Graduation Goal

The goal and scope of this graduation changed many times before it began and while it was running. However, as this is the final report, its state is fixed.

The goals of this graduation were to:
- Develop a design tool that helps designers add additional senses to augmented and virtual reality project.
- Test that tool using designers at Mobgen | Accenture Interactive.
- Build one of the resulting concepts as a fully functioning demo.
- Test that demo.

In short, these goals were all achieved. Readers with more interest can read the longer summary below. While very interested readers can attempt to read the entire report.

Summary

The project followed an eight phase structure as shown in Figure 01.1.

Phase 0: context.

This project expands eXtended Reality (or XR) with senses beyond sight and sound. Several companies have promised projects that use other senses however, little has materialized.

One of the examples of XR being implemented in a wide scale is with haptics in phones and wearables. It's the opinion of the author that this extends the "haptic space" of the users' world, and thus falls under XR.

Phase 1: research

Two researches were conducted: the first on senses, the second on design tools that are currently in use. Despite what many think, humans have more than five senses. Additionally, senses work together to create "sensations" that humans use in their perception (take for example the sense of direction). People are also people, thus their perception is susceptible to odd quirks and peer pressure.

Looking at four design tools: inSights, IDEO Method Cards, Google Design Sprints, and Conversational UI Design reveals four similar elements that each use to help guide and support designers. These elements are: activities, segmentation, path, and examples.
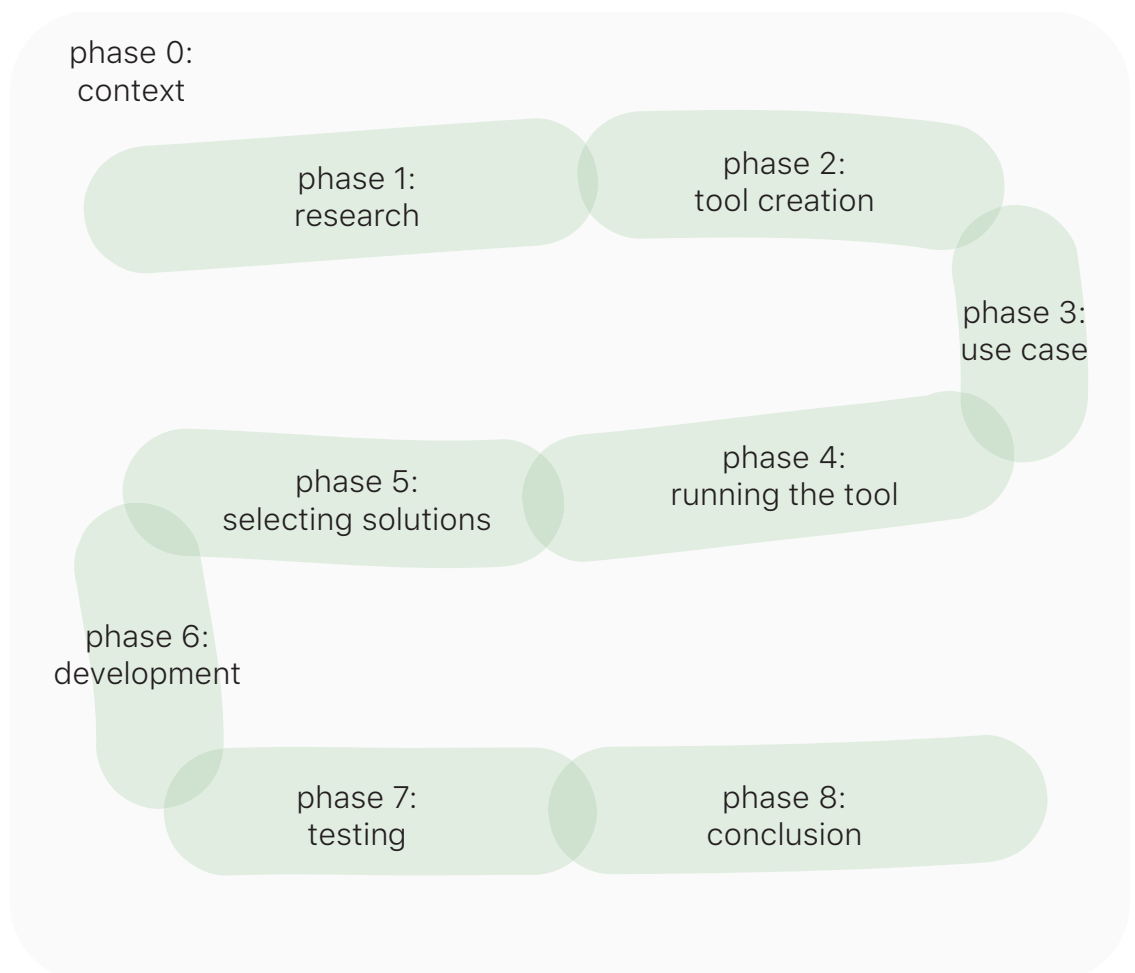
Figure 01.1: The 8 phase structure of the project and thus the report.

Phase 2: the XXR tool

The XXR tool uses these elements to help designers create a concept that uses one of the senses or sensations. Designers follow six steps: define, rate, select, ideate, modify, and synthesize. By running this tool, designers not only have a better understanding of their project, but also a well documented concept.

Phase 3: use case

ICU nurses face a very tough work environment that presents many opportunities for improvements both the lives of nurses and their patients. Two specific issues are: finding the cause of alarms in the dark, and helping nurses in training know the level of urgency of alarms. Both of these issues were discussed with nurses at Erasmus Medical Center in Rotterdam.

Phase 4: running the tool

Using the two aforementioned use cases, designers at Mobgen | Accenture Interactive ran through the XXR tool. Both trials lead to several improvements in the XXR tool itself. The trials produced two concepts: a glove that uses haptics to help nurses feel what equipment is raising an alarm, the other a foot mounted device that uses vibration and heat to convey the urgency of alarms.

Phase 5: selecting solutions

Based on the demo-real world fit, possible risks, number of senses used, and idea of transferring emotion rather than just information, the second concept from phase 4 was selected. In order to simplify development and increase usability: foot mounted became wrist mounted, and vibration would come from oscillating pressure rather than vibrator motors.

Phase 6: development

Using metaphors given by nurses at EMC; urgency levels were given a physicalization using vibration and temperature. A wearable was created using a commercial blood pressure cuff and a Peltier element. A VR mockup of an ICU room was developed using Unity. This was connected to the wearable using WiFi.

Phase 7: testing

Sixteen participants tested the wearable by first experiencing alarms without additional senses and rating the perceived urgency, then experiencing the alarms with the additional senses and rating the perceived urgency.

The highest level physicalization did not make a clear difference, however, testees were much more able to distinguish the urgency of the first two levels using the additional senses. Additionally, the testees noted an increase in immersion and felt like the alarms were personally addressed when additional senses were used.

Phase 8: conclusion

This section contains a few thoughts on the process and my achievements in the graduation process. We must strive for more creative solutions, while being limited by the technology of our time.