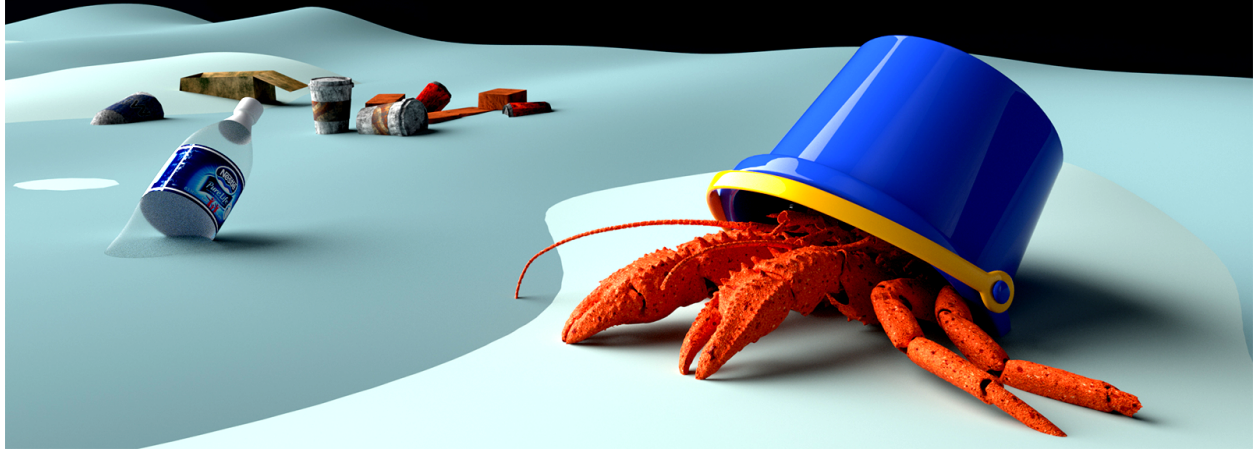# An Ocean's Story

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Designing Emerging Technologies, Fall 2019

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Design Process

Concept Brainstorming and Ideation

During our brainstorm session we wrote down any ideas that came to us. Some ideas were full experiences while others were specific interactions we would like to incorporate to whatever idea we decided on. We noticed the following themes, using vr as a learning environment, data and privacy, scale up/down, and living environments as noted below.
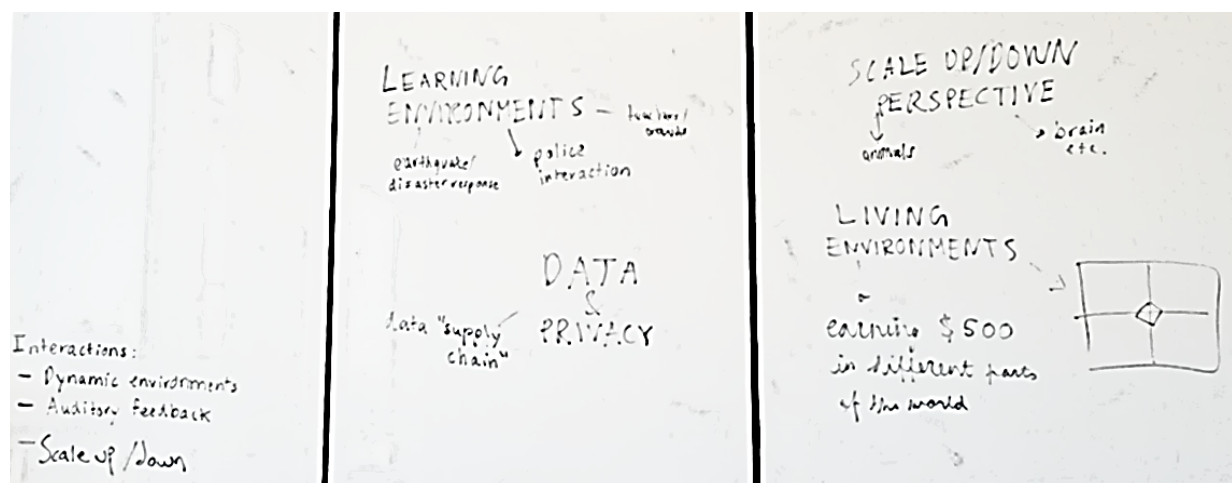
To narrow our focus, as a team we agreed we wanted to use VR to bring light to a major problem such as climate or pollution related:
- Glacier melt
- Rising water on an island nation
- Landfill
- Coral reef

We settled on marine debris and its impact on oceans. We thought using a hermit crab would be a nice way to view this problem. By choosing a small ocean creature we could have trash falling from above, trash on the floor.

