A BEHAVIORAL STUDY ON THE EFFECT OF MEMES ON RETENTION AND PERCEPTION

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***Abstract*—Memes have become an integral part of our daily lives. Whether intentionally or not, we tend to come across a fair share of memes on a daily basis. The purpose of this study is to understand the impact of placing memes in conjugation with text and to establish how it affect's one's perception of information presented in terms of opinion formation and also how it impacts retention of information presented to a person through a behavioral study. This report first discusses literature review done on the study of internet memes and finds gaps in research which are worth exploring. Then, the experiment design, sample space, results and conclusion of the behavioral study conducted by us has been discussed in depth.**

As per the experiment design, 50 participants were asked to go through a newsletter and then asked to respond to a questionnaire. The analysis of the data collected showed that the inclusion of humour through memes plays a significant role in improving retention of information amongst participants. It also showed the inclusion of memes had an effect on the opinions of the participants with respect an article in the newsletter.

I. Introduction

The term 'meme' was coined by Richard Dawkins in his book "The Selfish Gene"(1976)[1] and has since been widely used in the fields of anthropology, sociology, and cultural studies. A meme, in a broader sense, refers to a cultural element or idea that is transmitted from one individual to another through various means of communication, such as language, gestures, or images. In context to our research work, we shall restrict my study of memes to visual memes, which are images shared as a form of expression, with humour embedded into them in form of satire, irony or exaggeration. Not all images present in social media can be called a meme though, and we use the two characteristics set out by D'ıaz and Mauricio (2013)[2] in order to categorise an image as a meme; First, an image is only a meme if it is reasonable that the image could be spread virally, i.e., beyond a small, pre-ordained group. Second, an image is only a meme if the structure or content of the image could reasonably be imitated, altered, and re-shared.

As a result of the wide usage of Social Media in the recent times, the phenomenon of 'memes' has risen over the last decade, which sheds light on the age old saying 'A picture is worth a thousand words'. This alarming rate of increase in the circulation of information online mandates studies into how the emerging technologies and their forms of communications have real world consequences. Several studies on these online entities called 'memes' have shown how effective they are in tapping into people's emotions, and being capable of shaping people's behaviour and attitude towards a particular subject, leading us to extend the proverb to 'A picture with a few captions, is perhaps worth a book'. Hence, this mandates a deeper look into these entities.

The goal with the following experiment design was to evalutate the impact of memes on participants and this impact is two-fold:

- **Retention**: The impact that memes have on an individual in terms of the amount of information that they have retained from a piece of consumed content.
- **Opinion**: The impact that presence of memes have on the formation of opinions based off of a piece of consumed content.

II. Literature Review

A. Effect of Memes

While looking for research work which established any sort of a connection between exposure to memes and change in people's perception, we found an interesting survey based research paper titled "The Effectiveness Of Political Memes As a Form Of Political Participation Amongst Millenials In Uganda" (Kasirye, Faiswal. 2019)[3] which established strong correlations between one's exposure to political memes and their political participation (i.e. willingness to vote and/or engage in political discussions). The paper started out with the hypothesis that exposure to political memes is an important factor that influences participation of citizens in politics. Through partial and bivariate correlation analysis on the responses of a survey conducted amongst 225 politically active millennials in Uganda, they establish how exposure to memes influence one's Awareness, Attitude And Behavior towards a certain subject hence, affecting their political participation. They also establish how the perceived significance of memes plays a mediating role when Awareness, Attitude And Behavior are set to be the independent variables with Political Participation set as the dependent variable in the quantitative analysis.

