

### Assignment 4: Storyboarding

#### **1. Raul's Tongue: Value Proposition (short phrase)**

Our project aims to improve the lives of people suffering from Spinal Cord Injury by enabling independent living. To do so, we envision a tongue interface capable of controlling technology and help these people perform their everyday activities in a simpler manner.

#### **2. Each team member's name and role.**

Dan Levine

Oliver Hoffman

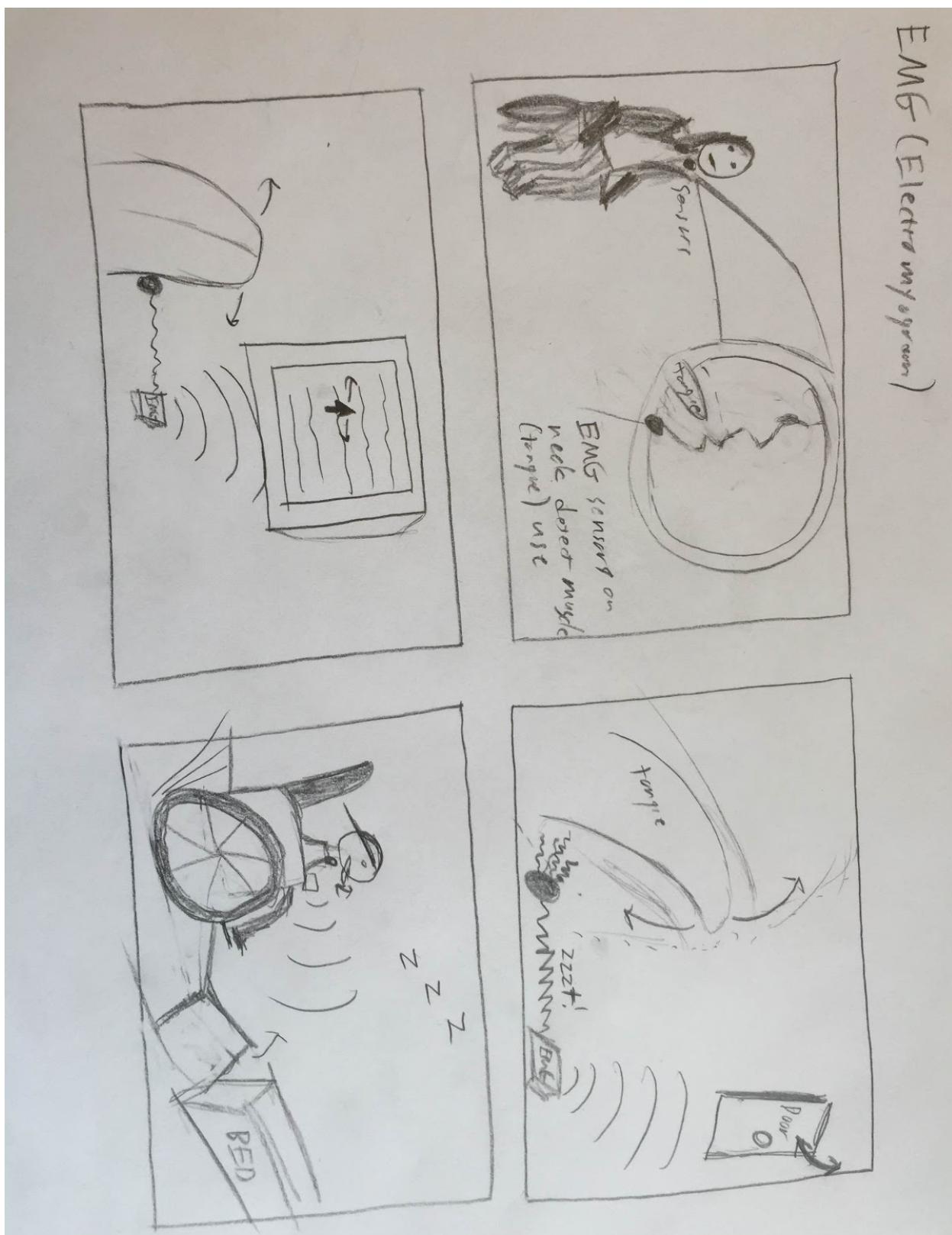
Shawn Bramson

#### **3. Problem and Solution Overview (short, 1 paragraph)**

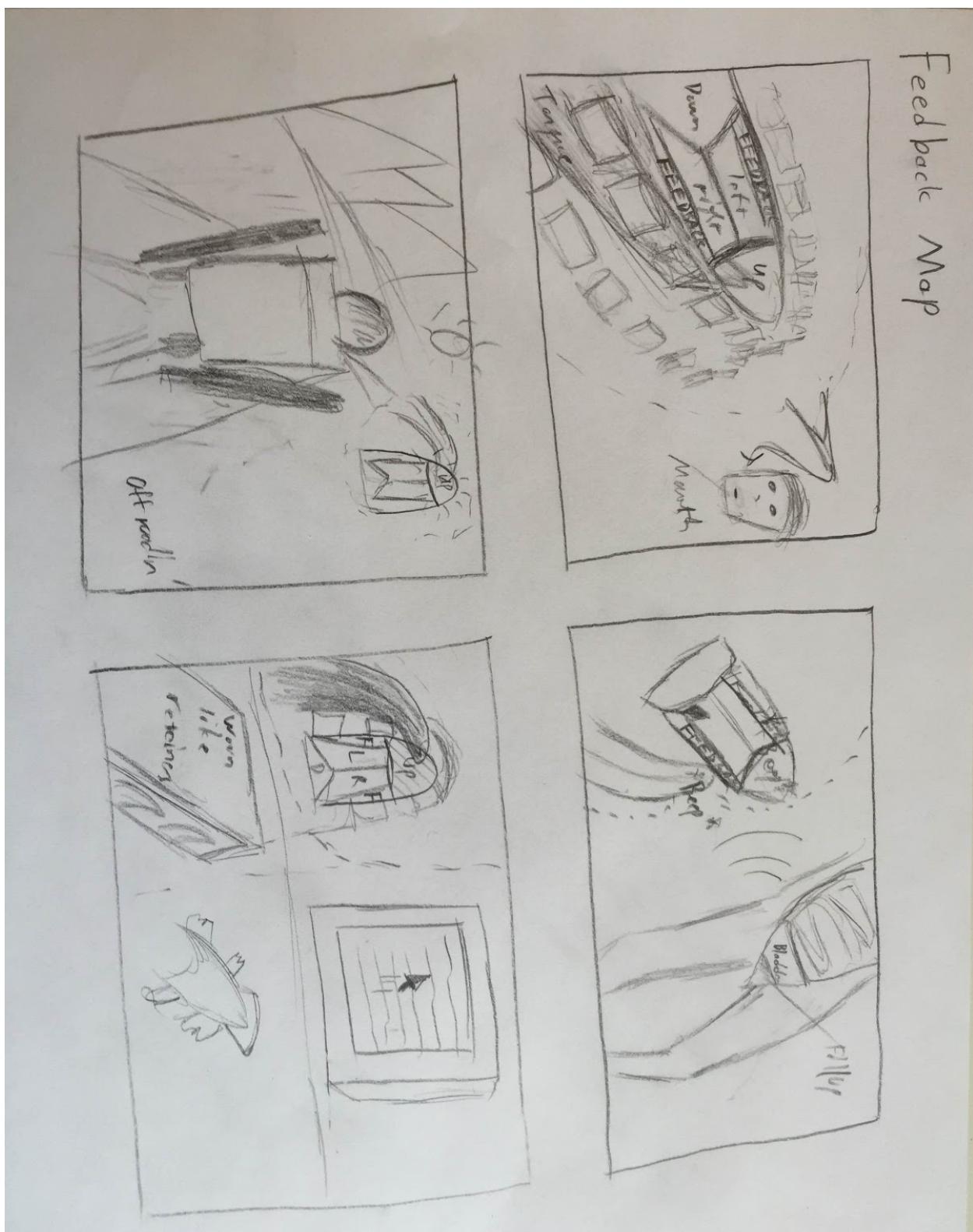
Life as a tetraplegic or paraplegic can be very difficult. These conditions are the result of a spinal cord injury which drastically changes the lives of people who suffer from it. While the standard of living heavily depends on the severity of the injury - some patients have some limited movement while others have none at all - the truth is that independent living is predominantly not possible. This is exactly the problem that we want to address. We envision an interface that stays inside the mouth, hidden either behind the teeth or in some barely visible location. This interface interacts with the tongue and enables it to control a variety of technologies wirelessly. As an interface that stays within the mouth, we anticipate cleaning requirements; like contacts or retainers the interface may be removed or cleaned on a frequent basis.

