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(poster)

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# Decision-Making and Cognitive Biases in Virtual Reality

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## Introduction

Cognitive biases greatly affect human decision-making in the real world. The purpose of this research is to explore how cognitive biases affect decision-making in immersive virtual reality environments. Our hypothesis is that people *infer the personal attitude of a virtual human differently depending on the gender or race of the virtual human*.

We have evaluated this by asking a participant to do typical attitude attribution tasks (essay and silent interview) with some controversial topics (e.g., capital punishment, genetically modified foods) in a virtual environment.

## Background

This research focuses on one well-known cognitive bias, the fundamental attribution error. This bias addresses our tendency to focus on other people's internal factors rather than external aspects when assessing their behavior. Our user study replicated a classic FAE study from the 1970s. However, our participants estimated the attitude of a virtual human, rather than a real person.

The virtual environment was created in Unity, and the HTC Vive Pro was used to display the virtual space. Our conditions are race and gender, so we created virtual humans that are male/female, and African-American/Caucasian.



HTC Vive Pro

## Method

### Experiment Procedure:

1. Informed consent, pre-questionnaire
2. VR tutorial
3. Judgmental task 1
4. Judgmental task 2
5. Silent interview
6. Post-questionnaire



Judgmental tasks 1 (left) and 2 (right)

### Judgmental task:

Like the FAE study, this was a no choice condition: Participants knew that the virtual human was forced to advocate the topic.

1. Participants receive a short essay on the topic from a virtual human.
2. Read the essay and infer the virtual human's opinion.



Silent interview task

### Silent interview:

Participants watch an interview with no subtitles or sound.

1. The virtual human behaves anxiously
2. Participants observe the virtual human and answer a question about the virtual human's behavior

## Results

The first user study resulted in 44 participants, all of whom were UNCC students or faculty in the College of Computing and Informatics. SPSS analysis of their responses did not return significant results. Unlike the original FAE studies, we could not find results that gender or race affected the users' judgment. There are many factors that may have impacted the initial study results, including demographic, personal history, and user knowledge of current events.

Dependent Variable: User\_Rating

| Source          | Type III Sum of Squares | df | Mean Square | F       | Sig. |
|-----------------|-------------------------|----|-------------|---------|------|
| Corrected Model | 7.630 <sup>a</sup>      | 3  | 2.543       | 1.597   | .207 |
| Intercept       | 1452.368                | 1  | 1452.368    | 911.759 | .000 |
| Race            | 1.007                   | 1  | 1.007       | .632    | .432 |
| Gender          | 1.007                   | 1  | 1.007       | .632    | .432 |
| Race * Gender   | 5.132                   | 1  | 5.132       | 3.222   | .081 |
| Error           | 57.345                  | 36 | 1.593       |         |      |
| Total           | 1517.000                | 40 |             |         |      |
| Corrected Total | 64.975                  | 39 |             |         |      |

a. R Squared = .117 (Adjusted R Squared = .044)

Two-Way ANOVA Results for Judgment Task 1

## Conclusions

While the initial results did not support the hypothesis, they did confirm that the topic is worth investigating further. The original fundamental attribution error study was performed in the 1970s, which was a vastly different time, both in society and technology. Even the original study may lead to different results if performed today. For this reason, we are replicating the studies both in person (using virtual reality) and online through M-Turk. Regardless of the results, this research will contribute to a better understanding of our interactions with virtual agents.

## Future Work

As the results of the first study were not conclusive, the project continues to undergo changes. We made some updates to the procedure, and deployed the user study through SONA, which resulted to 42 additional participants.

Future iterations include replicating the original fundamental attribution error study on Amazon Mechanical Turk. In this study, each participant views a text description, human stock photo, or virtual image of the author of an essay on a controversial topic. The topics and essays are the same, so the results of the online study can be compared with results from the VR study.

Finally, we are creating a second in-person user study. Other research in virtual environments has shown that users react better to virtual agents when they behave similarly to humans. To increase this effect, we are exploring the addition of different races and more fluid gestures for the virtual agents.

With both studies, the goal is to better understand how the effects of cognitive biases in online and virtual realms differ from those in human environments.

## References

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