

The Impact of Leading Questions on Memory Recall and Estimation

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ABSTRACT

Leading questions are known to bias memory and judgment, yet less is known about their effect on adolescents' numerical estimations after brief exposure to a stimulus. This study tested whether the intensity of suggestive wording shifts high-school students' recall-based estimates. Fifty-three students (ages 16–18) were assigned by intact class to one of three independent conditions: neutral (control), slightly leading ("Is there more or less than 20,000 grains of rice?"), or heavily leading ("Previous groups estimated 20,000; is that a fair estimate?"). After viewing a transparent jar (~44,000 grains) for 5 seconds and a 120-second interval, participants submitted a single numerical estimate via Google Forms. A one-way ANOVA showed a significant effect of question intensity on estimates ($p = 0.004119$). Relative to the neutral condition, both leading conditions shifted estimates toward the 20,000 anchor, with greater dispersion under slight leading and a narrower clustering under heavy leading. Results replicate and extend classic leading-question effects to quantitative estimation in adolescents, highlighting anchoring as a likely mechanism. Findings underscore the need for neutral phrasing when soliciting student reports or eyewitness-style recollections in school and youth-serving contexts. All procedures were conducted in accordance with school ethics guidelines, including informed consent and debriefing.

Keywords: Leading Questions, Memory Anchoring, Memory Recall, Adolescents, Eyewitness Testimony, Cognitive Psychology

List of Abbreviations

IB	: International Baccalaureate
ANOVA	: Analysis of Variance
SD	: Standard Deviation
H ₀	: Null Hypothesis
H ₁	: Research Hypothesis

Introduction

Numerous theories postulate that various factors affect our ability to recall information. In this experiment, the leading questions theory, as studied by Loftus and Palmer in 1974, is examined. A leading question is a question that suggests a desired answer due to its wording. According to the leading questions theory, a person's memory is malleable and may be influenced by new information they are exposed to between

witnessing and recalling an event [1]. To restate, the outcome of leading questions may trigger memory distortion or significantly impact the original recollections.

The study by Loftus and Palmer aimed to demonstrate that leading questions could distort eyewitness testimony accounts due to a language change [1]. The study involved showing a video of a car crash to the participants and asking them to recall the speed at which the cars were traveling. They were asked a series of questions: "About how fast were the cars going when they (smashed / collided / bumped / hit / contacted) each other?" The changing intensity of the verb used in the question was the independent variable that was manipulated in the experiment. The results of this experiment were that the participants who had a higher-intensity verb recalled significantly higher speed estimates compared to those with a low-intensity word. Thereby demonstrating that the wording of a question can influence memory recall.

The continued study of the leading questions theory is critical in the high school population, as today's students will become future eyewitnesses, professionals, and decision-makers.

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Understanding how leading questions affect their memory is crucial, as their recollections can influence disciplinary actions, legal testimonies, and personal decisions. Given that adolescents are still developing cognitive skills, it's important to assess if leading questions impact them as they did in past studies. By replicating Loftus and Palmer's study with high school students, we can evaluate the effect of leading questions on their recall and raise awareness about unintentional memory manipulation.

This study aims to examine the extent to which the intensity of leading questions (e.g., strongly suggestive vs. weakly suggestive wording) influences high school students' numerical estimates of the amount of rice in a jar.

H₀: The number of rice grains estimated by high school participants will not significantly differ based on the level of suggestion in the leading question (e.g., strongly suggestive vs. weakly suggestive wording).

H₁: The number of rice grains estimated by high school participants will significantly vary depending on the intensity of the leading question.

Review of Literature

Previous research has demonstrated that the phrasing of questions can lead to the distortion of memory recall. Loftus and Palmer illustrated that the participants' speed estimations of a

car crash varied as a result of the variance of the verb used in the question; thereby establishing that eyewitness testimonies are heavily susceptible to suggestion [1,2]. Similar studies that have been conducted, such as the study of Loftus and Pickrell 1995 illustrated similar results in which the reliability of memory recall came into question when they were able to plant fictional memories within some participants [3]. As such, research has demonstrated the susceptibility of memory recall to distortion; the introduction of a reference subconsciously shifts an individual's responses towards that reference point, resulting in memory distortion.