This paper provided valuable insights on a media effect theory called Elaboration likelihood model (ELM) of management, which explains how persuasion is used as a tool to affect opinions and measures people's willingness to engage in elaboration (Richard E. Petty and John T. Cacioppo, 1986)[4]. This paper also demonstrated how the use of analysis of closed

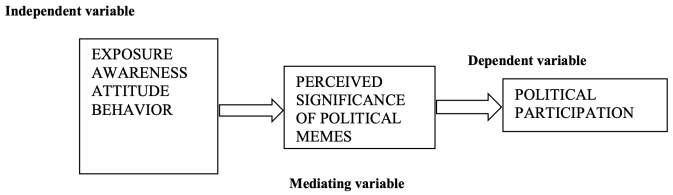

Fig. 1. Framework established by the author. Soure: Kasirye, Faiswal(2019)[3]

ended questions using SPSS (Statistical Package for Social Sciences), combined with descriptive analysis (frequency, percentage, mean and standard deviation) can be used to arrive at interesting inferences from data. Another research paper (Mahar et al. 2021)[5] replicated the same study, but in context to Pakistan, and arrived at similar results. I gained insights on tools that can be used for statistical analysis of surveys through these papers.

Ortiz et al. (2021)[6] establish how memes play a role in each stage of collective coping in stressful situation through a survey based methodology, analysed through partial least squares structural equation modeling (PLS-SEM). This study emphasizes on how memes cause emotional effects in people which eventually trigger various behaviours in people.

B. Memes and Persuasion

In any political system, it is imperative that people engage in well informed participation. McClure(2016)[7] States how memes *resemble individual panels of comic books or political cartoons, exemplary of what McCloud (2001)[8] refers to as 'amplification by simplification'* ". In this section we discuss existing work done on how memes play a role in shaping or changing perceptions of audiences, whether informed or uninformed. McClure argues that these *memes strip down a topic to the essential details and bring the focus on specific details. Hence he describes them as topical, political, and ideological entities that are intended to influence.*

Kadir et al.(2013)[9] elaborate upon various psychological and discourse frameworks(Such as Sublimal Persuasion, Propaganda Model, PsyOps and Elaboration Likelihood Model) through which political memes can be studied and conclude how memes could become a very effective tool in persuasive politics, influencing peoples perception by changing, or reinforcing them.

How memes play a role in each aspect of political campaigning (Narrative building, attacking opposition, media relations, connecting with the public etc.) and designing a study on whether people are able to identify the intent of a particular meme they encouter, and the effect memes have on their perception is a possible idea that can be explored along this domain. This can be connected to the various theories of persuasion to build up on the argument on how memes might affect one's opinions.

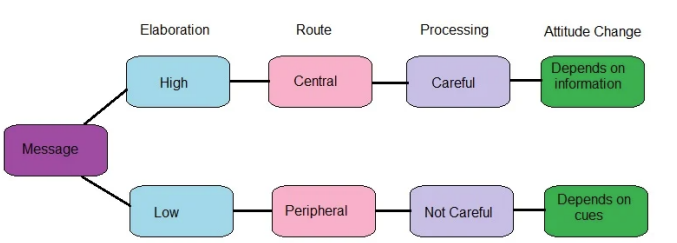

Fig. 2. The Elaboration Likelihood Model, developed by Richard E. Petty and John T. Cacioppo(1986)[4]

III. Research Methodology

Having underlined the importance to study and analyse the effects of memes, we wish to come up with a study that would help us understand the effect memes have on people encountering them in a practical sense. We wanted to see if inclusion of meme in any way affects how strongly one feels about a certain issue(effect of memes in shaping perception) and if inclusion of memes in any context helps people remember factual information about the topics in question in any sense.

A. Hypotheses Development

The hypotheses that the following experiment is designed to test are as followS:

1) **Null Hypothesis (H0):** Inclusion of memes into the content body has no effect on shaping perception or retention of facts in subjects.
2) **Hypothesis 1 (H1) - Retention:** Inclusion of memes into the content body improves the retention of facts and information amongst the subjects.
3) **Hypothesis 2 (H2) - Opinion:** Inclusion of memes in the content body plays a significant role in the shaping of opinions and perception of topics amongst the participants.

B. Participant Sampling

1) Sample Space: For the experiment, the sample space was chosen as the students of IIIT Hyderabad, as it would primarily consist of young aduls who would potentially be exposed to a wide variety of memes through the usage of social media on a basis.

