



# Virtual Reality and Climate Change Perception: A Galveston Case Study

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## ABSTRACT

This study explores how virtual reality (VR) simulations impact public perceptions of climate change and adaptive behaviors using Galveston, Texas, as a case study.

Participants engaged in a public goods game to contribute to a climate resilience fund, experiencing either VR simulations of flooding or receiving informational content. Results showed that VR participants contributed more consistently and in higher amounts. Higher education levels positively influenced contributions, while older participants contributed less.

The findings highlight VR's potential as an effective tool for climate change education, emphasizing the need for targeted communication strategies considering demographic factors. Despite limitations, the study provides valuable insights into enhancing public engagement with climate change issues through immersive experiences.

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## INTRODUCTION

The study addresses the challenge of making climate change's long-term impacts more immediate and salient to the public. Using Galveston, Texas, as a case study, the research explores how virtual reality (VR) simulations of extreme weather events can influence public perceptions and behaviors towards climate change.

The objectives include examining the impact of VR on willingness to contribute to mitigation efforts, comparing VR experiences to informational content, and analyzing how demographics and pre-existing beliefs affect these perceptions.

## METHODS AND MATERIALS

The study employs a lab-in-the-field experimental design involving a public goods game where participants decide on contributions to a climate resilience fund. Each participant was given \$20 and participated in five rounds of the game with four bots. They were given the option to pay \$0-4 into the climate fund, with the goal of reaching at least \$50 by the end of five rounds.

Participants were informed that if the threshold was met, they would keep the money they did not contribute; if not, they faced a 50% chance of losing their remaining endowment. The treatment group experienced VR simulations of hurricanes and storm surges, while the control group received informational content through charts and photographs.

The VR simulations were created using Unity3D and SketchUp, providing immersive experiences of heavy rain and progressive flood levels in Galveston. Data collection included demographic and socio-economic information, pre-existing climate change knowledge, and behaviors in the public goods game. The experiments were conducted with 39 participants, primarily UTSA students, using Oculus Rift headsets and administered through Qualtrics.

The data analysis involved two-sample Wilcoxon rank-sum tests, paired sample t-tests, dynamic panel regression, and Tobit regression to assess the impact of VR simulations on climate change perceptions and behaviors.

## RESULTS

Descriptive statistics indicated that participants exposed to VR simulations tended to contribute more consistently and higher amounts to the climate fund compared to those receiving informational content. The average contributions in the VR group generally increased from Step 1 to Step 4, with a slight decrease at Step 5, while the informational group showed a more consistent increase. The Wilcoxon rank-sum test revealed significant differences in contributions at the initial step, suggesting initial reactions varied between the two scenarios.

However, behaviors converged in later steps, leading to no significant differences by the end of the experiment. Tobit regression analysis indicated that higher education levels, particularly bachelor's and master's degrees, positively influenced contributions, while older participants, especially those aged 45-64, tended to contribute less. Gender did not significantly impact contribution behavior. These findings suggest that VR simulations can effectively influence initial contributions to climate resilience efforts, and that higher education levels are associated with greater engagement in climate change mitigation activities.