There is significantly more research done on the impact of leading questions that has been conducted on adults, with a lack of research put into its impact on adolescents who are still developing critical cognitive abilities and may be increasingly susceptible to suggestion. By testing the effect of leading questions on high school students' numerical recall, this study addresses that gap and explores how leading questions may influence younger populations.

Materials and Methods Research Design

This study utilized an independent sample design in which participating classes were randomly allocated to one of the three conditions. This design was chosen to prevent participants' responses from being influenced by exposure to multiple conditions. Random allocation was conducted at the class level to minimize individual participant bias and maintain consistency within each condition.

Ethical Considerations

Within the study, ethical guidelines were met through a thorough debriefing and informed consent form. Participants were given the informed consent form, which detailed the right to withdraw

and age limitations. Additionally, the debriefing detailed the aim of the study, as well as the various conditions of the study. A definition and explanation of the leading questions theory was also given. Furthermore, participants were informed that their results were anonymized and that if they wished to withdraw from the experiment, they could.

Sampling Method

This study utilized opportunity (convenience) sampling, selecting participants based on availability and accessibility within the high school setting. Available classes were randomly assigned to one of three conditions as whole class groupings.

Participants

The sample consisted of 53 high school students aged 16–18 within a school setting. Participants were all in grade 11, enrolled in IB Higher Level Mathematics, IB Higher Level Physics, or mainstream Law and Accounting classes.

Materials

- Transparent glass jar filled with ~44,000 grains of rice
- Three variations of a Google Form document
- Informed consent form (Google Form)

Procedure

- Classes were randomly allocated to one of three conditions: control, slightly leading, or heavily leading.
 - The first condition was a control condition in which participants were asked how many grains of rice were in the jar
 - The second condition was the slightly leading condition in which participants were asked, "Is there more or less than 20,000 grains of rice?" and then told to estimate the number of grains of rice
 - The third condition was the heavy leading condition in which participants were asked, "Previous groups have estimated 20,000 grains of rice. Would you say this is a fair estimate?" They were then asked to estimate the number of rice grains
- Participants observed the jar for 5 seconds, waited 120 seconds, then submitted estimates via Google Forms.
- A consistent briefing and debriefing script was followed.

Controlled Variables

To minimize confounding variables, several steps were implemented. A consistent procedure and script were followed to prevent participants from learning the true nature of the task before the debriefing. All participants had 5 seconds to examine the jar and an equal opportunity to hold it. They were also instructed to count to 120 before completing the Google Form to ensure minimal variation in time between viewing the jar and answering. Individual differences were controlled by randomly assigning entire classes to one of three experimental conditions (strongly suggestive, weakly suggestive, or neutral question). Using a Google Form allowed independent, anonymous responses, reducing social bias. The experiment was conducted in a controlled classroom setting to limit distractions, and all participants were high school students (ages

16-18), controlling for age and cognitive ability. These controls ensured that any observed effects on memory recall were due to

the manipulation of the independent variable, the intensity of the leading question.

Results

Table 1: Descriptive Analysis of Data Across Conditions

Descriptive Analysis of Data					
Conditions	Mean	Median	Mode	Range	Standard Deviation
Condition 1 (Control)	5,001.8	2,200.0	2,000.0	34,413.0	7,974.9
Condition 2 (Slightly Leading)	24,291.7	21,242.0	5,000.0	94,650.0	24,554.2
Condition 3 (Heavily Leading)	18,619.1	15,000.0	15,000.0	49,000.0	12,333.7

Descriptive statistics showed that the mean estimates of rice grains aligned with the leading question's anchor (20,000): Control (5,001.8), Slightly Leading (24,291.7), and Heavily Leading (18,619.1). Median values followed a similar pattern but were less reliable due to outliers. The Slightly Leading condition had the highest range (94,650.0) and standard deviation (24,554.2), suggesting mild suggestion increased variability. The Control condition had the lowest range (34,413.0) and standard deviation (7,974.9). The Heavily Leading condition showed a narrower clustering (range = 49,000; SD = 12,333.7).

