Game Console

Sound and Haptics

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COMP 341

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Group Members

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Abstract

The consoles we tested were the Microsoft Xbox One, Sony PlayStation 4, and Nintendo Switch. We tested the narration, high contrast mode, and controller vibration settings for the Xbox and PS4. The Switch did not have any features for accessibility other than a zoom function. Although we focused our work on the Xbox One for testing purposes, we based our presentation around the idea that our results could be modified to adapt to the various systems and would be helpful in each system.

Project Narrative

Our project was focused on the improvement of sound and haptics in video game consoles. Sound and haptics would be used to help the user navigate the menu screens successfully without full visibility of the screen itself. People with visual impairments were the primary user that was in mind during this project. We wanted to also give the

user increased functionality and customization, such as multiple narration modes with varying levels of detail and add movement based haptic support. Our modifications provide a significant increase in functionality and support to people who have visual impairments.

Research and Design Considerations

Much of our research for this project was based in responses to nonvisual stimuli and how that could lead to condition-based learning and understanding. We based our project specifications on control scheme development, operant and classical conditioning, as well as some of the Xbox controller documentation.

Audio design is often intended to stand out on its own and fill space. In this particular case, the audio is designed to actively elicit an ultimately unconscious response (unconscious referring to “without thought” rather than “not in a state of waking consciousness”). To achieve the desired unconscious responses, a combination of operant and classical conditioning (Lumen, 2020) were used in combination with audio and haptics from the Xbox One Controller to serve as the stimuli. We developed a “dark” negative sound to be played in contrast to the Xbox’s already existing “bright” affirmative sound. Positive punishment was the primary addition to the Xbox’s already existing response conditioning which uses exclusively positive reinforcement.

We found through our research that utilizing positive punishment in addition to the positive reinforcement would produce greater understanding of the Xbox menu and interface for the hard of sight. The end of a menu or invalid action was acknowledged

only visibly leaving those unable to see the invalid response having to infer something had either gone wrong or the Xbox had a hung process for some reason. Incorporating the positive punish mechanism allowed for the understanding that the user had done something wrong and that the behavior should not be repeated.

Design and Specification

Development of our project is based on video mockups of our narration and haptics solutions. We found this to be the best way to demonstrate the motions a typical user would go through when using the accessibility features. This was also the only way to provide a realistic demo of our project with a console, given the nature of the OS in these consoles. For the narration portion of our demo, we were able to chop up the original narration and edit it down to a shorter version. We recorded these original videos using an Xbox One and Elgato game capture card. The haptics feedback was portrayed using a graphic in the corner of the screen that showed an animation we created displaying vibration times of the various motors. We edited these two aspects of our project together to show a final demo with everything enabled.

Example of motor indication on controller used in video overlay

The design specifications for the haptic and audio narration interfaces we sought to apply is based on the concepts of notification and feedback (Dotsenko, 2017). Feedback is a passive response to action occurring within the system. Notification is an active response to an event that is occurring or has occurred within the system. Using these definitions, we designed the haptic system around a notification scheme with the audio narration serving as the feedback scheme. The events used within the design relied on cursor movement and option selection primarily. The following table describes the tested haptic configuration.

Cursor Action	Active Motor	Left Motor Speed*	Right Motor Speed	Duration (seconds)
Up*	Both	25%	50%	1
Down*	Both	25%	50%	0.5
Left	Left	50%	0%	0.5
Right	Right	0%	75%	0.5
Select	Both	10%	20%	0.25
Invalid Operation	Both	50%	75%	.4

Narration design was done using the existing Microsoft narrator, but shortened to effectively make the narrator less verbose and to reduce user confusion.

Testing

Our testing was done primarily through two sources. We went through different motions that would commonly be done when using the Xbox One and measured times it took to execute these motions utilizing the default narrator. We also used these motions to determine what needed to be improved on, what we liked, and what we thought could be taken out. Our second primary source of testing was our case study. We had a friend who has trouble seeing without glasses complete tasks using only the narration (without her glasses) and to provide feedback on what made her navigation tasks easy and what made them difficult. This was very valuable to us in understanding how someone who actually needs these features would use them.

Our results determined that haptic feedback was considered extremely helpful in acknowledging cursor movement. Haptics and no narration was helpful to indicate cursor position. Our case study participant found the haptics to be nonintrusive and reinforcing to positive behavior and deterring to negative behavior. The haptic feedback in addition to the narrator was also found to be helpful in the case that someone might need both. Some other feedback to be noted was:

- Motor variations and vibration patterns would need to be reconfigured
- Vertical direction feedback shook controller more violently than subject's preference

- “Select” action response felt strange. Effective, but uncomfortable
- Alternating side motor distinctions remained slightly too different despite different speed percentages
- Combination of haptics and narration lowered stress in subject as haptic feedback gave illusion of participation rather than simple “lecture and consider” concept
- Haptic feedback unnecessary if the cursor could be seen without high contrast mode

Restrictions, Limitations, and Constraints

Our development and testing was limited by Microsoft’s Xbox OS development restrictions and access. This prevented any possibility of an implementation of our results on an actual Xbox One game console. Testing the haptic feedback implementations was also difficult because we could not match up physical vibrations with controller input to test.

Conclusion

It was noted that the Xbox’s existing accessibility system, while robust and accommodating, can be stressful to use and albeit not very helpful to users new to the Xbox. The narrator is verbose and repetitive as well as loud and robotic. Our feature additions to the Xbox’s accessibility system will allow for it to enhance its value to those in need of it and will prevent feelings of difference between users requiring and those not. The additional features presented would allow the Xbox One to enhance its

accessibility features to those that strive for the closest to normal configuration of the system. Additional features also add greater customization to the experience of using the accessibility features thus making it more available to those that may want to use it but are discouraged by the limited options. Haptic feedback proved to be the ideal UX addition to accessibility system as it was non-intrusive and could be done quietly. While audio feedback is not as important of an addition as the haptics, it should still be considered.

Works Cited

Dotsenko, A. (2017). *Designing Game Controls*. From Gamasutra: https://www.gamasutra.com/blogs/AndrewDotsenko/20170329/294676/Designing_Game_Controls.php

Hayward, N. (2020). COMP 341 - Human Computer Interaction. Illinois, United States of America: Loyola University Chicago Department of Computer Science.

Lumen. (2020). *Classical and Operant Conditioning*. From Lumen Learning: https://courses.lumenlearning.com/atd-fscj-generalpsychology/chapter/classical-and-operant-conditioning/