The following section contains notes and a summary of our feedback session in class.

Our final story:
+Perspective of a hermit crab from beach into ocean
+Will have claws and little antenas as 1st person perspective
+Interactions
  +Avoid falling trash -> move around
  +trapped in a plastic bag -> struggle to get free
  +Crab looking for a new shell

Key items:
+Glad we choose a narrow focus of an adorable hermit crab
+They were concerned that the seriousness of the issue may not come across since a hermit crab seems cute

Suggestions:
+Consider a health bar to indicate damage by getting hit my plastic / eating plastic
+Decide if we want this to be a doomsday sad ending or how it could be optimistic (if optimistic consider recreating with a cleaner beach)
+Consider showing different perspectives of trash on beaches around the world

Decisions / Updates we made:
A health bar seems relatively easy to implement. Moreover ONLY if you get hit or health goes below a threshold then you need to find a new shell.

We are choosing a specific location to ground the story in -> Based on our research Hawaii deals with trash and plastic quite a bit due to its location in the pacific. While it's a vacation destination you wouldn't think this. Also those of us in the US always seem to assume this plastic issue happens on beaches far far away.

To end on an optimistic note, we want to show the beach or water underneath getting cleaner to express positive change in policy and efforts to clean beaches.We can do this by having the hermit crab walk into a direction that triggers a time lapse (new timeframe appears on screen ex: May 2030).

Plastics & their
impact on the ocean/
marine life

coast | ocean
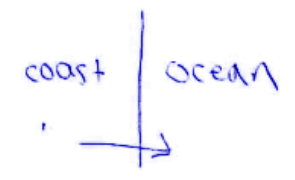
Perspective of a
hermit crab going
from coast to water

Start w/ 1 level

Interactions

- Avoiding floating/
falling trash

shells/
plastic caps - Crab looking for ↳ if you
↳ can't find   a home/shell   hit by
a shell that   plastic
works   shell
↳ have to pick - Trapped in plastic (cracks)
up a plastic
cap/object - "Health bar"

real locations — specific } batch tag
(multiple?)   location
HEA?
What would some sort — people
of policy effect book like cleaning?
Too long = ingested too much
plastic

Problem: Marine Debris

Marine debris is any man-made, solid material that enters waterways either directly through littering or via rivers, streams and storm drains. Marine debris can items such as a discarded soda can, plastic bag, or straw that ends up in the ocean potentially harming marine life. 80 percent of marine debris comes from land-based sources[1]. Moreover, an estimated 8 million metric tons of plastic trash ends up in the ocean every year[2]. Each year we see horrific images of the amount of plastic in birds and marine life have digested along with stories of marine life trapped in plastic. We want to highlight how hermit crabs are now resorting to using plastic caps and objects for their home rather than natural shells[3].

We grounded our VR experience in Kamilo Point, Hawaii which is one of the dirtiest beaches in the world. The beach is on the southernmost point of the big island where loads of plastic washes up from the pacific ocean garbage patches.

