformation effect by using linguistic characteristics to induce false reconstructive memory and study the biases in decision making. The use of specific linguistic characteristics to evoke certain semantics is based on the theory of priming. Priming occurs when an individual is exposed to certain stimuli which subconsciously affects their response to another stimuli. According to a study conducted by

Carmichael, that recalling of certain memories may be determined by the nature of the words that are presented to the subjects during the recalling process. (Carmichael et al., 1932). This conclusion was used to form the methodology for the study (Loftus & Palmer, 1974).

It is important to study this effect as the formation of false memories can lead to false eyewitness testimonies, which results in false imprisonment of innocent people. It is important to study this effect to understand how to avoid misinformation and view an event from an objective point of view. This research is a replication of the first experiment of (Loftus & Palmer, 1974) with the primary goal of investigating the effects of priming. The aim of this experiment was to investigate if priming would affect decision making by speed estimation. This experiment aims to replicate the study (Loftus & Palmer, 1974), to establish reliability and further the understanding of false memories. Based on the results of the original experiment a direct hypothesis was chosen.

Experimental Hypothesis H_1: Priming the participants with words that are perceived to be more violent were more likely to estimate significantly higher speeds of the car shown in the video.

Null Hypothesis H_0: Priming the participants with words that are perceived to be more violent would not affect the estimation of speed of the car shown in the video.

2 Methodology

Design:

The independent sample design was chosen since assigning one subject to multiple conditions risked a chance of biased results due to priming multiple times. This research utilized a lab experimental method to establish cause and effect. This allowed us to control the experimental conditions, such that performing the experiment on different subjects at different times would still yield similar results. Ethical considerations were thoroughly followed. The participants were briefed before the experiment and debriefed after it. They were informed that they have all the right to withdraw from the experiment and are entitled to the results of the experiment. The consent of each participant was taken through the T&C of the school, where the school has the right to survey the student as long as they were not harmed physically or psychologically. Additionally, they were asked to give a verbal consent and were in no circumstances obligated to participate in the experiment. No participants withdrew from the experiment.

Variables:

Independent Variable: Verbs

Independent Variable Operationalization: Categorizing different groups to each verb by perceived intensity

Dependent Variable: Speed estimation

Dependent Variable Operationalization: A questionnaire

Controlled Variable:

- Age: A large delta in age could result in different justification of speed estimations. People aged 30-40 years are more likely to be experienced in driving than from ages 1618, due to differently formed schemas. Hence, limiting the range of ages, allows the cause effect to be observed regardless of vastly different personal experience.

- Experimental Conditions: All subjects were tested in the same room under the same conditions. Doing so otherwise, could potentially affect the priming and recalling process. Subjecting the participants to the same conditions will allow for a similar cognitive process taking place.

Participants:

The participants were found using "Opportunity sampling" as it was the most convenient and time efficient. The target populations were the IB students at EKOLA International School with a fluency in English. The participants who consented to participate were taken to an empty classroom and were seated appropriately. This experiment was performed on twice on different groups in similar experimental conditions. The sample consisted of 17 males and 21 females ($N = 38$), between the ages 15-18 years ($\leq a \leq 18$ years, $\bar{a} = 16.7$, $\sigma_a = 0.8$ years, $\tilde{a} = 17$ years).

The participants were divided into 3 groups called "Smashed", "Collided" and "Bumped".

This experiment was performed twice on 2 different sets of groups in order to gather appropriate amount of samples N. The group "Smashed" consisted of 7 males and 6 females ($N_s = 13$). "Collided" consisted of 7 males and 7 Females ($N_c = 14$) and "Bumped" consisted of 4 males and 7 females ($N_b = 11$).

Materials Used:

- Briefing and Debriefing instructions *(figures 6 and 7)*

- Multiple copies of the questionnaire for 3 groups. *(figures 3, 4 and 5)*

- Digital whiteboard

- 10s video of a car crash.

