VR Kitchen

CALEB ATKINS

SCHOLARSHIP SYMPOSIUM, 2022

Mission Statement

"To build a virtual reality kitchen for Union University's EDGE program. This kitchen should be pertinent to the program's coursework and give the program's students an appealing introduction to the basics of VR."

Overview of Project Timeline

- Fall '21: Research and Resource Gather
  - Attended EDGE cooking class sessions
  - Set up basic environment, completed minimum goals for the project
- Winter Break: Feature Design
  - Began designing: final household environment, liquid and heating physics, physics-based object interactions, etc.
- Spring '22: Finalized Feature Design, Testing
  - Finished design on key Features
  - Ran group testing sessions

Technological Details

- Built for Oculus Quest 2
- Created in Unity using C#, Open XR Toolkit
- Maya
- GitHub

Project Goals and Methodologies

- Modularity and Scalability
  - Abstraction / C# Polymorphism
- Intuitive Design
  - People should be able to navigate the environment and complete the recipe without outside guidance
- Educational Value
- Appeal
  - Took precedence over educational value as project evolved

Overview of Features

The Virtual Player

- Movement
  - Continuous or teleportation?
- Hands
  - Blended animations

Environment Interactions

- Grabbable Objects
  - Instantaneous or Velocity Tracking?
  - RESOLUTION: Change speed of Unity's built-in physics update loop
- Interactable Cabinets, Drawers, etc.
  - Hinge joint jitter
  - RESOLUTION: Lock objects on certain axes
  - In retrospect, it may have been smarter to use SteamVR rotational drivers
- Two-Point Contact

Heating Physics

- One of the most successful aspects of the project
- Convincing heating physics from the ground up:
  - Dynamic heating and cooling
  - Different objects heat and cool at different rates
  - Utilizes modular, scalable code
    - All heat-ABLE objects derive from “Heatable” class
    - All heat-ING objects derive from “Heater” class
  - Modular application: Any # of objects, in any space of any size or shape

Liquid Physics

- Most difficult part of the project
- Liquid physics from the ground up:
  - Two types of liquid: static and flowing
  - Slosh effects, stream effects, liquid mixing, recipe compatibility,
  - Utilized modular, scalable code
    - "Stream" class governs the physical behavior of all streams
    - All flowing liquid utilized the "Ingredient" class
- Issues:
  - No spilling effects for "pot-like" liquid containers

Other Features in the Project

- Recipe system that keeps track of units of measurement, completion conditions, etc.
- Recipe creation dropdown menu (modularity!)
- UI Recipe display that dynamically updates as progress is made
- Particle effects
- Fully interactable environment (pantries, cabinets, forks, knives, plates, bowls, fillable cups, usable sink, refrigerator, various ingredients, etc.)

Rejected Feature: Slicing

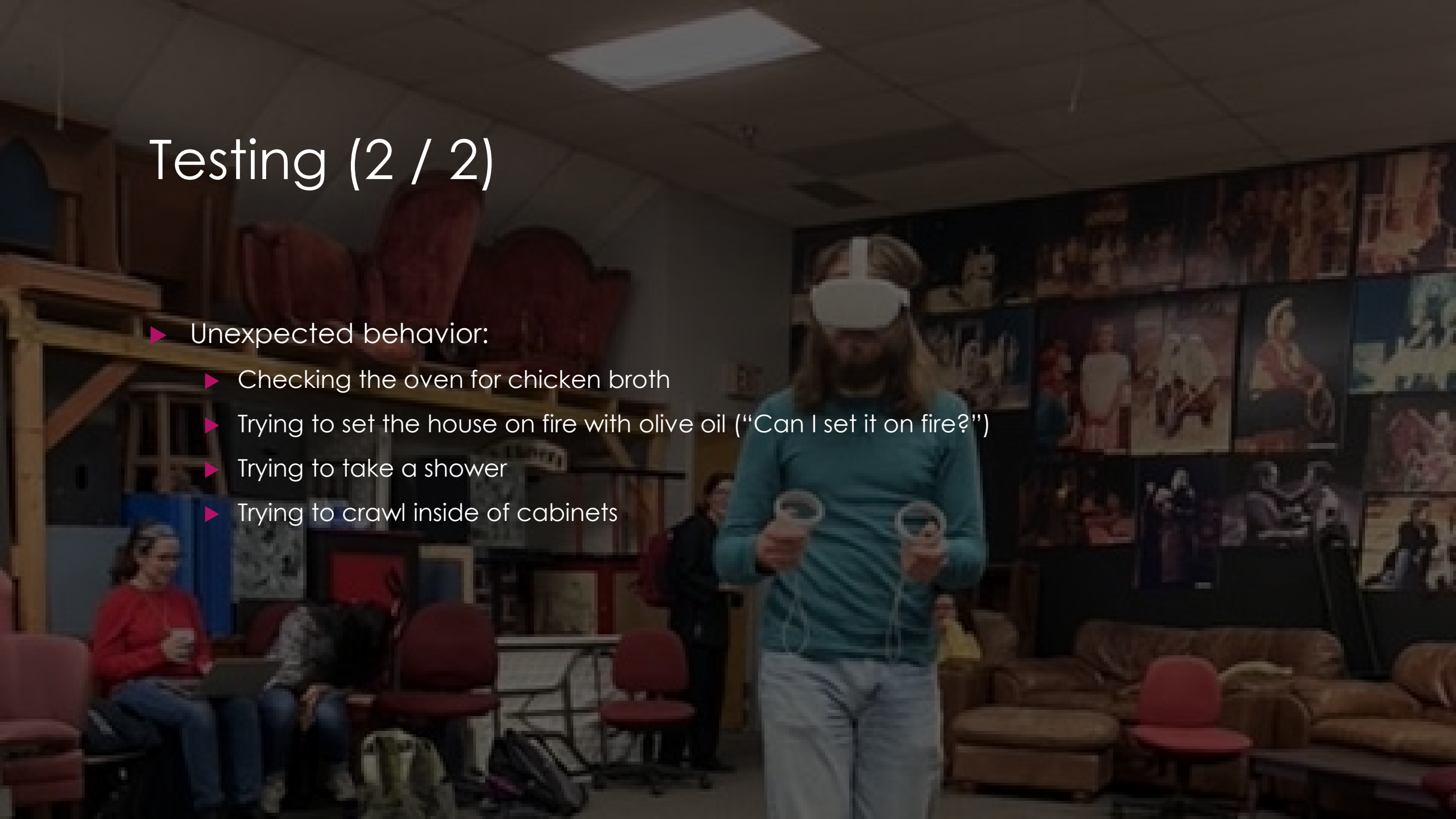
- Originally an intended feature
- Didn't make the cut due to complexities
- Library could not be reconciled with other demands of the project (ingredient measurements, etc.)

Testing

Testing (1 / 2)

- Ran test session with 10 – 15 people
- Feedback:
  - Two-point contact
  - General bug fixes (falling through the floor, getting stuck, etc.)
  - More helpful UI system that followed player around
  - More realistic recipe system that allowed for backtracking

Testing (2 / 2)



- Unexpected behavior:
  - Checking the oven for chicken broth
  - Trying to set the house on fire with olive oil (“Can I set it on fire?”)
  - Trying to take a shower
  - Trying to crawl inside of cabinets

Retrospective

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