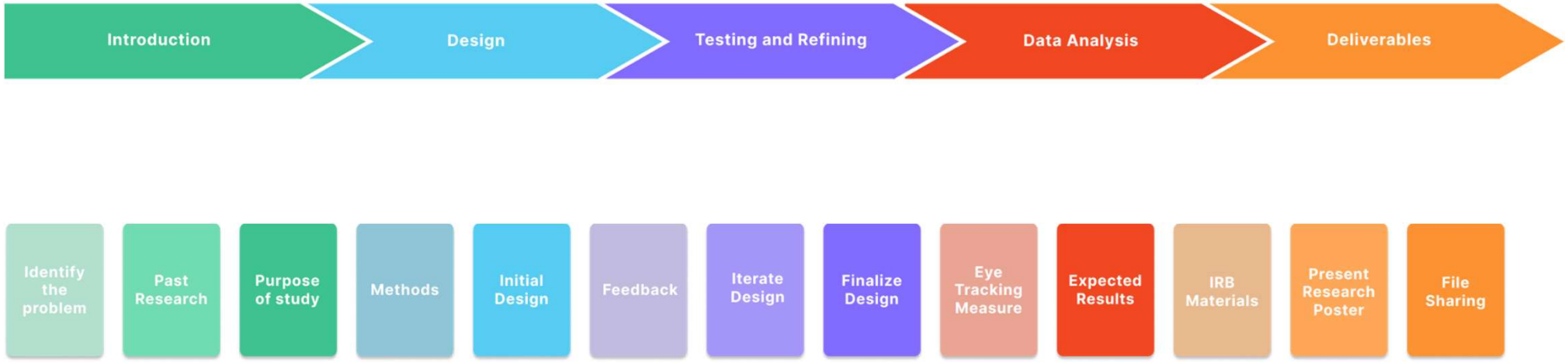
Balancing Ecological Validity and Laboratory Control in Social Neuroscience Research: An Immersive Task Design

Marissa Chitwood

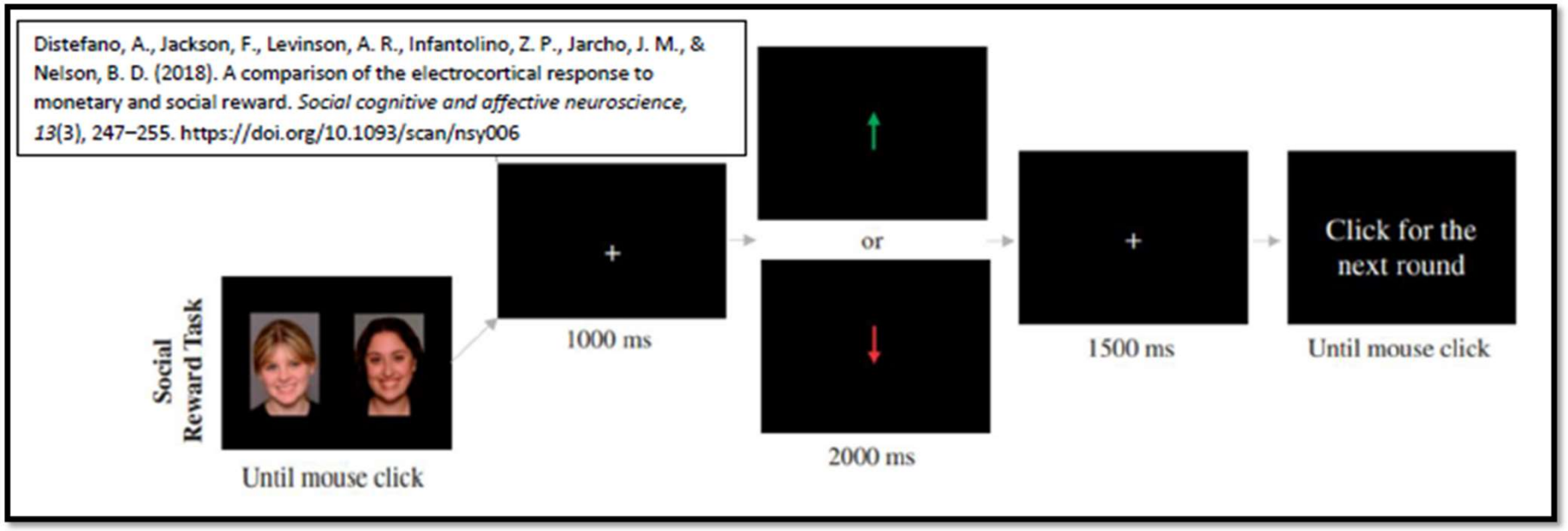
Project Workflow



Introduction

Identify the Problem

- In social neuroscience research, many of the research tasks used under fMRI and EEG recordings are outdated, two-dimensional, and lack immersive social connections – an important element to triggering social behavior.
- **Proposed Solution:** A social task that is built using innovative technology, such as virtual reality (VR), may increase response to social feedback compared to a non-immersive social task



Introduction

Background

- Virtual environments can increase ecological validity by delivering control in experiments and implementing narratives that enhance social communication, cognition, and emotions (Gorini et al., 2011; Parsons, 2015).
- **Face-to-Face Interaction:** Embodied human figures in virtual scenes can have social influence on participants, expressing the impact that human figures can have on presence in virtual environments (Miller et al., 2019).