**4. UI Flow Storyboards for 3 different interface designs (as many pages as needed)**

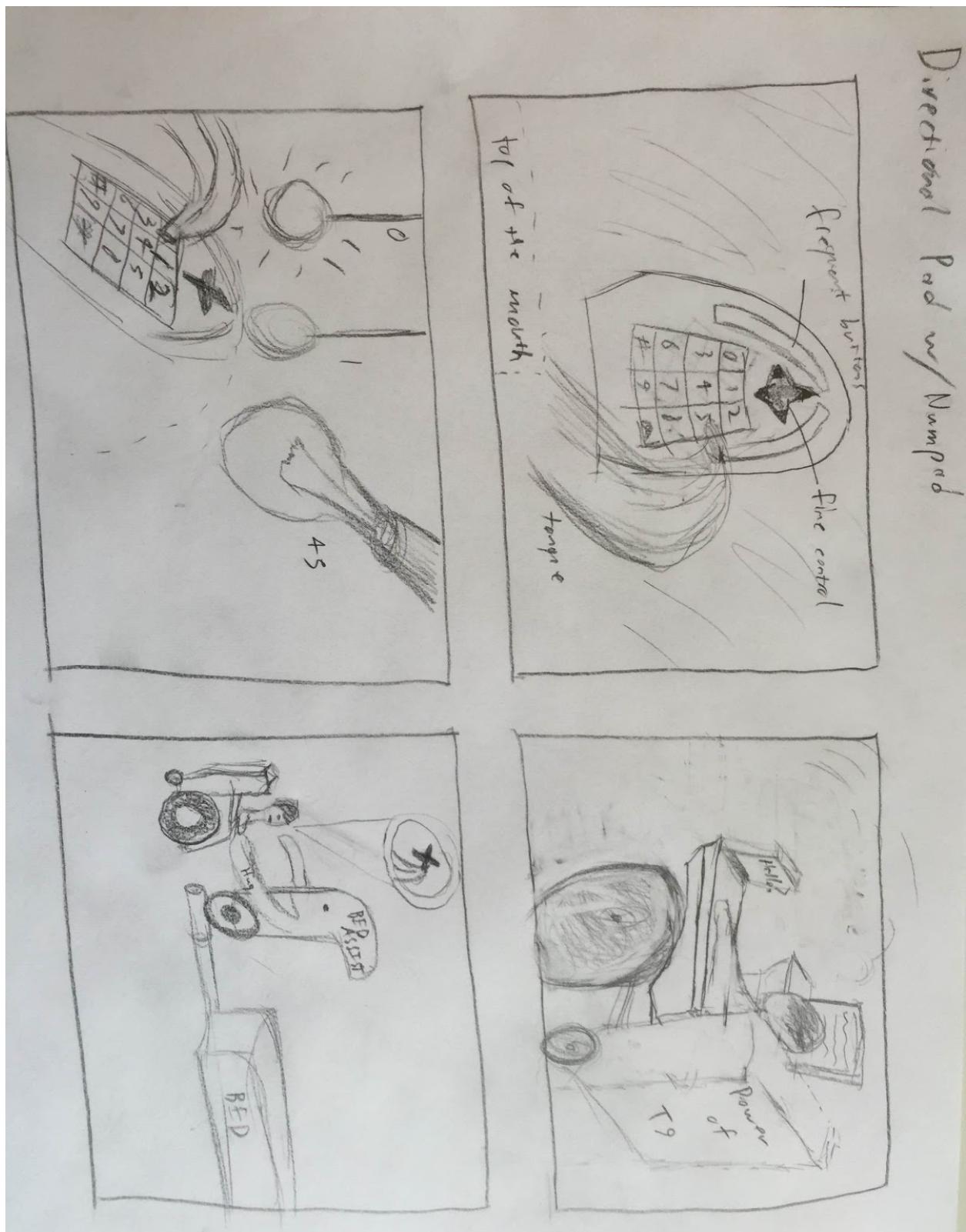
Interface 1: Electromyogram Sensing of the Tongue