2) Sampling Method:: In the following experiment, the method of **Voluntary Response Sampling** was used amongst to sample space (IIIT Hyderabad students) to collect participants. The test subjects were gathered through students who expressed their willingness to participate in the study through a form circulated online and by asking for participation in places of gathering such as labs, hostels and workspaces. The intention of this sampling method was to have **Simple Random Sampling** within the college community as the sample generated from this method would be the most representative of the overall student community at IIIT Hyderabad.

IV. Experiment Design

The experiment design was a **true experiment** with a **between subject design** which consisted of two tasks that the participant had to complete as part of the experiment, which are as follows:

1) **Read Newsletter**: As part of the experiment, a special newsletter was created which consisted of 10 articles regarding events and news about IIIT Hyderabad, and the participants were asked to go through the newsletter as they normally would.
2) **Answer Survey**: Once the participant was done reading the newsletter (which on average took about 5-10 minutes), they were asked to fill out a survey based on the information they just read in the newsletter.

Note that the participant was not informed earlier about the survey in order to avoid any possible biases. Once they were done reading the newsletter, only then were they told about the survey. Here, the extraneous variables could be the memory and concentration of each individual participant and their pre-existing biases and opinions towards certain topics.

A. Newsletter Design

In the first task of the survey, the participant was asked to read a custom newsletter. This newspaper was specially designed in order to eventually distribute memes and non-meme images in some of the articles. Overall, there are 6 newspaper versions in which, each version has 9 articles and 1 advertisement. Each article consists of an accompanying image, which can either be a meme or a non-meme image.

Fig. 3. Two newspaper version, one where the second article consists of a meme in one version and a non-meme image in the other

For every newspaper version, in order to ensure even distribution of memes across all articles and all newspaper versions, the conditions were set:

- All versions have equal number of memes and non-memes (5 each)
- All articles have equal number of memes and non-memes across newspaper versions (3 each)

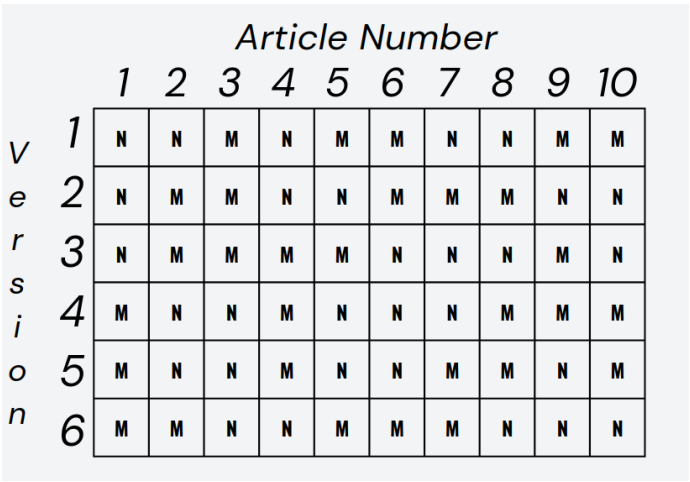

Fig. 4. Distribution of memes across articles and newspaper version, here 'M' refers to meme and 'N' refers to non-meme image

B. Survey Design

Once the participant was done reading the newsletter, they were then asked to fill out a survey based on the information that they just read. The survey consisted of two parts (unbeknowst to the participant):

1) **Retention**: The first section of questions tested the participants' retention of some factual information of the topics talked about in the articles shown to them. The questions were of MCQ format and short answer format.
   Operationalization of Section 1: For these questions, the independent variable would be whether the participants was presented with a meme or non-meme image for a particular article and the dependent variable would be their response to a question corresponding to that article (correct or wrong).
2) **Opinion**: The second section of questions tested the participants' perception, i.e., how strongly they feel about certain topics that were talked about in the articles.
   Operationalization of Section 2: For these questions, the independent variable would be whether the participants was presented with a meme or non-meme image for a particular article and the dependent variable would be their response to a question corresponding to that article. Here the participant was expected to answer with a rating (**likert scale**), either from highly negative to highly positive or a number between 1 and 5.