Fig 5. Examples of sitting next to and on the virtual agent.

Table 3. Number of participants who either sat on or next to the agent in each condition.

	Seat Choice	
Wearing headset when sitting?	On Agent	Next to Agent
Headset	0	27
Without Headset	8	21

Introduction

Background

- **Facial Expressions:** Allows inference of emotional states or motivational intentions (Rimmele & Lobmaier, 2011) providing many forms of social feedback, such as a smile towards someone that signifies like or a scrunched-up face that indicates dislike

- When dynamic relations between two people are unbalanced, the social connection can be distressing

- Unbalanced dynamic relations can cause the tendency to apply cognitive restructuring to balance the relational state as positive (i.e., like each other) or negative (i.e., dislike each other) (Heider, 1946)

- Ultimately, a balanced state relation is essential for social feedback to generate feelings of *acceptance* and *rejection*

Introduction

Background

- **Similarity-Attraction Effect:** The inclination for one to be attracted to peers similar in their values, activity preferences, and attractiveness (Reis, 2007)

- Comparing oneself to others in order to find similarities is a major determinant of our ability to increase social connections (Ren et al., 2012) and these similarities are necessary for social influence to occur

Purpose

- Investigate the potential value of using VR in social neuroscience research by impacting feelings of social acceptance and social rejection in both immersive and non-immersive testing environments and comparing the results between environments.

Design

Materials

Unity engine –development platform
- Immersive social task (IST)
- Both non-immersive social tasks (NIST and NISTavatar)

HTC VIVE Head-mounted Display
- Used to run each of the three versions of the research task

Eye Tracking – BeGaze
- Embedded in the HMD
- Assess participants mutual eye gaze during the rejection and acceptance trials

Slater-Usoh-Steed (SUS) Questionnaire
- Presence factor
- 1-7 scale with 7 being the highest level of presence

unity

SMI
SensoMotoric Instruments

Using Presence Questionnaires in Reality

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Department of Computer Science
University College London
Gower Street
London WC1E 6BT
UK

Design

Conditions

Three Versions of the Social Reward Task

Participants:

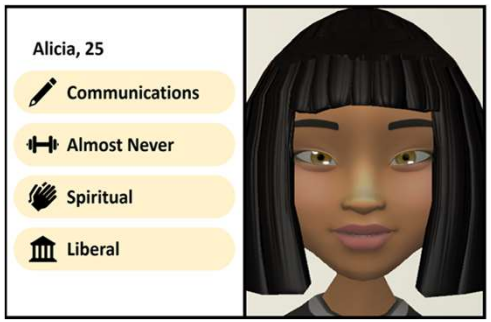
(β=0.80, α=0.05, f = 0.25) resulting in a total sample size of 24