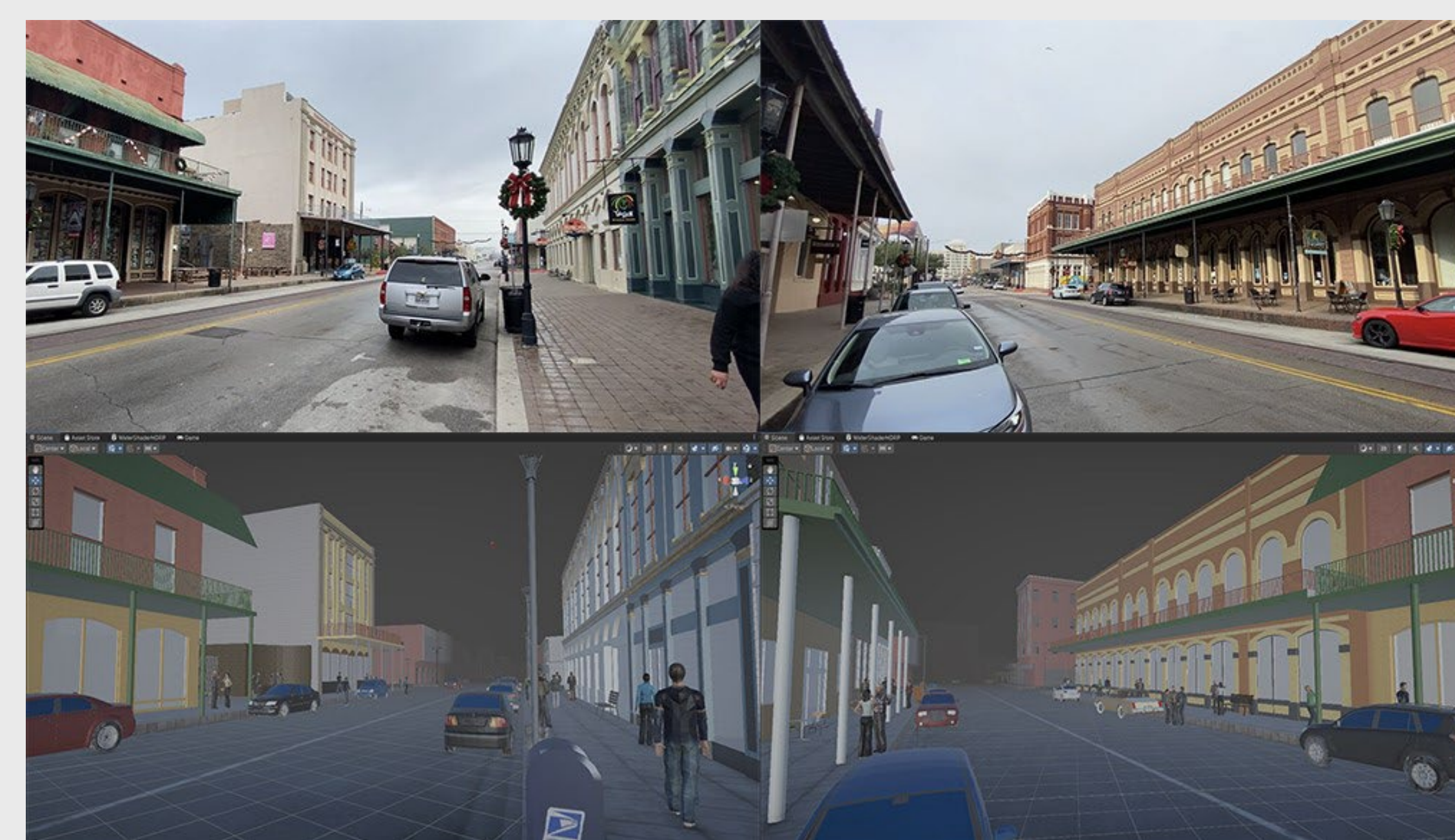


Figure 1: Comparison of Real-World Location and VR Simulation

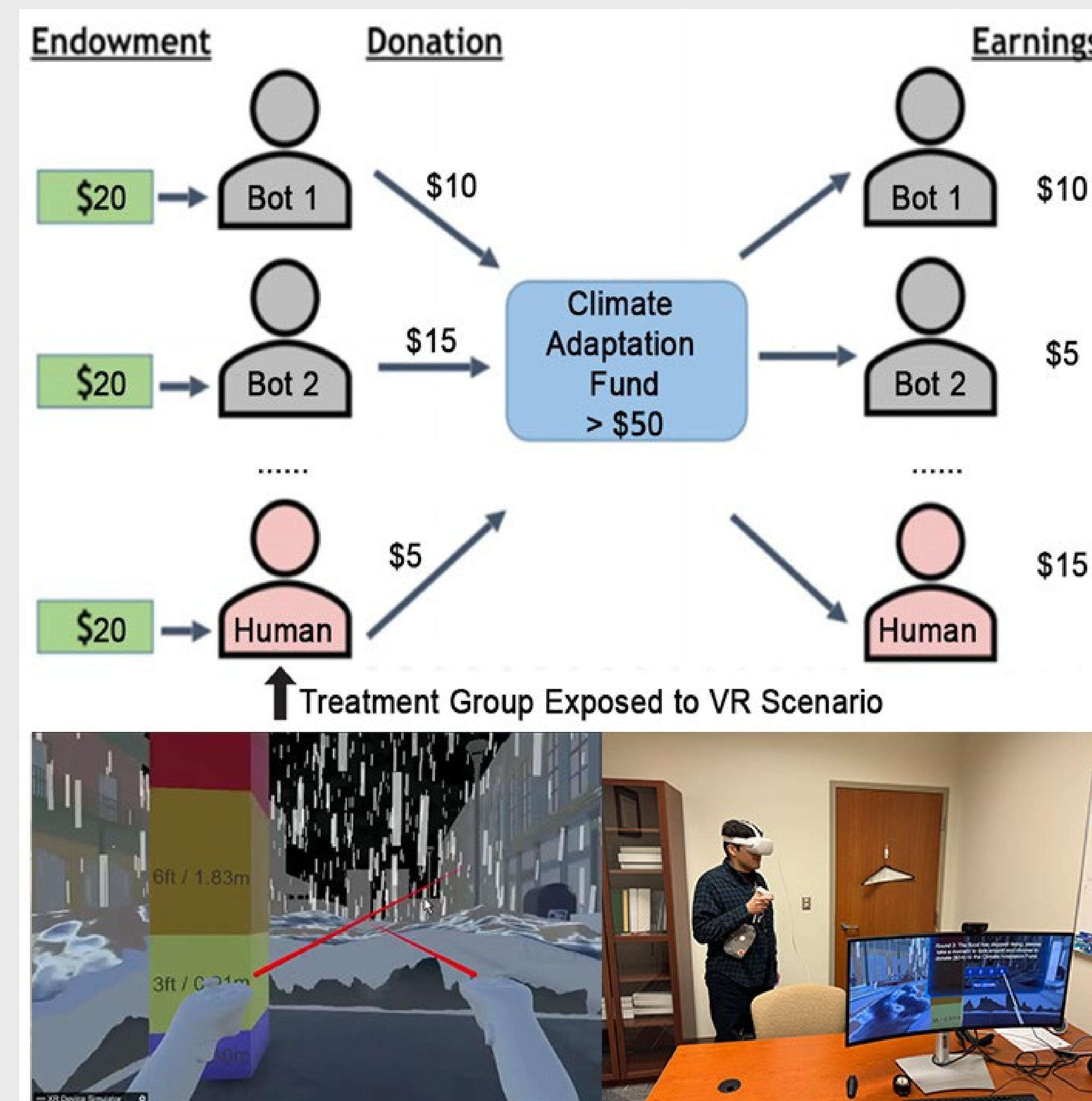


Figure 2. Public goods game with VR scenarios

## DISCUSSION

The findings suggest that both VR and detailed informational content effectively enhance public engagement and understanding of climate change. VR experiences had a significant initial impact on contributions, which converged over time with those receiving informational content. Higher education levels correlated with increased contributions, highlighting the importance of educational interventions. The mixed results indicate the need for further research into the interactions between demographic factors, VR experiences, and climate change perceptions.



Figure 3: Demographic and Behavioral Insights of Survey Participants

## CONCLUSIONS

The study demonstrates the potential of VR as a powerful tool for climate change education and engagement. By providing immersive experiences, VR can significantly influence public perceptions and behaviors towards climate change mitigation. The research underscores the importance of targeted communication strategies considering demographic factors to maximize the effectiveness of climate change education and engagement efforts.