Interface 2 Feedback Map:



Interface 3: Directional Pad with Numberpad



## 5. Selected Interface Design (1 page)

### a. Explain which design & reasoning for choice

We selected the directional pad and number pad based design. This design is both versatile and recognizable. Furthermore, in discussions during contextual inquiry, we learned that a previous technology, the Tongue Touch Keypad enabled near complete independence for quadriplegic users: the numbers provide a programmable flexibility while we have incorporated a directional pad for refined spatial control.

This design beat the other two for us as a consequence of its simplicity, and established familiarity. EMG in theory would be most ideal, but EMG is also notoriously hard to get consistent and clean. The Feedback Map lacks the fine control and number familiarity of the directional and number pad based design, although we acknowledge that bladder feedback is very important to many quadriplegics who cannot feel or control their bladder. At the moment we plan on incorporating this feedback via sound into the directional and number pad design.

We modified the shape of the selected interface, creating a radial siphon of generality. What does this mean? The interface appears (and feels) like three rings. At the center is a circle with a directional pad for fine control. Around the center is a number pad with raised braille for a programmable specialty determined by context (much like apps). The outermost ring incorporates “context” buttons that each toggle an atmosphere of abilities to tackle the most common difficult tasks quadriplegics face (from our contextual inquiry) with independent living. On our present design that is Door opening, Movement, Computers, Bathroom, Sleep, and Lights.

### b. Functionality summary (what you can do with it)

In its present form, the interface can be used to best accomplish tasks related to movement of the wheelchair, using computer electronics, doors, lights, sleeping, and using the bathroom. Within each of the domains, the range of abilities are quite vast, and are primarily dependent on the smart/compatible technologies available for remote interfacing. The Tongue-Touch-Keypad from fifteen years ago was a retainer mounted number pad with wireless and programmable characteristics was able then to provide a significant degree of independence according to one of our interviewees. In function, we believe that our interface has the potential to dramatically reduce quadriplegic dependence on naturally able-bodied people.

c. User interface description (how you use it - reference sketches in #3 & add more if needed)pj

(See Chosen Interface in 5. for a visual).

As mentioned previously, the design is mounted on a retainer, and consists of 3 rings of touch-identifiable buttons. The middle button is a special “directional-pad 8-way button” that enables fine, directional, and spatial control. Outside of the middle directional pad, there is a rotary number pad with braille labeling for an established and recognizable touch. The outer ring provides the context of use.

A general use might be as so. I need to use the bathroom, so I toggle the Bathroom context on. Now that the bathroom context has been selected, I can pick a variety of number combinations to perform different tasks within the bathroom. In general, we start from the context - pick the relevant context - and do everything that I can (that has been programmed in). With the specific task set, I would use the directional pad for fine control over the context’s task’s function.

5. UI Storyboards for 3 Scenarios -- example tasks carried out with selected interface design (1 page)

Chosen Interface: Refined Directional Pad w/ Numpad | page 1/2

Scenario #1: Wheelchair Movement

Recliner Base

Scenario #2: Opening and Closing Doors

Recliner base to open door D.

Using the interface; Context

1) Tongue pushes "Movement" Context

2) Tongue closes movement speed on scale from 0 to 10 using braille mid buttons, e.g.

3) Tongue depresses direction the person wants to go in ⇒ depressing right means "right"

Using the interface; Context

1) Tongue pushes "Doors" Context

1) Tongue pushes "Movement" Context

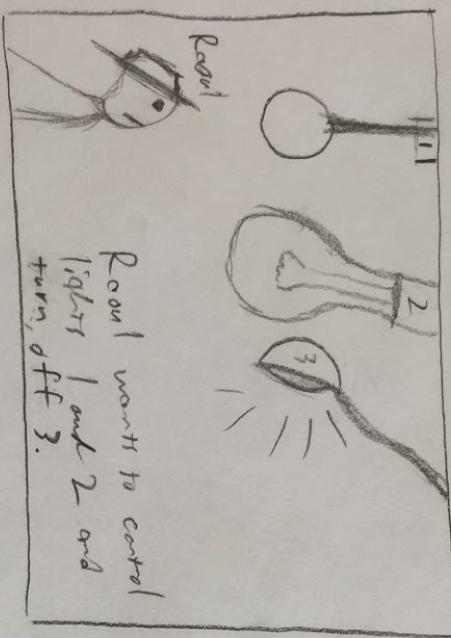
2) Tongue chooses door # for available screen doors using middle braille buttons.