V. Statistical Analyses

In order to carry out the data analysis, the survey data has been split into 3 separate sections: mcq, short answers and opinions namely MCQ, SHORT and OPINION. Separate tests are performed on all 3 datasets and all of their results are used to reach the conclusion of this study.

A. Participant Demographic and Question Selection Criteria

Over the course of the experiment, a total of 50 participants took part in the survey across all newspaper and on average

each newspaper version was read 7 participants.

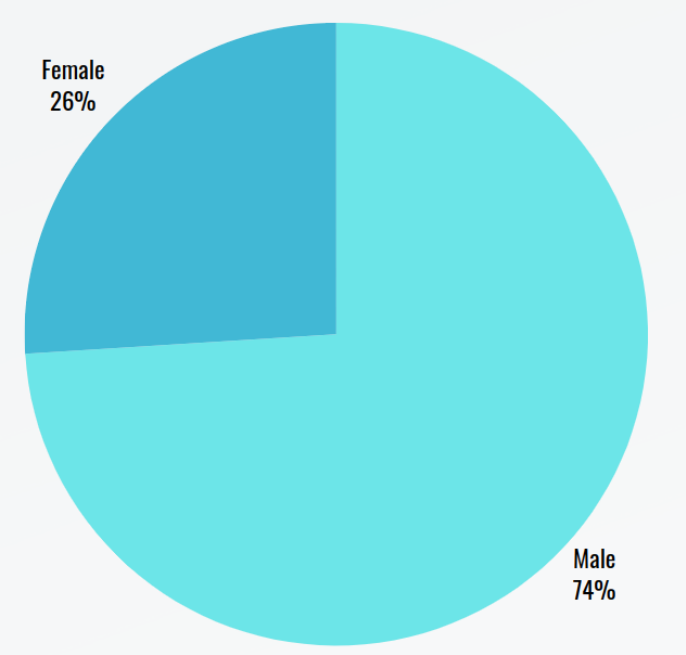

Fig. 5. A total of 50 participants took part in the experiment where approximately 75% were male and the rest were female, which is representative of the gender ratio amongst the students of IIIT Hyderabad

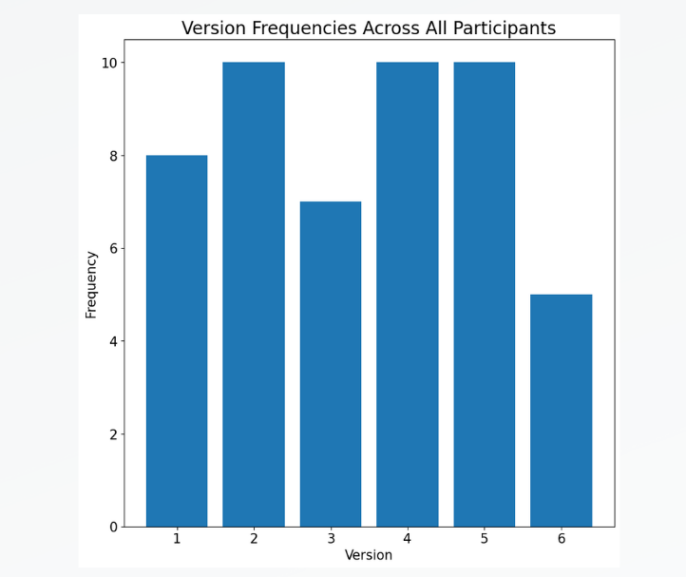

Fig. 6. Distribution of participants across all 6 newspaper versions

In order to reduce bias, the participants were asked to answer a variety of questions, including some questions that were not relevant to the study in order to ensure the participant doesn't become conscious on what they are being tested on. From statistical analysis and subject feedback, filtering was done based on whether the responses to the questions could be skewed by the participants' pre-existing personal opinions and knowledge regarding the subject.