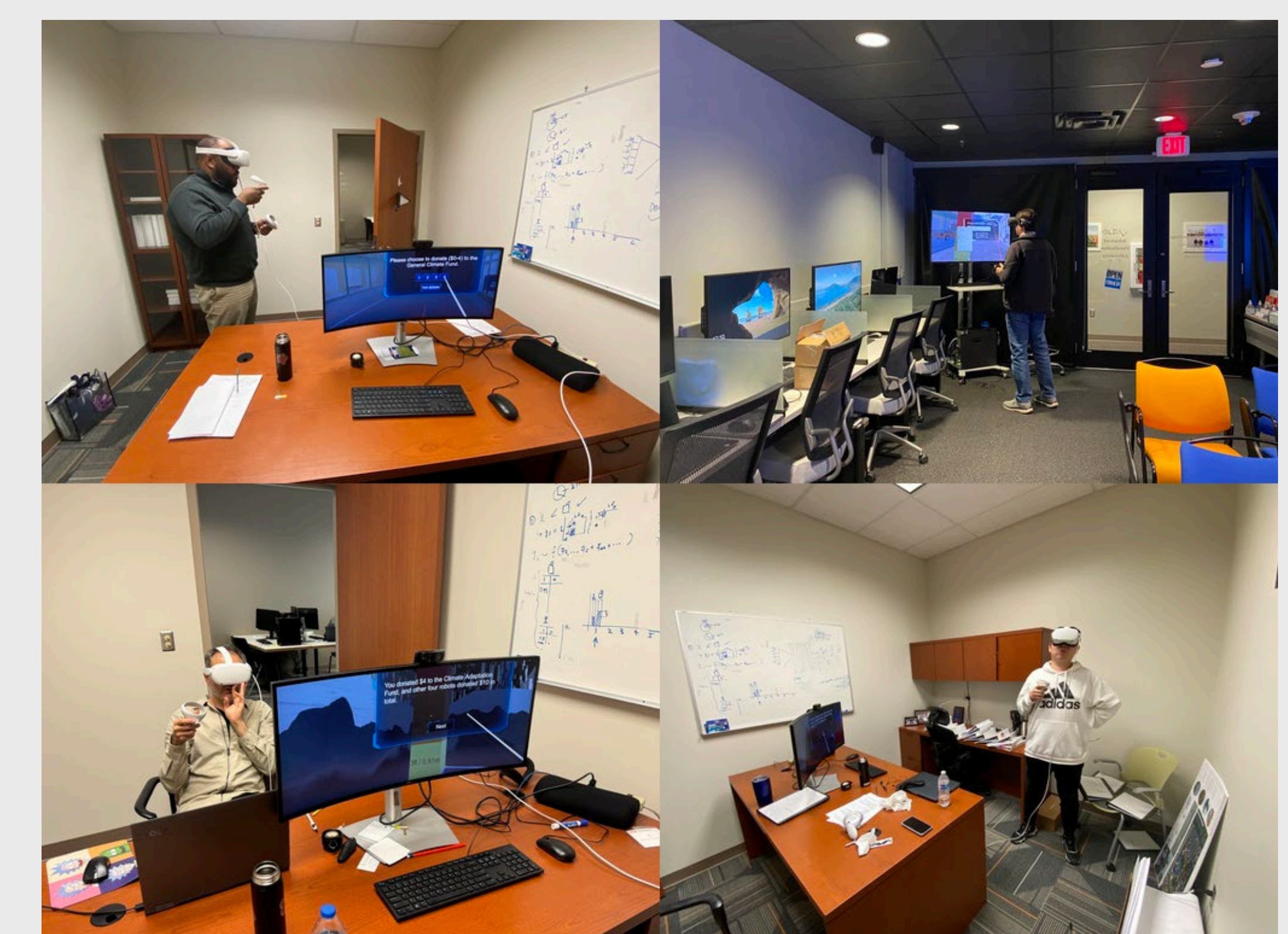


Figure 4: VR Experiment Participants