3) Tongue depresses directions for methods of control, forward open, back closed, left lock.

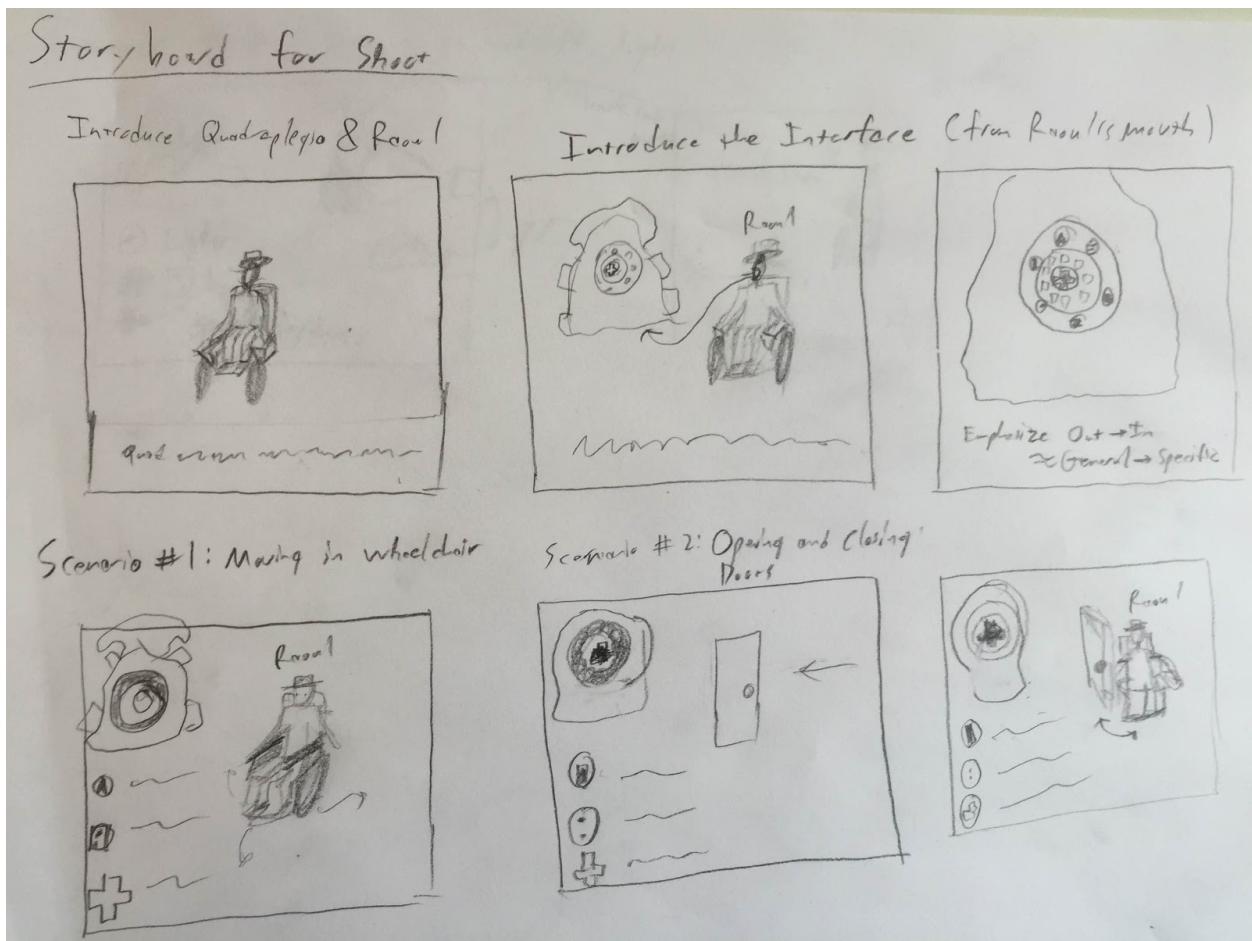
Chewie Interface: Refined Directional Pad w/ Numpad