Design

Procedure

Part 1: Online Survey

- Photo of participant
- Avatar profile of participant



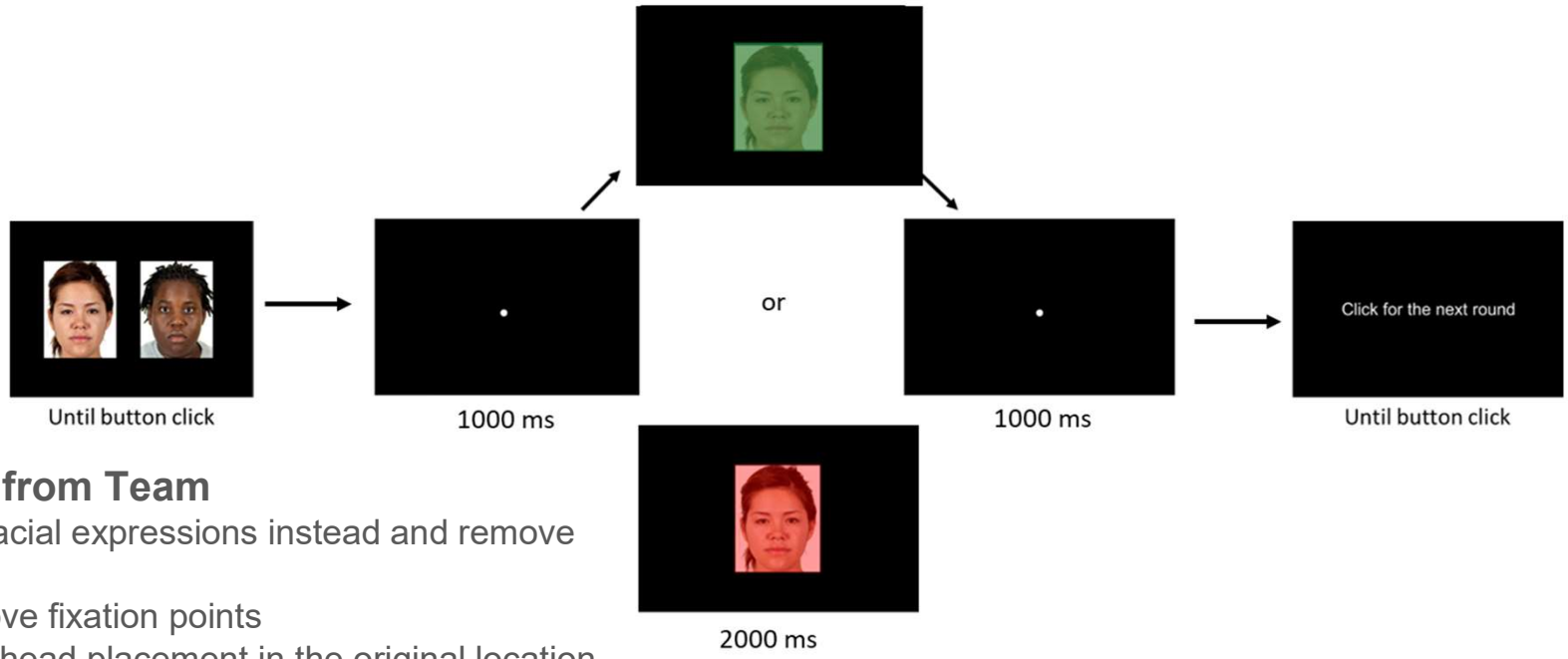
Part 2: In-person

- Participants complete 3 tasks of which they will learn if the pseudo evaluators accept or reject them
- SUS Questionnaire at the end of each condition
  "During the time of the experience, did you often think to yourself that you were actually in the office space?"
- Final survey
  "Which task made you feel more accepted (when you were liked) or rejected (when you were disliked)?"