Table 2: Raw Data Table

Participants	Raw Data Table		
	Responses Gathered from Participants (#Of Rice Grains Estimated)		
	Condition 1 (Control)	Condition 2 (Slightly Leading)	Condition 3 (Heavily Leading)
1	1,478	5,000	9,600
2	1,324	30,000	11,000
3	10,155	350	25,000
4	737	21,242	24,567
5	8,000	35,345	6,000
6	2,400	35,000	13,000
7	1,376	95,000	15,000
8	5,500	5,000	15,000
9	2,000	2,000	22,000
10	4,372	6,590	10,000
11	853	7,500	15,000
12	1,000	18,000	12,000
13	587	25,000	27,500
14	2,000	20,000	55,000
15	4,000	40,001	N/A
16	2,500	80,000	N/A
17	35,000	24,000	N/A
18	6,750	2,300	N/A
19	N/A	24,597	N/A
20	N/A	3,200	N/A
21	N/A	30,000	N/A

Within the raw data (Table 2), several outliers had vastly different responses from the rest of the data. Several estimations were comparatively different from the average guess, such as 350, 587, and 95,000. The most likely explanation for these outliers is a lack of experience with cooking involving rice, given that the actual number of grains of rice within the jar was 44,000.

Furthermore, minimal data had to be thrown out; however, one particular estimation that was thrown out was an estimation of two grains of rice. This estimation was thrown out, given that this estimate was the result of the 'screw you effect' in which participants attempt to destroy the credibility of the study. This occurs when participants become demotivated or antagonistic towards the experiment or experimenter and attempt to provoke the experimenter by intentionally disrupting the integrity of their experiment.

A One-Way ANOVA test (Figure 1.) produced a p-value of 0.004119, indicating a significant effect of question intensity on recall-based estimates. This rejects the null hypothesis and supports the research hypothesis.

Result Details				
Source	SS	df	MS	
Between-treatments	3714013083.2182	2	1857006541.6091	$F = 6.14216$
Within-treatments	15116885172.7063	50	302337703.4541	
Total	18830898255.9245	52		
The F -ratio value is 6.14216. The p -value is .004119. The result is significant at $p < .05$.				

Figure 1: One-Way ANOVA Test Results (Significant as $p = 0.004119$)

Discussion

In relation to Loftus and Palmer, the results of this study fully align with the findings on the impact of leading questions on memory distortion [1]. Like in the original study, participants exposed to leading questions in this study provided significantly different and higher estimates compared to the control group. This supports the idea that suggestive phrasing can bias recall and estimation. The effect observed in this study further reinforces Loftus and Palmer's conclusions, demonstrating that the influence of leading questions extends beyond event recall to numerical estimation. The consistency between both studies suggests that memory recall and judgment are highly susceptible to external influence, particularly through anchoring and suggestion. The leading questions theory supports the results of this study. The leading questions theory states: "If someone is exposed to new information during the interval between witnessing the event and recalling it, this new information may have marked effects on what they recall" (Loftus and Palmer 1974). Such is the case with this experiment, seeing as how the leading questions posed to the participants in the slightly leading and heavily leading conditions had their memory "modified, changed or supplemented", as indicated by their responses [1].

Findings

This study found that the intensity of leading questions had a significant effect on the numerical recall of adolescents. Both the slightly and heavily leading questions shifted the participants' estimations towards the anchor (20,000) compared to the control condition, thereby confirming the research hypothesis. The slightly leading questions led to greater variability in the participants' estimations, while the heavily leading questions resulted in more clustered and focused responses. The results of this experiment suggest that the suggestive phrasing of questions (such as leading questions) can bias participant recall in a predictable direction towards the anchor. Furthermore, the intensity of the suggestive phrasing influences the accuracy and consistency of participant responses.

Limitations, Conclusions, Recommendations

Given that the samples were taken from individual classes within a single school, the generalizability of the experiment and its results is limited. Moreover, there may have been varying factors between the classes; however, classes are typically fairly diverse in terms of personality, culture, school grades, etc.

This study replicates the findings of Loftus and Palmer's study on the effects of leading questions on memory recall in that leading questions heavily impact the recall of participants. The results of this study provide further evidence of how leading questions can lead to the distortion of memory recall.

Future studies should maximize generalizability by increasing the number of schools included in the sample. This would increase the generalizability from a single school to all adolescents in a region. Furthermore, future studies may use matched-pair designs in order to reduce participant variability between the conditions.

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