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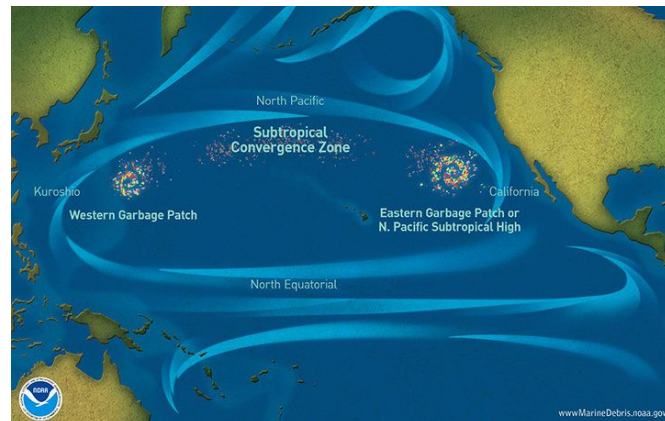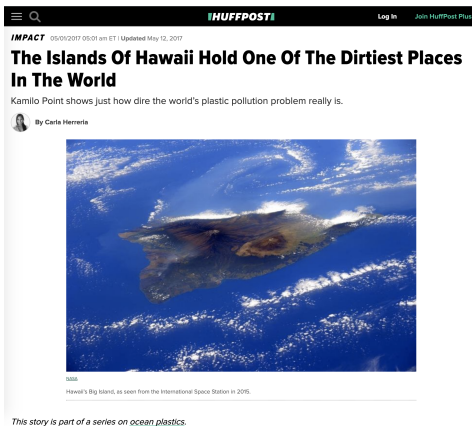
[1] thankyouocean.org/threats/marine-debris/
[2] www.huffpost.com/entry/kamilo-beach-hawaii-dirtiest-beach-america_n_58e99a38e4b05413bfe3792d
[3] https://www.globalcitizen.org/en/content/oceans-so-polluted-crabs-living-out-of-bottle-caps/

Design Opportunity

How might we design an experience to change the perspective of people about marine debris?

Issues around marine debris and plastic pollution are widely addressed through traditional media such as news articles and documentaries. We thought that we could use virtual reality to further engage people in the topic by allowing them to experience a day in the life of a creature that is directly affected by the problem.

Implementation

Key Components

- **Movement of player**
  - We knew that in order to most effectively change the perspective around marine plastic pollution, we wanted the user to see through the eyes of an animal. However, this would mean that the character would be very small relative to the world we would create.
  - Initially, we thought that the user, as the crab, would be guided through the terrain automatically. However, it was difficult to figure out how to guide the player controller without restricting the user's ability to move around freely.
  - In the end, instead of any automated controls, we decided to indicate a flattened path on the terrain for the user to follow. This would show the user where to go while also allowing the user to control how quickly or slowly to move through the environment.