Design

Testing and Refining

NIST - Initial Design

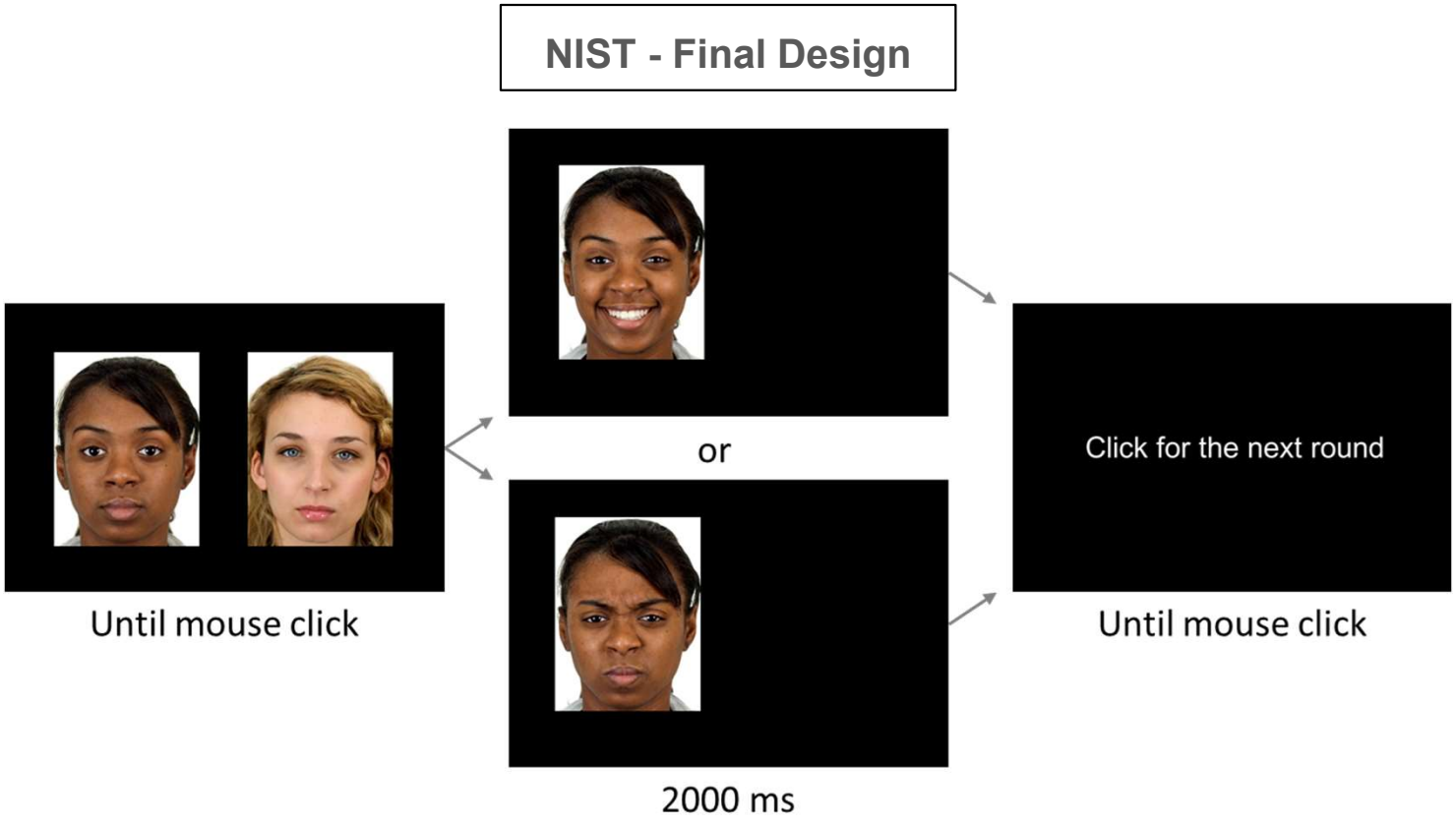


Feedback from Team

1. Use facial expressions instead and remove color
2. Remove fixation points
3. Keep head placement in the original location for eye tracking accuracy
4. Include another version using avatar faces