Procedure:

Each participant was firstly briefed about the experiment. The words for briefing *(figure 6)* were carefully chosen as to reveal minimal information about the experiment and reduce risk of biased results. The participants were shown a 10-second video of a car crash. The participant then turned their questionnaires *(figures 3, 4*

and 5) from face up and answered them. After everyone finished writing, the questionnaires were collected and the participants were debriefed. Each participant were randomly divided into 3 separate groups ("Smashed", "Collided", "Bumped") and the questionnaires they received were different by only a word. This different word was the same as their group. As in the group "Smashed", received the questionnaire with the word "Smashed" *(figure 3)*. The question with the different word was at the end as it was the critical question. The critical question asked the subject to estimate the speed of the focus car during the crash. All questions above were to distract the subject from the significant question and verify if the answer was valid, meaning the subject answered them with full seriousness.

The raw data *(Table 2)* was collected and manually inputted into Jamovi project, 2022. Then using Jamovi and its built-in statistical libraries Team, 2021 and Fox and Weisberg, 2020, One-Way Anova test was performed to get the descriptive and inferential statistics.

3 Results

3.1 Descriptive statistics

This study collected interval data and hence, the mean and standard deviation were chosen as descriptive statistics. *(Table 1)* shows the descriptive statistics of different groups' speed estimation. In the table *(Table 1)* it can be seen that on average, subjects primed with the verb "Smashed", estimated higher speeds ($\bar{S} = 99.2km/s$) as compared to "Collided" ($\bar{C} = 62.4km/h$) and "Bumped" ($\bar{B} = 36.1km/h$), with the latter having the lowest speed estimation The Standard Deviation (SD) shows that the results were dispersed fairly wide, with $SD_s = 22.9km/h$, $SD_c = 16.9km/h$, $SD_b = 12.0km/h$. The mean and SD of different groups are represented graphically in *(Figure 1)* and *(Figure 2)*

Table 1:
Descriptive data

Groups	N	$Mean[km/h]$	$SD[km/h]$	$SE[km/h]$
Smashed	13	99.2	22.9	6.35
Collided	14	62.4	16.9	4.51
Bumped	11	36.1	12.0	3.63

Figure 1:
Bar Graph of Average estimations ($\bar{S}, \bar{C}, \bar{B}$) for each group
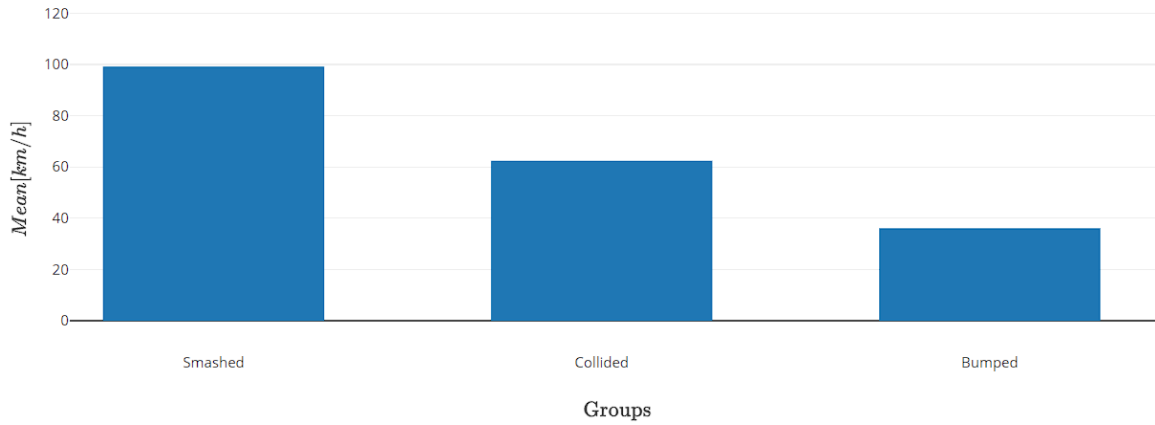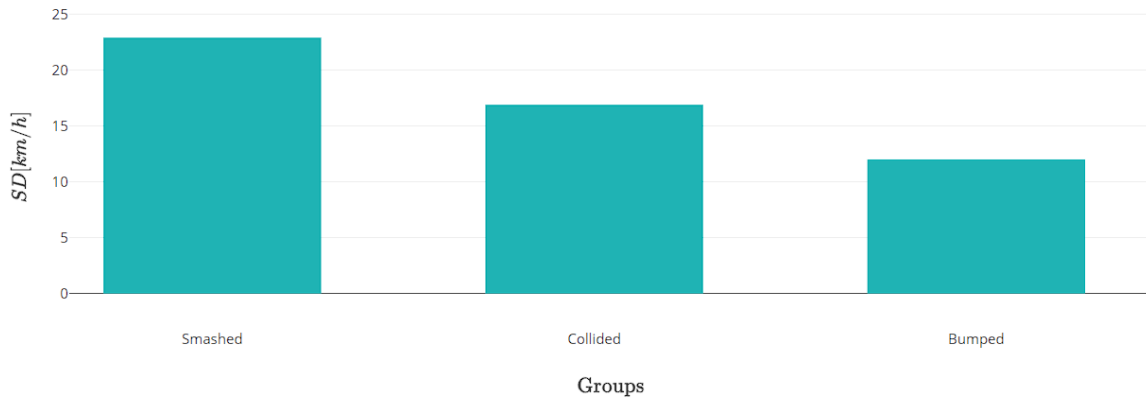