- **Customization of hands in the form of crab's claws**
  - Since we wanted a first person perspective of the crab, we wanted the player to have crab characteristics. We considered the possibility of using a crab character and animating it to walk and open and close its claws as you would expect in real life. However applying animations to objects and having the program run inverse kinematics seemed a bit too complex for our timeline.
  - Instead we opted to use the course demo scene as a template for hand interactions while overlaying crab arms (from a Thingiverse .obj file), ultimately hiding the whiteglove hands.
  - In the final iteration, we simply used the OVR Player Controller and placed the crab arms as a child to the left and right hand anchors. We also made the arms a rigid body with a collider so you can hit the trash out of your way.
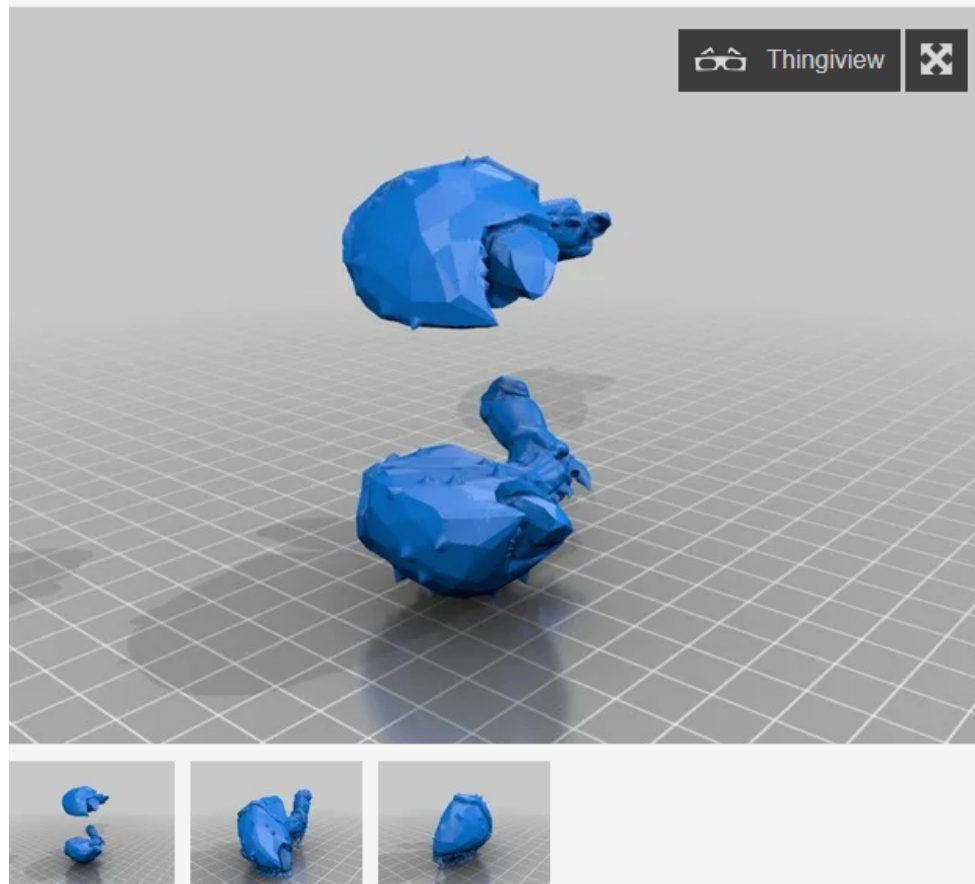
- **Cascading Trash**
  - Having the player (taking the form of a hermit crab) interact with the trash in the ocean was an essential feature of our game and the message it intends to convey. Hence, designing the interaction for the trash was a critical component.
  - We wrote a gravity script that changed the gravity effect on each piece of falling trash. Individual pieces of trash were duplicated to create an effect of multiplicity and layered above the scene.
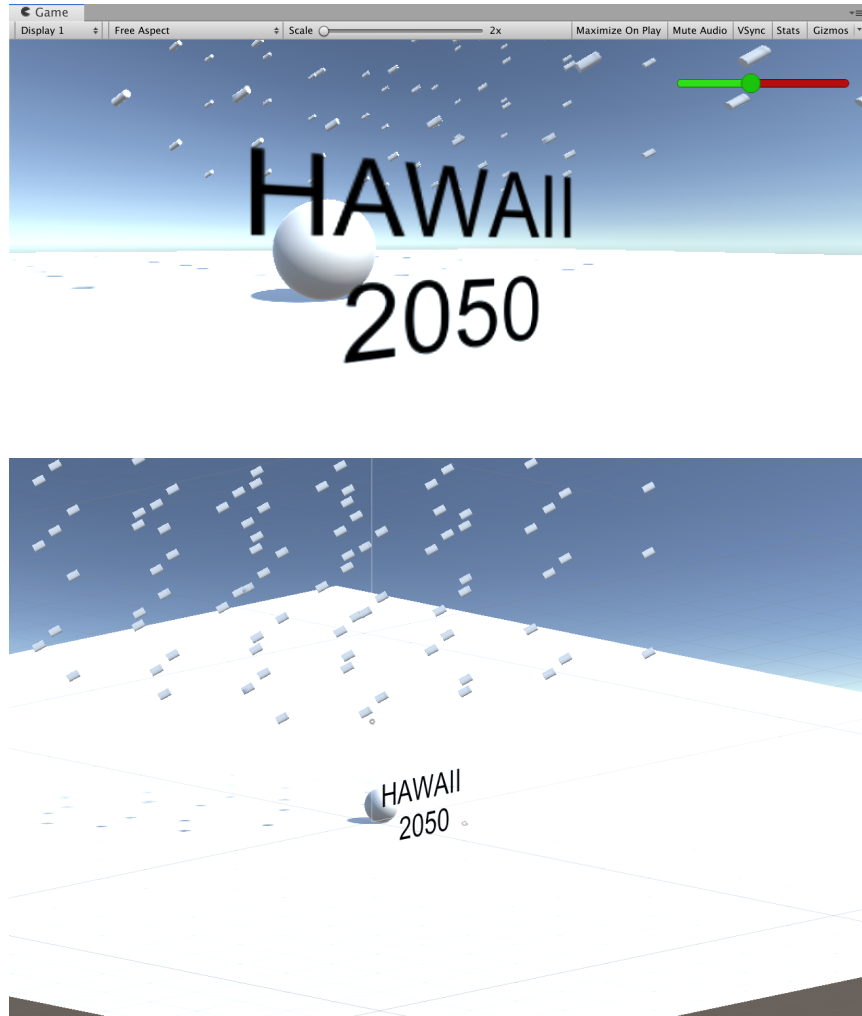
- ○ Another important interaction was the collision between one of the pieces of trash with the OVR player controller. For this, we used the OnCollisionEnter function to play an audio file of a cracking sound.