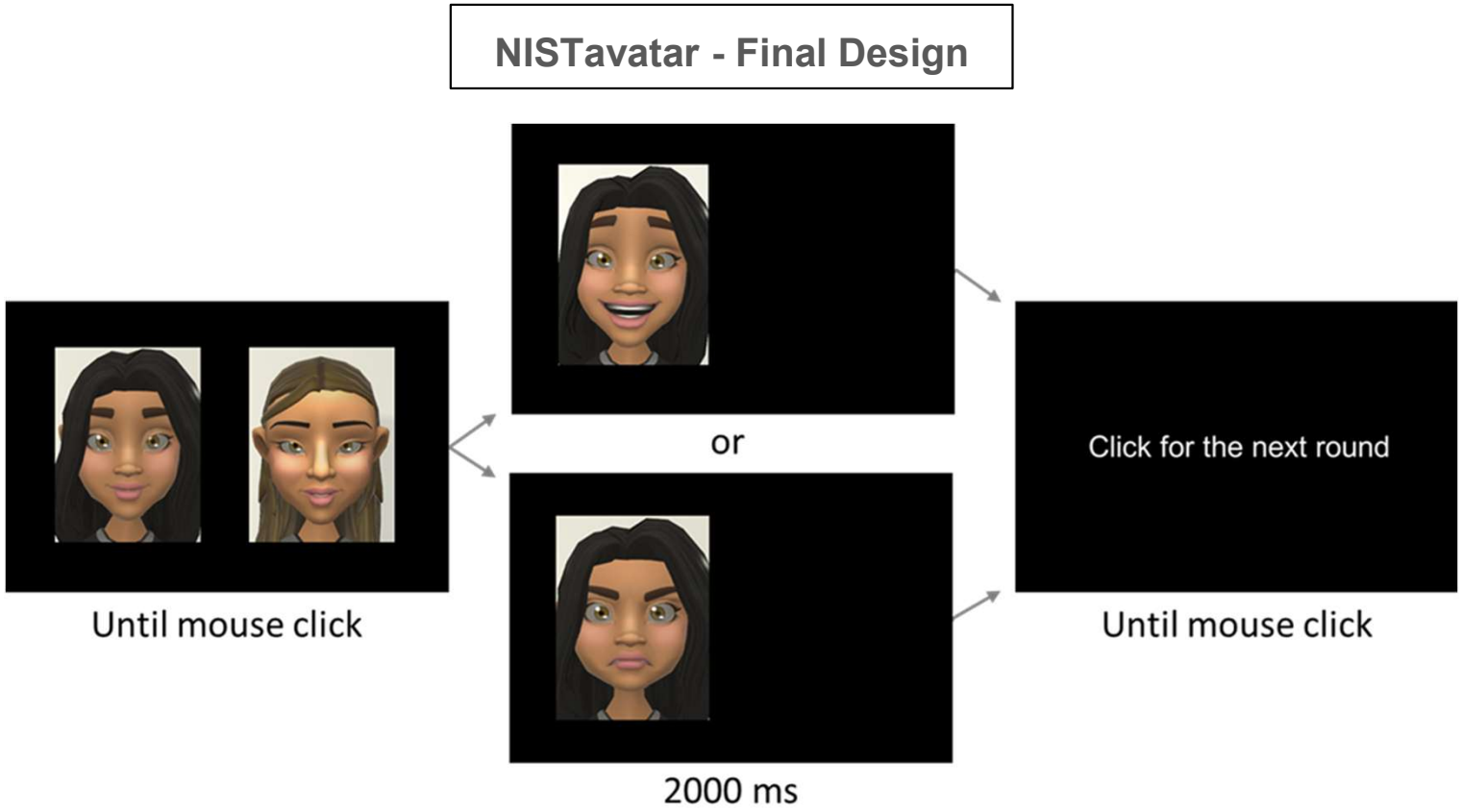
Design

Testing and Refining



Design

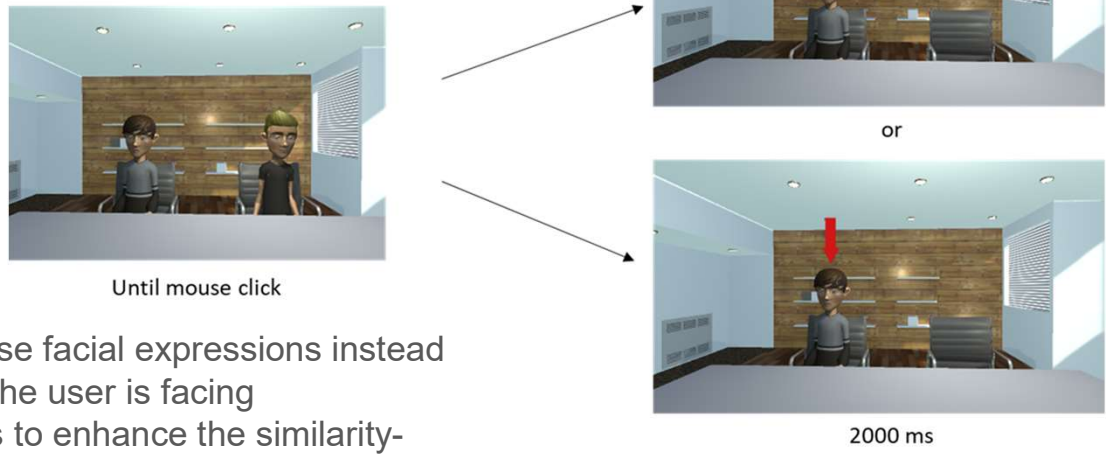
Testing and Refining



Design

Testing and Refining

IST - Initial Design

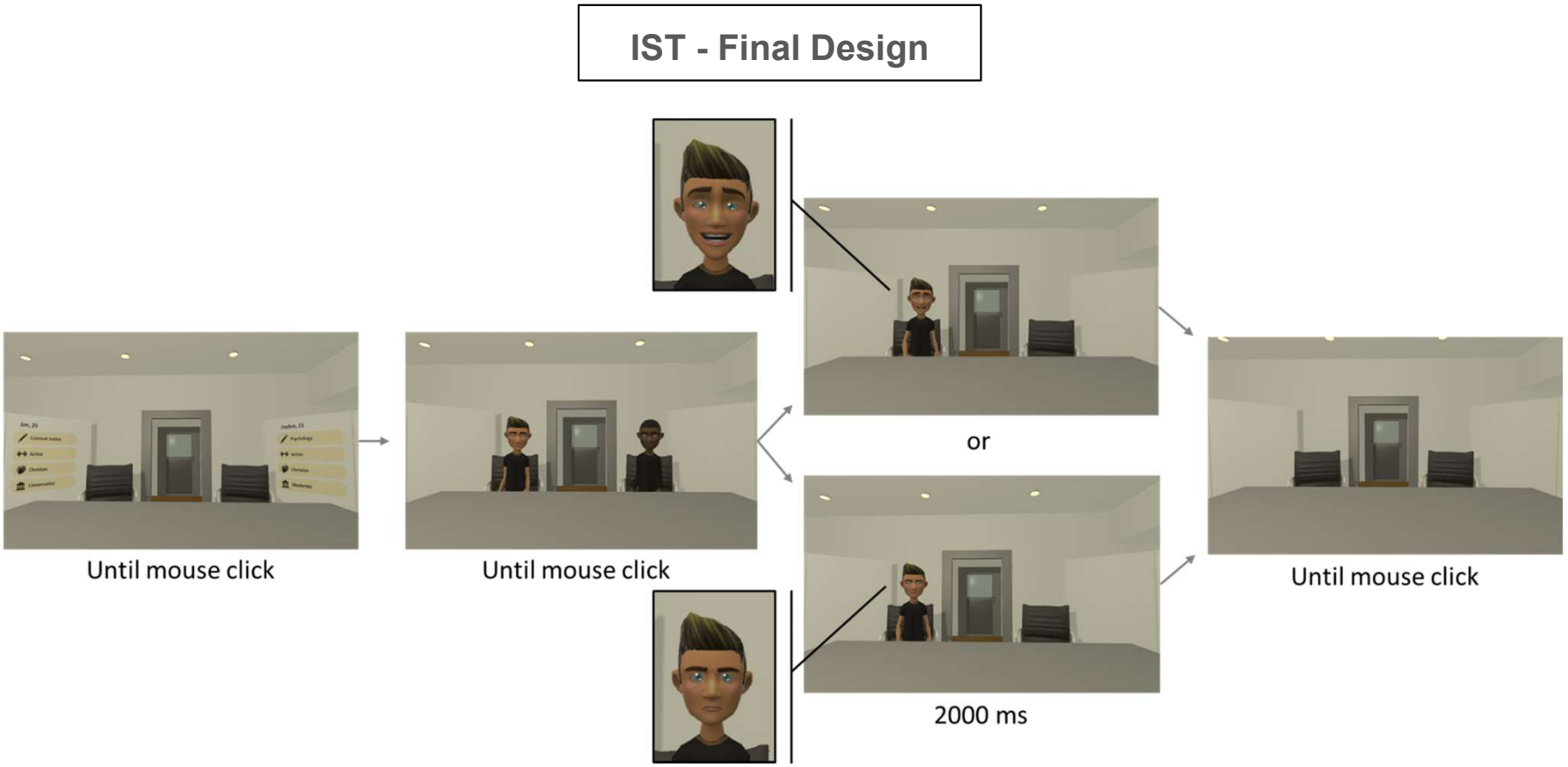


Feedback from Team

1. Remove arrows and use facial expressions instead
2. Flip the direction that the user is facing
3. Incorporate social bios to enhance the similarity-attraction effect by giving more information about the peers for the participant to relate to
4. Create the virtual room to mimic the actual room that participants put the headset on

