Stress Generator

Overview

Stress Generator is a simulated rope bridge crossing created to help researchers trigger and study stress responses using the **HP Omnicept headset.** The system captures real-time biometric data and researcher annotations, providing detailed insights for later analysis.

The simulation was developed in collaboration with the **University of Miami's Virtual Experience and Simulation Lab (VESL)** and **Dr. Firdaus Dhabhar**, a tenured professor in the Department of Psychiatry and Director of the Laboratory of Stress and Resilience in Health and Healing.

Role

Project Lead and Lead Developer

Joining the project as the **Project Lead and primary developer**, my responsibilities included:

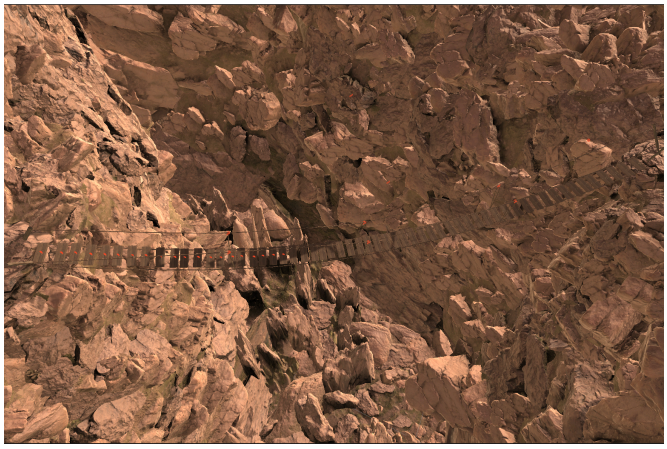
- Planning and managing development sprints
- Organizing regular check-ins with the Principal Investigator (PI)
- Refactoring and upgrading core systems
- Implementing new features and improving existing functionality
- Ensuring the simulation was polished and stable for researcher use

Project Milestones

1) Revamping the Environment and Researcher UI

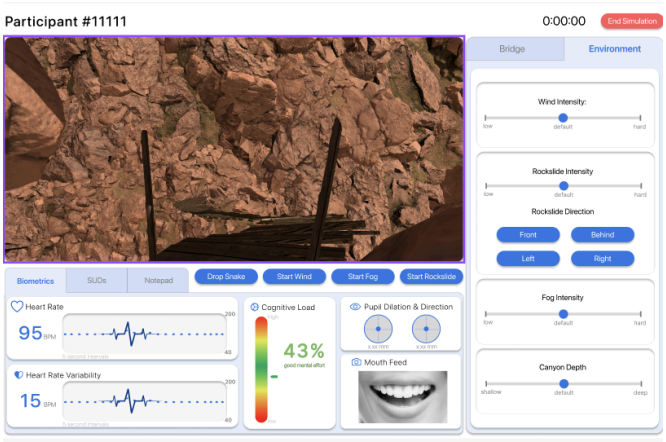
The first phase of the project included transforming the **particpant environment.** The original bridge environment was too short, lacked depth, and was overall visually unconvincing. Based on feedback from the PI, I:

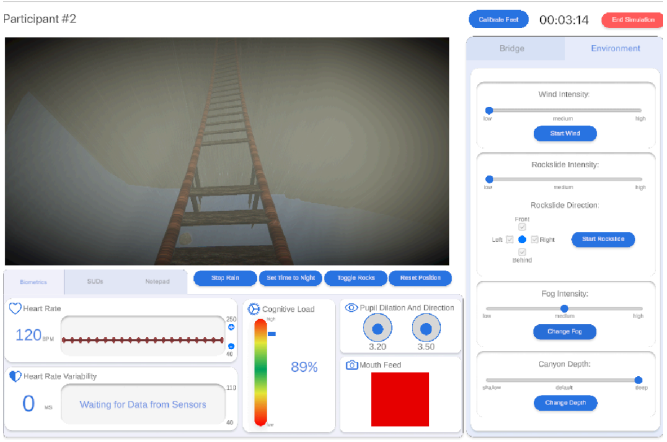
- Redesigned the canyon to be **wider and deeper,** enhancing its psychological impact
- Introduced a **more natural, less arid environment** with a river, boulders, and foliage to deepen immersion
- Added **spatial audio** for realism and depth
- Balanced visual perspective to amplify height perception