- **Health Bar**
  - ○ Implementing the health bar was essential in order to provide visual feedback to the player and close the loop of interactivity in the game. The "health" on the health bar (marked by the green area) would decrease as the player collides with trash objects. Conversely, when the player would grab the shell object, their health would increase, following the metaphor of reviving the cracked shell.
  - ○ To implement the health bar, we created an empty GameObject and placed a UI component of a slider inside it. Using the Inspector, we changed the alignment and stylistic elements such as the colors of the bar and the max and min value, as shown below.

Direction	Left To Right	▲▼
Min Value	0	
Max Value	100	
Whole Numbers	☑	
Value	⸺⸺⸺○⸺⸺⸺	42
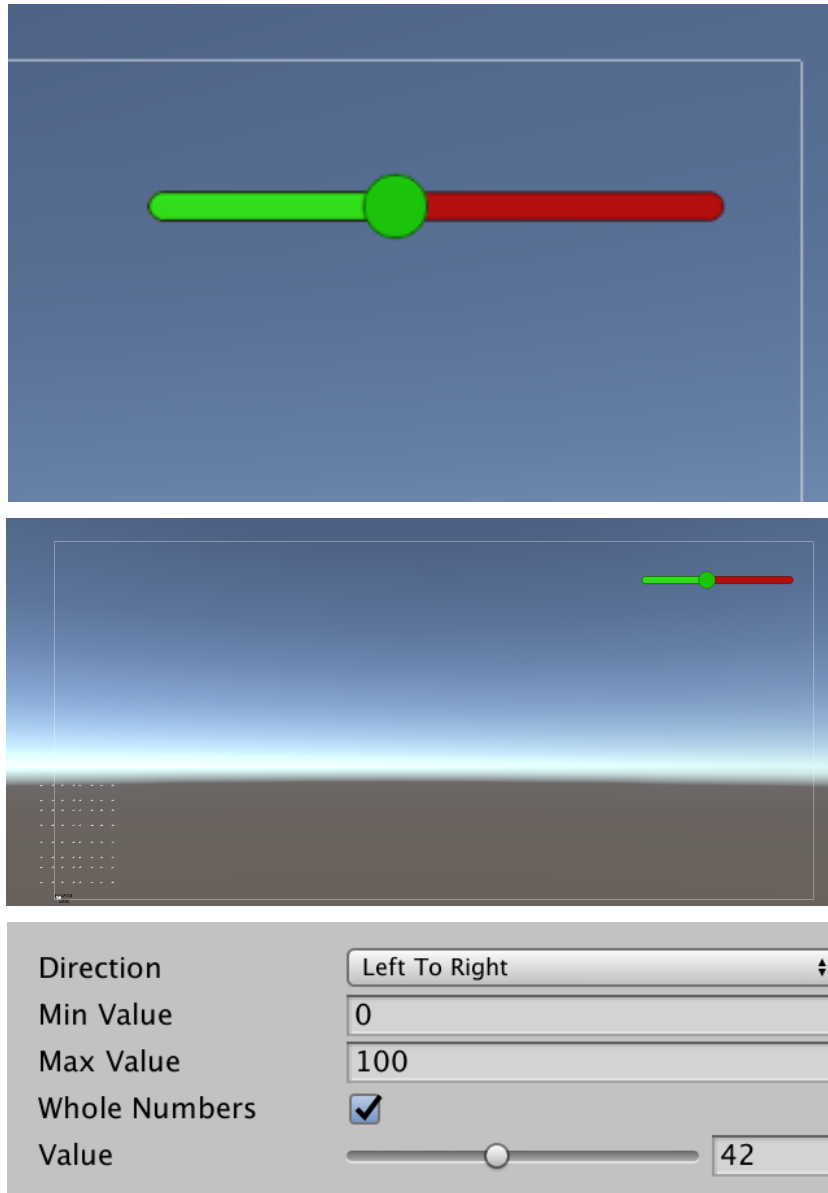
- **Environment**
  - In order to provide a hermit crab experience, we tried to create a natural environment that would illustrate the ocean's pollution story.
  - The terrain was created using an imported terrain tools package that allows us to sculpt the terrain from a flat plane using different brush types. The borders of the terrain are raised higher to blur the boundaries of the game and hide the horizons.
  - A sand texture package has been imported, and used as textures for the terrain brush to paint sand, rock, mud, and moss onto underwater rocks.
  - Corals are imported as a package of different textured coral prefab models.