B. Internal Consistency

In order to ensure the collected dataset is reliable, firstly the internal consistency of the dataset was checked using **Cronbach's alpha**. The α value was calculated for the data to check how closely the responses of each dataset were related to one another.

Dataset	α
MCQ	0.669
SHORT	0.746
OPINION	0.722

Here, we can see that for the selected questions, across all 3 datasets, the Cronbach's alpha is close to 0.7, which implies that the internal consistency of the dataset is good and further analysis can be done.

C. Testing For Null Hypothesis (H0)

In order to test for null hypothesis, we are testing to ensure that the any observed statistically significant relation is not occurring purely due to chance. Therefore, **permutation tests** will be used to test for the null hypothesis. The test is done as follows:

1) For each article across all newspaper version, there are two categories of answers, answers of those participants who have seen a meme in that particular article and participants who saw a non-meme image.
2) The data for each article is collapsed into these two categories MEME and NOMEME.
3) Permutation testing for each article is done separately.

Question	p-value
1	0.071
2	0.067
3	0.058
4	0.069
5	0.042
6	0.084
7	0.068

Here, we can see that the significance values are coming between 0.04 and 0.08. With this, we can conclude that the null hypothesis can be rejected and the relations are not occurring purely due to chance.

D. Testing for Alternate Hypotheses (H1 and H2)

1) Visualizations: Testing for the alternate hypotheses was done using various visualization as follows

In 7 we can see that participants that viewed articles across newspaper version that consisted of memes have answered the MCQ and SHORT questions more accurately as compared to the participants that viewed the non-meme version. This provides partial evidence towards H1.

From the figure above 8, we can see that the percentage of participants that viewed the non-meme version of particular article that answered the question incorrectly is higher than the percentage of those who answered it correctly. For the participants that viewed the meme-version of the article, the