Figure 2:
Bar Graph of Standard Deviation (SD_s, SD_c, SD_b) for each group

3.2 Inferential statistics

A One Way ANOVA test was used since the experiment tested a difference between 3 groups. Using a Statistical tool, Fisher's Variance $F(2,35) = 37.2$, and $p < 0.001$ (statistical significance) were calculated. The low statistical significance means that the difference in the speed estimation between groups were significant enough for the null hypothesis can be rejected and the experimental hypothesis can be accepted.

The results from the descriptive and inferential statistics show that similar words with different semantics, do lead to a bias in decision making which was reflected by the estimation of speed.

4 Conclusion

This experiment showed that priming the subjects lead to the misinformation effect which resulted in a biased decision-making. This conclusion was reflected by the subject in group "Smashed", estimating a higher speed than groups "Bumped" and "Contacted". On participant specifically stated in the answer to the significant question that they did not see the car crash as they were distracted. Yet this subject, from group "Smashed" estimated a relatively high car speed *figure 8*

5 Evaluation

Despite the conclusions being consistent with the original study, this study conducted resulted in several strengths and limitations.

Firstly, this study uses a sample consisting of international students. This allowed for a cause effect to be established across multiple cultures. Additionally, everyone in the sample had a fluency in English language which was necessary for the priming effect to work. This established the external validity of this experiment. **Secondly**, a high internal validity was established the use of lab experimental method which helped factor out the controlled variables hence assuring that every subject participated in the experiment in very similar environment

Moreover, The study used independent measure design, which contributed to the credibility of the experiment. The original study used repeated measures, but it was disregarded for this study as it would have resulted in the subject already familiarized with the questionnaire when redoing the experiment under different conditions. While the use of matched pair design would make it difficult to isolate the independent variable due to other factors such as age, gender and race needing to be accounted for.

Lastly, ethical concerns were also attended to. Briefing and debriefing the participants allowed the study to be overt and ethical. Each participant had the right to withdraw anytime they wished to until submission since the form couldn't be traced back.

Albeit the strengths, the study has certain limitations also, that could be further improved upon the replication of this experiment.

Firstly, the sample size was relatively small, and restricted to 3rd year high school students. Due to partic-

ipants all attending a private international school, they belong to a relatively high socio-economic status. This decreases the generalizability of the experiment, as they do not represent the whole of population.

Another major limitation was the flaw in the questionnaire with the critical question "What was the speed of the focus car?", these 3 participants' answer to with "I do not know". An improvement to this would be to phrase the critical question as "Estimate the speed of the focus car:?"

The **third** limitation of this experiment is, that one cannot be certain if a memory was constructed of the car speed or simply the estimation was biased due to use of language. This experiment concludes that it might be a combination of both where the use of semantically heavy language influenced, influenced the memory reconstruction. This negatively affects the internal validity as doubts about an isolated cause effect still exist.

Lastly, the use of experimental methods introduces artificiality. This decreases the applicability of the findings as the subjects may or may not perform differently in a naturalistic environment.