- Different 3D models are imported including the palm trees, rocks, a shark, and trash objects. New materials have been created for those objects with UV maps of different color shades, UV maps, and product photos.
- Trash objects and corals were scattered around the terrain using prefab brush tools.
- The shark 3D model follows a specific path object that allows it to follow in a repeating fashion.
- In the rendering settings, blue fog is added to the scene to blur distant objects and allow the player to only visualize what is in close proximity.
- An HDRI map of a Hawaiian sky is used as the scene background image and source of lighting for the experience, replacing the default Unity blue sky.
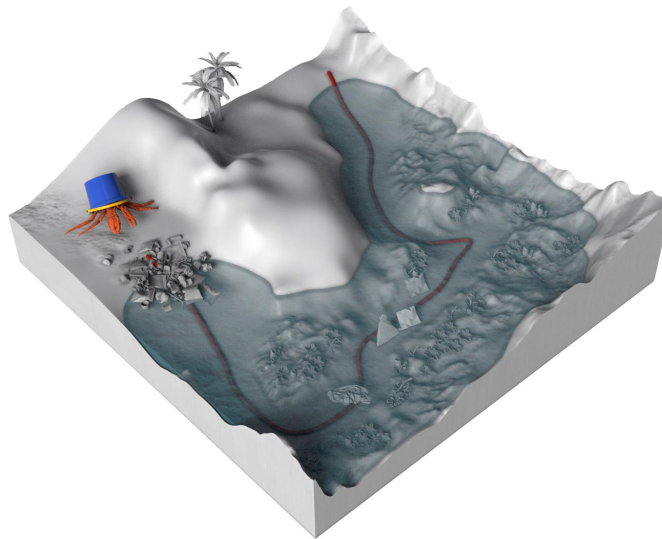
Integration

In the beginning, we split up to work on the different interactions separately in Unity and planned to integrate them together. However, when we met to integrate the parts, we discovered many problems. First of all, we had to be conscious of which version of Unity each of us was using. In addition, when transferring the project file between our respective computers and Google Drive, we found that parts of the file were becoming corrupted. At one point, we lost an entire day's worth of progress due to trouble with transferring files. Finally, we decided to only edit the in-progress project file from one person's computer. This mitigated the corruption issues, though it made it difficult to work on the project efficiently.

The next challenge we had with integration was the difference between testing the file within Unity and testing it in the Oculus Quest headset. When Unity was set to PC Standalone mode, it was easy to debug the interactions, but to test with the VR headset, it would take a long time to switch platforms. For that reason, we kept Unity in Android mode so the build could easily be

sent to the headset when it was ready. However, as our file got bigger and bigger, it took longer to send to the headset. At the same time, it was impossible to see if the new features were working without doing the transfer. Additionally, sometimes features that seemed to work on the computer would have problems in the VR environment that were difficult to debug. Specifically, it was difficult to understand the OVR Player Controller, which had to interface with all of the interactions we envisioned. Once we realized that the embodiment of the user was actually the "Local Avatar," we were able to use collisions to detect what was happening within the environment.

User Feedback

We let 10 users try An Ocean's Story to get informal feedback about the experience. For the first user, we didn't provide any information about how to navigate the experience but realized that it wasn't easy to understand what to do without any background information. For the rest of the users, we explained the problem we were tackling and what they were supposed to do in the VR world. Below are some quotes from what people said while in the experience.

"Oh, I'm a lobster"
"Come take it away from me otherwise I'll stay here"
"There's hella trash"
"Excuse me, swimming through the trash"
"It's all about these claws"
"I'm literally swimming through trash"
"I'm here and there's no trash"

Common themes included being overwhelmed with the amount of trash they were swimming through and wonder at the underwater environment and crab claws. It was evident that making a realistic environment that the users could easily imagine as the crab's habitat was important to achieve the desired effect. Although users often thought they were a lobster, including the claws was essential for showing the users that they were no longer human. Further user feedback would probably want to focus on identifying the balance between making the VR experience serious and informative but not make marine debri clean-up seem unsolvable, which we aimed for through the temporal journey.