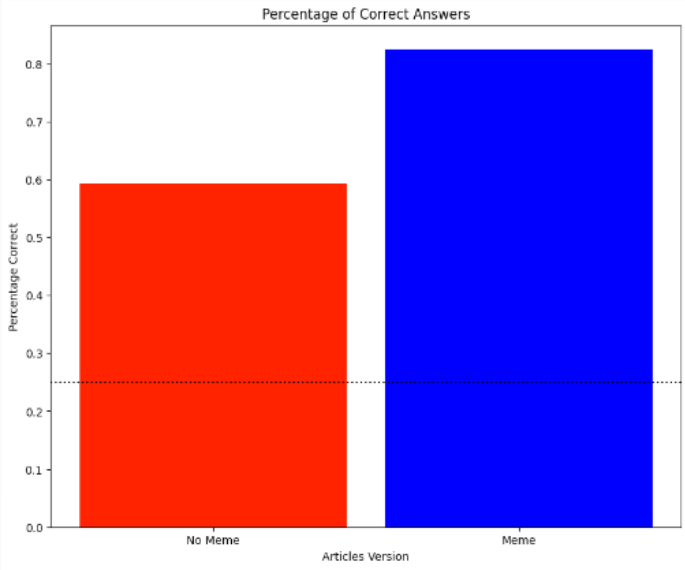

Fig. 7. Percentage correct answers across meme and non-meme articles

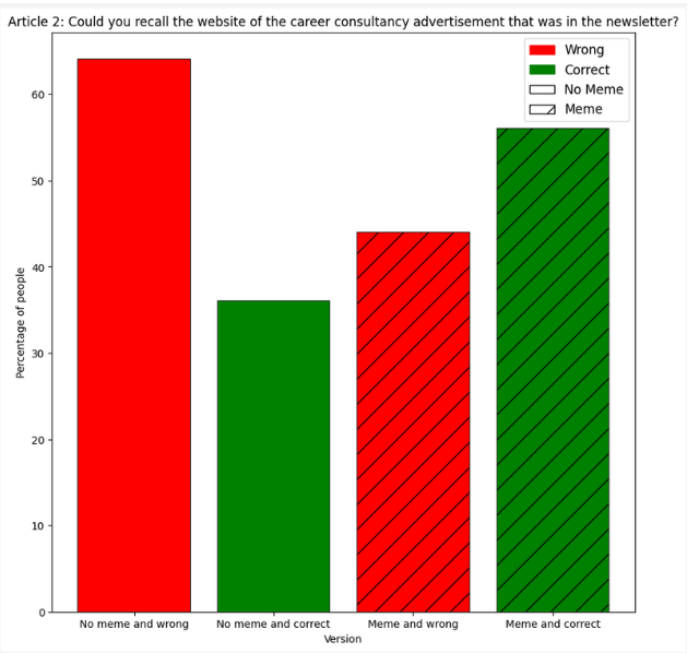

Fig. 8. Percentage of correct and wrong answers across versions

percentage of students that viewed the meme-version of article that answered the question correctly is higher than the percentage of participants that answered incorrectly. A similar trend is noticed across all questions in MCQ and SHORT. Therefore, we can say that this provides partial evidence towards H1.

In 9, we can see that for participants majorly had a netural opinion opinion in the non-meme version, where majority of the responses are 3, but the opposite trend is observed in the meme version where majority of the responses are 5 and a few of the responses are 1. This trend is observed across other articles as well. Therefore, this provides partial evidence

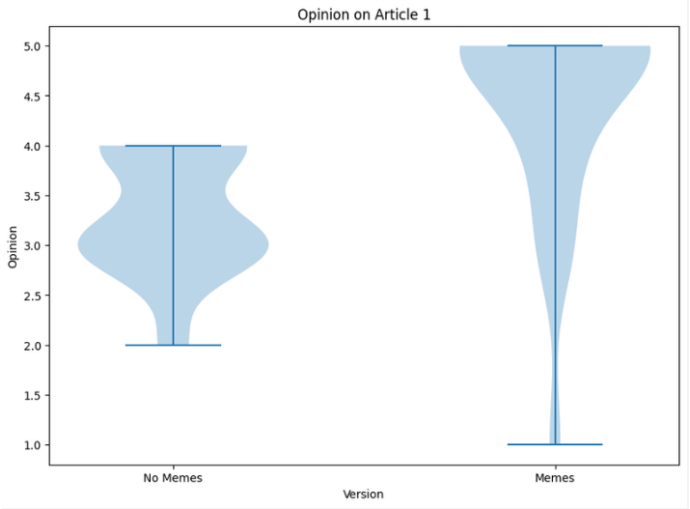

Fig. 9. Violin plot of responses across meme and non-meme versions

towards H2.

2) ANOVA: In order to test the significance across the MEME and NOMEME categories, ANOVA testing was done and the results are as follows

1) Across all articles, participants have either viewed the meme version or the non-meme version
2) Collapse the dataset into these two categories across all questions and perform ANOVA for each question.
3) If the p-value obtained is close to 0.05 then we can conclude that there is a statistically significant difference between both the categories.

Question	p-value
1	0.046
2	0.076
3	0.034
4	0.097
5	0.090
6	0.010
7	0.070

From the ANOVA analysis, we can see that p-values are close to 0.05, with the mean p-value being 0.0604, which is extremely close to our selected alpha value of 0.05. Therefore, we can conclude that there is a statistical difference between the two groups that have seen meme versions of the articles and non-meme versions of the articles across all articles and across all newspaper versions. Therefore, this constitutes as strong evidence towards H1.

VI. Conclusion

Since the p-value obtained from ANOVA is approximately less than 0.05, we can conclude that the results obtained from our analysis are statistically significant and from the p-test results, we can conclusively reject the null hypothesis, implying that the inclusion of memes in content bodies do have an impact on retention and opinion of information amongst

the participants. Added to this, from the visualizations made for MCQ, SHORT and OPINION questions we have partial evidence for the alternate hypotheses H1 and H2 and from ANOVA there is strong evidence for H1, we can conclude that participants that encountered memes in articles **engaged** with the article more as compared to those who didn't. Inclusion of memes in the content body had an effect on the formation of opinions of the participants.

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