The next goal was to modernize the **researcher interface.** Based on an upgraded Figma design, I:

- Recreated the UI in **Unity** with full interactivity
- Integrated **biometric data** display and note-taking functionality
- Ensured researcher annotations are saved in real time with the simulation data for analysis



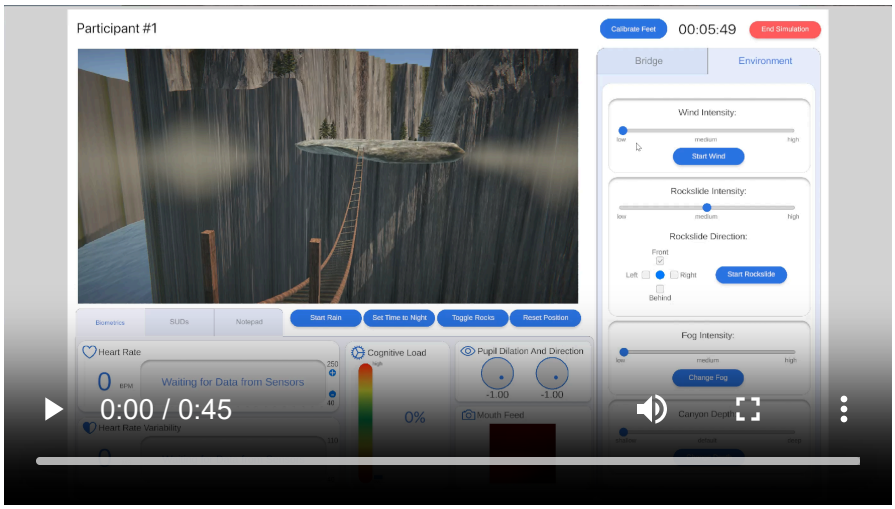


2) Integrating Advanced Environmental Controls

To allow researchers greater control over participant experience, I implemented a suite of dynamic environmental tools, including:

- **Time of day:** Toggle between day and night
- **Weather effects:** Switch between clear and rainy conditions
- **Fog and wind levels:** Adjustable in real time
- **Dynamic canyon depth:** Alter perceived height mid-simulation
- **Bridge instability:** Trigger falling rocks and breaking planks for heightened tension

I also implemented a new feature where researchers could break bridge planks mid-crossing, introducing surprise elements to amplify stress. One major technical challenge involved ensuring Unity's XR Toolkit properly synced physics between the participant and moving bridge elements, especially under strong wind forces.



3) Enhancing Participant Mobility

Originally, movement across the bridge was joystick-based. Based on a new requirement from the PI, I added support for **real-world physical locomotion** using the HP Omnicept controllers as trackers. This involved:

- Researching motion tracking options compatible with the Omnicept
- Reworking the movement system to accommodate **step-based locomotion**
- Allowing researchers to select between joystick and physical movement modes

Future Development

Next steps for the team include finalizing mobility features, conducting user testing, and collecting stress-response data. Before handing off for further development, I:

- Created thorough technical documentation
- Onboarded a new developer to ensure a smooth handoff
- Provided guidance on remaining features and upcoming testing

Takeaways

Leading this project challenged me to connect big ideas with real-world execution and allowed me to put a wide range of key skills into action:

- **Project management and team coordination**
- **VR simulation design and 3D spatial reasoning**
- Navigating the intricacies of **real-time physics in XR environments**
- Communicating with stakeholders across research and technical disciplines

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