Future Vision

Storyline

If we had more time, we would have expanded on the storyline to give more detail to the "traveling in time" theme. How might we encapsulate the different nuances of climate change from the perspectives of both activists and policymakers? How would our experience best

communicate the real problems with climate change? How might we empower people to take tangible steps in their day to day lives to practice more sustainable living?

Characters and Locations

Currently, the game is played from the perspective of a hermit crab in the Pacific Ocean off the coast of Hawaii. In future iterations, in order to appeal to a wider audience and raise awareness about the nuances of climate change-related problems to marine life, it would be worth exploring different characters in the game in the form of different sea creatures. Adding a wider variety of locations too would increase the appeal of the game to different audiences.

Environment

It would be interesting to go deeper with visual details in the environment of the game. Currently, we worked with a terrain, corals and trash objects but in the future, we would like to incorporate more undersea elements that make the environment more vibrant and realistic. One such example of a possible future addition is the modeling of 'fog' under the surface of the water. We would also like to explore adding more complex physics logic to objects to make them behave like they're moving underwater. Adding more sea creatures would also make the ocean come 'alive'.

Dynamic Music

In future iterations, we would like to work closely with sound designers to create a more dynamic music experience within the game. This would involve a wider variety of sound samples to pick from for different interactions (perhaps even with different materials) and "hot" zones around certain parts of the environment to encourage or discourage the player from certain interactions. Overall, music is a critical part of making this experience memorable since it's a direct play on emotions.

Haptics

The current iteration of our experience only utilized in-game visual and auditory feedback through UI elements. In the future, we would like to incorporate haptic feedback within the Oculus controller since it will allow the player to have a more vivid experience from a crab's point of view. Since our core interactions are centered around collisions with other objects, haptic feedback seems like the natural step forward in improving the design.

Links

Video	https://youtu.be/CKMGqEr92SU
Presentation	https://docs.google.com/presentation/d/1reqC7OACRPssOpFxRbIXNgQpivoxLVb-SMJ0o4p_6fc/edit?usp=sharing
Image	https://drive.google.com/open?id=1ktnG8iiA21z-rUPweXKbGjb3bX7riWx3
Design Files	https://drive.google.com/open?id=1reqC7OACRPssOpFxRbIXNgQpivoxLVb-SMJ0o4p_6fc

Acknowledgments

This project wouldn't be possible without the support of Dr. Hutz, Dr. Paulos and Dr. Rao for providing the hardware and initial guidance to get us started. Since none of us had experience developing for Unity, we would like to thank Sophia Batchelor from our DET class for her help with some bugs we faced during the development process. Finally, the users who agreed to give us valuable feedback as we tested our experience. Linked below are the sites we downloaded assets from:

- Problem and Story Development
  https://www.huffpost.com/entry/kamilo-beach-hawaii-dirtiest-beach-america_n_58e99a38e4b05413bfe3792d
  https://thankyouocean.org/threats/marine-debris/
- Oculus Integration:
  https://assetstore.unity.com/packages/tools/integration/oculus-integration-82022
- Crab Arms:
  https://www.thingiverse.com/thing:3357772
- Corals:
  https://assetstore.unity.com/packages/3d/vegetation/plants/corals-153595
- Prefab Brush:
  https://assetstore.unity.com/packages/tools/terrain/prefab-brush-21321
- Bezier Path Creator:
  https://assetstore.unity.com/packages/tools/utilities/b-zier-path-creator-136082

- Trash Objects:
  https://www.cgtrader.com/3d-models/exterior/street/trash-7ffb457c-cd22-42aa-a8e1-34fa63f84a9b
- Standard Assets for Unity:
  https://assetstore.unity.com/packages/essentials/asset-packs/standard-assets-for-unity-2017-3-32351
- Sand texture:
  https://assetstore.unity.com/packages/2d/textures-materials/floors/pbr-beach-sand-texturepack-85510
- Terrain Tools Sample Asset Pack:
  https://assetstore.unity.com/packages/2d/textures-materials/terrain-tools-sample-asset-pack-145808