Design

Testing and Refining

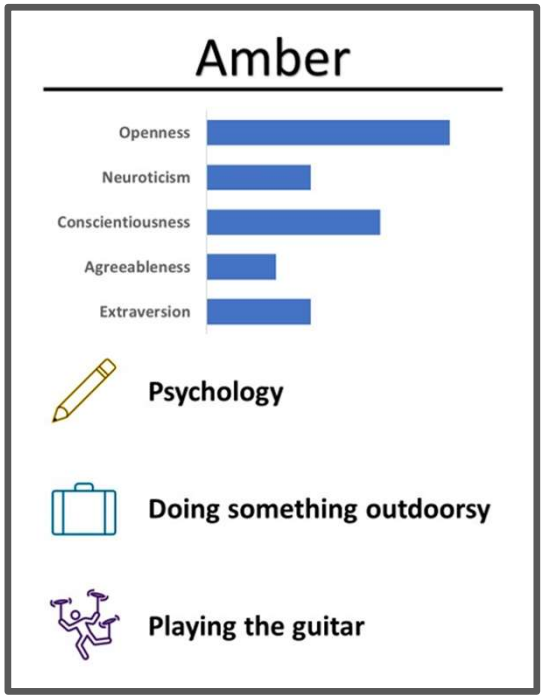


Design

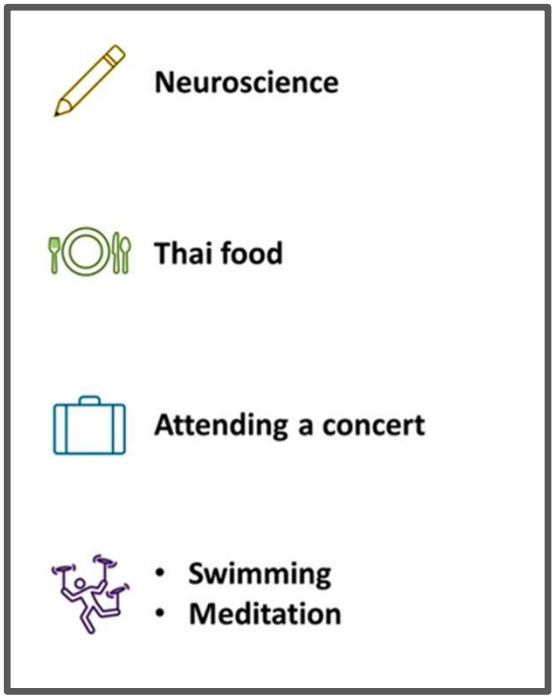
Testing and Refining

IST - Bios

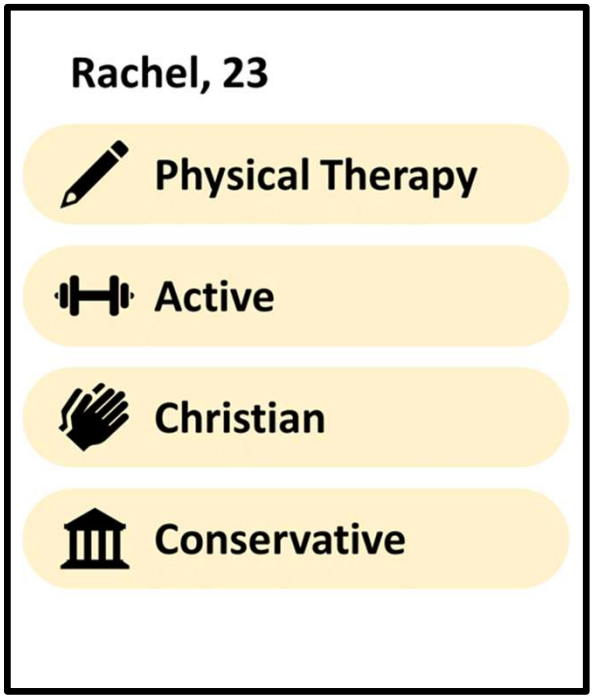
1st Iteration



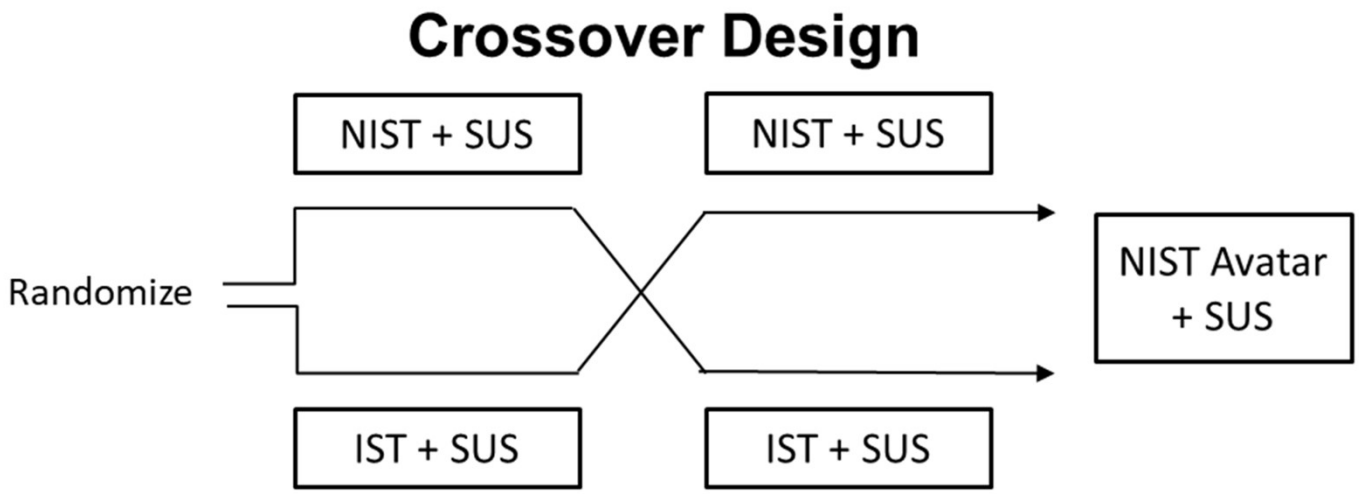
2nd Iteration



Final Design



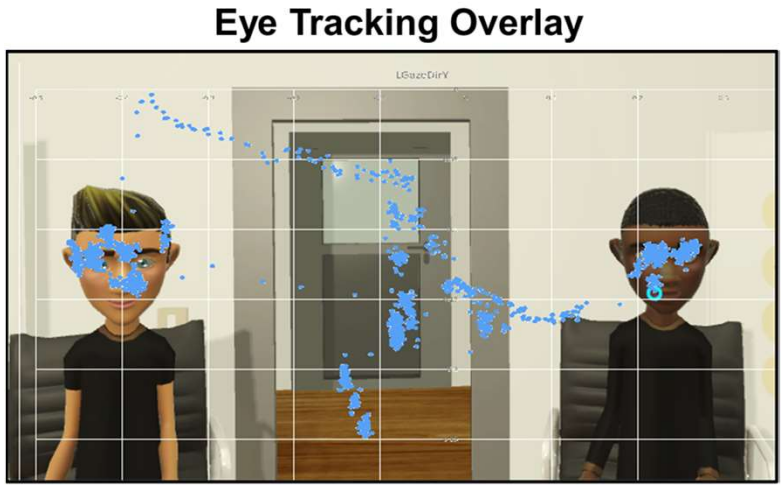
Data Analysis

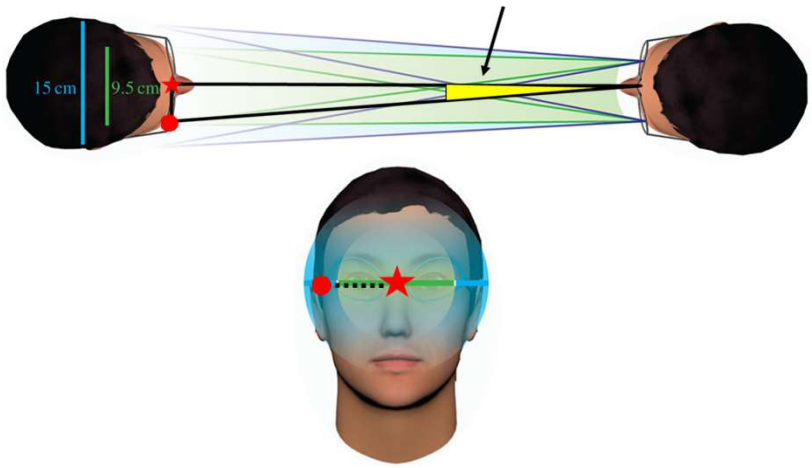


Data Analysis

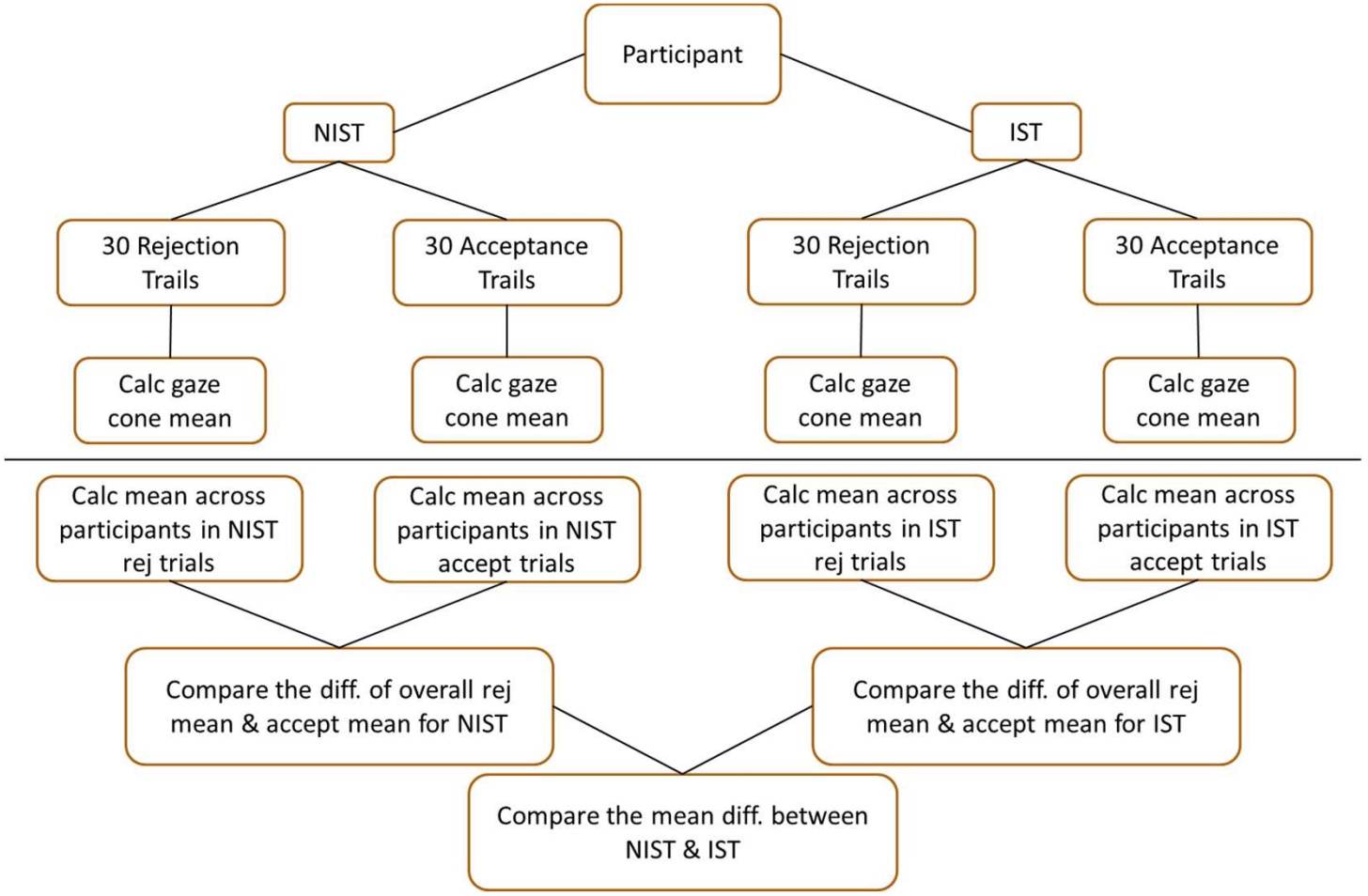
Mutual Gaze: Occurs when an individual gazes at the eyes of another (Gamer & Hecht, 2007) and can be explained as a cone centered on the interpupillary point of the eye (Hecht, Hörichs, Sheldon, Quint, Bowers, 2015)

By recording eye movements from a direct gaze by using the gaze cone width, we can examine the impact that being rejected or accepted has on the participant





Data Analysis



Data Analysis

Expected Results

Findings show that accepted participants did not disengage their attention from faces with a direct gaze (Syrjämäki & Hietanen, 2020)

- Participants will continue engaging their attention on faces who like them, showing little to no widening of the gaze cone

Social rejection causes widening of the gaze cone due to the need to search for inclusion (Lyyra, Wirth, Hietanen, 2017)

- Participants will disengage their attention on faces with direct gaze who chose to dislike them

Hypotheses

- The mean of the gaze cone width for the participants will be wider for rejection trials compared to acceptance trials in both the immersive task and non-immersive task.
- There will be a greater effect in the immersive task compared to the non-immersive task.

Deliverables

IRB Materials	Presentation	File Sharing
- Application for Human Research - Debrief Form - Informed Consent - Part 1 & Part 2 - Protocol - Proposal - Recruitment Flyer - Letter of Modifications - Online Survey - EndofStudy_Survey - SUS Presence Questionnaire	Created research poster and presented it at the Temple University Annual Neuroscience Research Day in May 2021	- SOP's included with sharing of all documents needed to run original study design - GitHub repository for researchers interested in using the Unity projects for use in their social psychology or social neuroscience research studies

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