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Appendix

Table 2:

Raw data collected from the experiment processed in project, 2022

N	Group	Speed Estimated [km/h]	Gender [F/M]	Age
1	"Collided"	80	"F"	17
2	"Collided"	95	"F"	17
3	"Collided"	80	"M"	18
4	"Collided"	60	"F"	17
5	"Collided"	41	"F"	17
6	"Collided"	67	"M"	17
7	"Collided"	60	"F"	17
8	"Collided"	35	"M"	16
9	"Collided"	50	"F"	15
10	"Collided"	50	"F"	16
11	"Collided"	50	"M"	15
12	"Collided"	65	"M"	18
13	"Collided"	60	"M"	17
14	"Collided"	80	"F"	17
15	"Bumped"	40	"F"	17
16	"Bumped"	30	"M"	17
17	"Bumped"	35	"F"	17
18	"Bumped"	27	"F"	17
19	"Bumped"	40	"F"	17
20	"Bumped"	40	"M"	18
21	"Bumped"	60	"F"	18
22	"Bumped"	15	"F"	17
23	"Bumped"	30	"M"	16
24	"Bumped"	30	"M"	17
25	"Bumped"	50	"F"	16
26	"Smashed"	100	"F"	17
27	"Smashed"	60	"F"	17
28	"Smashed"	120	"M"	17
29	"Smashed"	100	"M"	17
30	"Smashed"	100	"M"	17
31	"Smashed"	100	"M"	16
32	"Smashed"	80	"M"	16
33	"Smashed"	70	"F"	17
34	"Smashed"	100	"M"	17
35	"Smashed"	120	"F"	17
36	"Smashed"	100	"F"	16
37	"Smashed"	150	"M"	15
38	"Smashed"	90	"F"	16

Supporting documents

Figure 3:

"Smashed" questionnaire

Age: Gender: (Male / Female)

1. Describe the events that occurred during the accident:

Figure 4:
"Collided" questionnaire

Age: Gender: (Male / Female)

1. Describe the events that occurred during the accident:

2. What was the colour of the focus car?:

3. Was the focus car at fault? (Yes / No)

4. What was the speed of the focus car when it collided into the other car? (number in km/h):

Figure 5:
"Bumped" questionnaire

Age: Gender: (Male / Female)

1. Describe the events that occurred during the accident:

2. What was the colour of the focus car?:

3. Was the focus car at fault? (Yes / No)

4. What was the speed of the focus car when it bumped into the other car? (number in km/h):

BRIEFING

Welcome everyone!

We thank you for your time to participate in this experiment.

You will be distributed a questionnaire faced down. Then you will be shown a video on the digital whiteboard and then you can answer the questionnaire. Please keep the questionnaire faced down until the video is over. Once the questionnaire is faced up, please read and answer the questions carefully. The data collected from this experiment can, in no way be traced back to you. We request you to not speak during the experiment or use any electronic device. We request to have nothing on your desk except a pen. After you finish writing please place you pen on the desk and don't move until everyone is done.

If anyone has any questions, please do ask us now. Once the video starts, any questions raised will not be answered.

DEBRIEFING:

The aim of this experiment was to measure the effect of priming the participant with words that have different semantics. The room was divided into 3 groups. Each group received that same questionnaire except one word. The different words were "Smashed, Collided, Bumped".

We believe that those who got the word "Smashed" estimated a higher speed of the car, while those who got Bumped estimated a much lower speed.

For any inquiry regarding the experiment, please contact us and we'll be more than happy to help you.

Thank you once again for your participation.

Age: _____ Gender: (Male / Female)

1. Describe the events that occurred during the accident:

Car was driving forwards very fast, then it hit some object and rebounded backward to hit a yellow bus that tried to evade the crash by moving right.

2. What was the colour of the focus car?: Blackish, grey (most probably a BMW)

3. Was the focus car at fault? (Yes / No)

No

4. What was the speed of the focus car when it smashed into the other car? (number in km/h):

100 km/h

note: I did not see the focus car hitting another car so I please dont mind hope u wont mind it

One-Way ANOVA

One-Way ANOVA (Fisher's)

	F	df1	df2	p
Speed Estimation	37.2	2	35	< .001

Group Descriptives

	Verbs	N	Mean	SD	SE
Speed Estimation	Collided	14	62.4	16.9	4.51
	Bumped	11	36.1	12.0	3.63
	Smashed	13	99.2	22.9	6.35