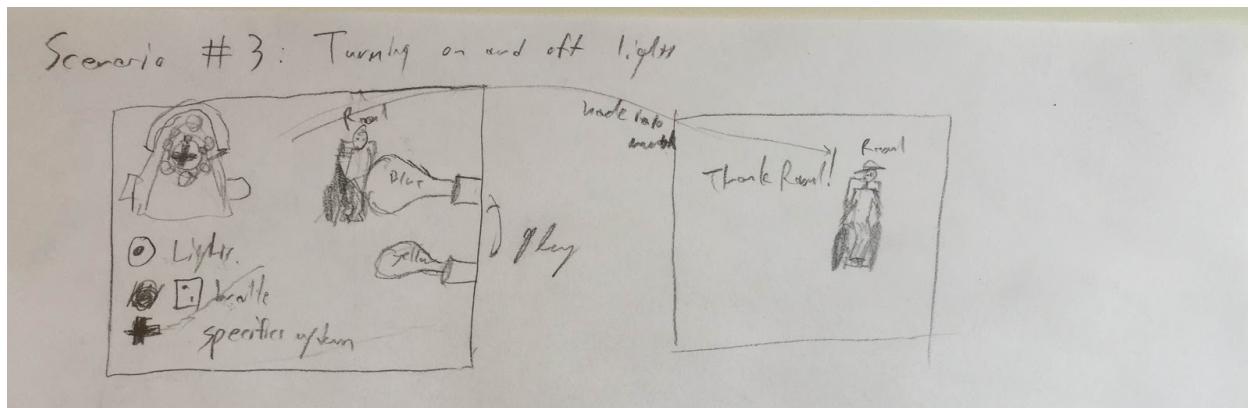
page 2/2

### Scenario #3: Controlling Lights



- Using the  interface on page 1/2:
- 1) Tongue pushes "Lights" context 
  - 2) For each light Roo! wants to change, he chooses its respective  to change it with his tongue by pushing it with his tongue into the broille pad.
  - 3) Using the directional pad, up/down = on/off, left/right = dim/brighten.

**6. Video Storyboards for 3 Scenarios for shooting video (1 page)**



## 7. Concept Video Description (1 page)

### 1. How did you make it?

We made the concept video using 3-D modeling and animation. Before diving in, we had to build up all included models first - very much like building up clay. We spent a significant amount of time and effort into designing a simple, sleek interface that we felt really made sense. We looked at well-loved interfaces (videogame controllers) and established accessibility technologies (braille) as some influence for our design. We also wanted the design to have spirit, and gave it some of our own flair. With the design it was a matter of sleeping.

### 2. Any interesting new techniques you came up with?

In particular when putting together the animation we found some new organizational tricks for setting keyframes and body positions. Doing some sketches after making the video, there was a cool realization of how a purely paper medium became more expressive and fun than models in computer space.

### 3. What was difficult?

With 3D animation you usually need to do a few takes/tests to get the timing down well. Building up a scene with reasonable lighting and a reasonable animation rig (to keep things intuitive and organized) takes time. In the end, with only one render we found that there were pacing issues and syncing issues that were hard to catch while working on it semi-blind. In the future, will set up text in an editing program rather than a 3D modeling program, as in the making of the video there was very little indication to the nature of text dissolve pacing.

### 4. What worked well?

The overall design and model building went well. The text sync did not. In the future I will probably design the timing of parts more uniformly. I feel like the work was also a bit deliberate - it worked in some places but looking at sketches, a more cinematic and artistic piece would both be fun and more experiential.

**5. How long did it take for each phase of design prep, shooting, editing?**

Design prep took roughly 4-5 hours. Shooting in this case was 18 hours with roughly 4 hours for rendering. Because of the nature of the rendering - (text was embedded in 3d), 30 minutes-1 hour editing.