Virtual Reality in Experimental Economics

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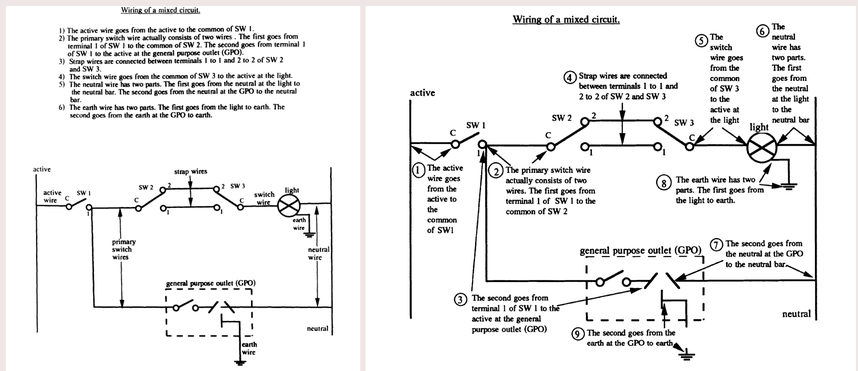
Introduction

For our final year computer science capstone project at McMaster University, we are partnering with the McMaster Decision Science Laboratory to create 2 virtual reality-based economics research simulations. Each simulation is designed around the user repetitively completing a basic task with the goal of maximizing earnings that are awarded on every completed iteration of the task. The simulations are structured such that their lifetimes are separated into discrete time periods, days, in which the user's ability to perform the repetitive task is hindered by an impairment(s). The user will be given the option to reduce the effects of such an impairment by receiving a treatment - such treatments can be paid for, or received for free after waiting a predetermined duration. Each simulation will feature both a virtual environment designed within Unity and HTC Vive support to offer a truly immersive simulation experience to the participant.

The Original Simulation

- Crate carrying exercise (Figure 1 (a))
- Large environment that does not scale to experiment room (Figure 1 (b))
- No extensive customization of configuration variables.



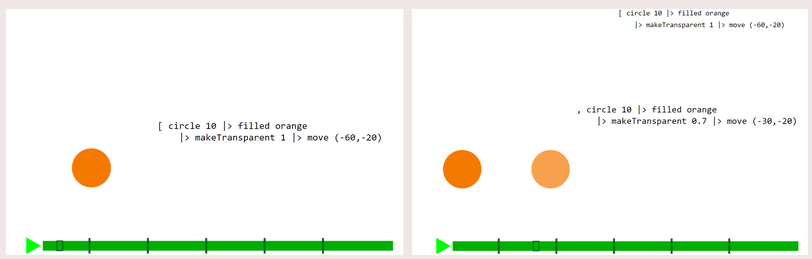
(a) Diagram, information separate (b) Diagram with integrated captions

Figure 1: Original cognition figure from [1]. a) shows the diagram with separate captioning, presented to group A; b) with integrated captioning was presented to group B

[1] There was a third case in the original study which is not relevant to the current study.

Our Simulations

- Allow for complete customization of the experiment domain through a comprehensive configuration file
- Uses a SQL database for improved data storage
- Scaled to the size of Vive equiped the testing room

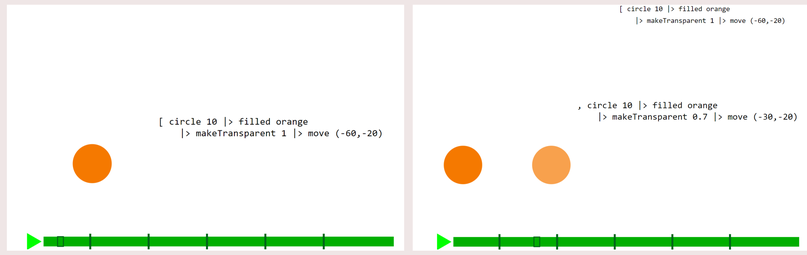


(a) (b)

Figure 2: An example teaching the code for creating transparent shapes, corresponding to #4 on Table **??**. Parts a), b) and c) gradually introduce circles of different transparencies alongside the code used to generate the output.

Simulation 1

In this simulation, the participant will be required to repeatedly transport a volume of liquid between a source and destination using a single hand-carried vessel. Their goal will be to maximize the total volume of liquid that successfully reaches the destination.

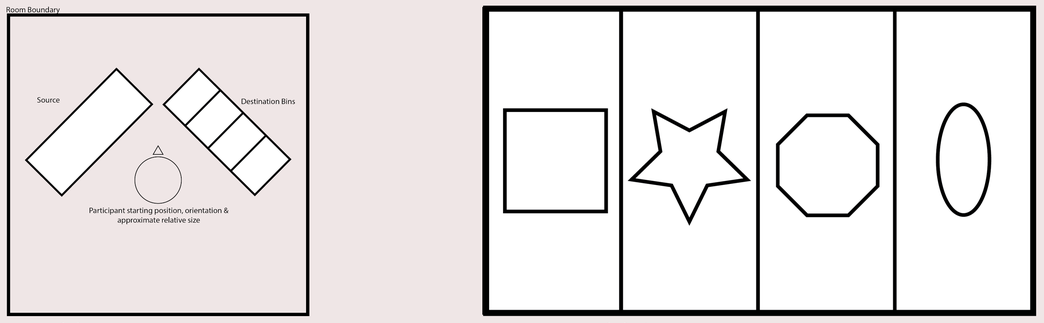


(a) (b)

Figure 3: An example teaching the code for creating transparent shapes, corresponding to #4 on Table **??**. Parts a), b) and c) gradually introduce circles of different transparencies alongside the code used to generate the output.

Simulation 2

The second simulation will provide the participant with a set of three-dimensional shapes, and task them to sort them into separate containers by passing them through a filter that only permits one particular shape. The aim of the participant will be to maximize the total number of shapes successfully sorted into their respective containers.



(a) Layout of simulation environment. (b) Shape sorting filter.

Summary of Configuration Variables

Experiment varibles to be set in the configuration file.

- Money acquired per accomplished task
- Cost of treatment
- Waiting time for option to purchase treatment
- Waiting time for option to receive treatment free of charge
- Waiting time after treatment before health restored
- Number of "days" the experiment runs
- "Days" the participant is impaired
- "Days" free treatment is offered
- "Days" payed treatment is offered
- Health level on impaired days
- Health gained from treatment
- Impairment type
- Intensity of impairment

Conclusions & Future Work

Using the existing experiment and while consulting with the McMaster Decision Science Laboratory we have developed a plan and have begun implementing the two simulations as described here. These simulations will allow the laboratory to run dynamic a unique experiments using either of the simulations with specific configurations. The simulations will be tailored to the test room so the overall experience is as realistic as possible.

Acknowledgements