DESIGNING FOR A HAND GESTURE INTERFACE AND 'SIGNPLAY'S SUCCES AS A GESTURE INTERFACE

A reflective report on the project 'SignPlay'

Abstract: The following report details the DECO3850 Project 'SignPlay' which was built with a hand gesture only interface. It details some of the design decisions that went into making in and compares it against some success criteria about how well it performs as a gesture only interface.

Isaac Hill

DECO3850 TEAM SIGNPLAY isaachill13@gmail.com

Table of Contents

1.0   Introduction

This report aims to address my findings and the work involved in the creation of 'SignPlay' in relation to design choices made to accommodate for a gesture only interface. Firstly, a brief description of 'SignPlay' which will outline how it works and its physical design, after this some background information will be presented to give relevant context on gesture interfaces to provide more understanding too the content. Following this, sections will outline certain parts of the projects and how they relate to designing for gesture interfaces. Some success criteria to put against 'SignPlay' along with observations made out users interacting with the project. Finally, these observations are compared against the success criteria and a discussion on their meaning to made.

2.0   Project Description

Sign Play is a learning tool designed to teach young children sign in an interesting and fun way, taking input from gestures users are rewarded for spelling correct three letter words by getting 3d pudgy animals that users can play with. Different animals corresponding to the word spelled would be created, while a larger reward of many animals spawned at once are given to users on successfully spelling three words.

The physical build of Sign Play makes use of a large box with a screen mounted above it. This exists with a piece of Perspex below it, this is used a way to create a 'holographic' effect. A mount is also made that allows for the leap motion to be put on an angle to read hand with more efficiency.

3.0   Background Survey

3.1 What is a Gesture Interface?

A gesture interface does not take traditional mouse and keyboard interface and instead relies on gestures from the user. When working with a gesture interface, it brings unique challenges and constraints that as Golod[1] points out, traditional human computer interaction (HCI) design principals can be applied to gesture first design they are not specific enough nor do they account for some of the specific issues that can come from gesture design. The design principals that Golod[1] talks about are designed for micro interactions, with a different gesture set up then using the leap motion. As such only the relevant principals will be presented here, these are as follows.

Activation

Labelled as activation by Golod[1]it refers to the method by which a user signifies the start of an action. These one off motions should require a relatively difficult action to ensure that do not accidentally activate this state when they do not attend to.

Feedback and Feed forward

Feedback and feed forward refers to to ensuring that a user's actions have obvious and noticeable effects. This informs users that their system is interpreting their actions as they had wished, this is especially important with gesture interfaces as there is no direct interaction with a physical component that a user would get with a conventional mouse and keyboard.

Error Recovery

When dealing with gestures, much like conventional interfaces users need ways to recover from errors while dealing interacting with the system. Users must have an easy way to undo decisions they have made, or revert back to the previous state they were in without difficulty.

Fatigue

This refers to the difficulty using the system can have on a user's muscles. Actions from systems such as Charade[2] which require a user to hold their hands away from their body while using the system. The time that these actions take to perform need to be considered as well as the overall movements required to use the system to ensure users are not fatigued too quickly.

Reliability

This refers to how reliable the actions are within a system. A user must be able to repeatedly preform the same interactions without miscommunication between what the user inputs and how the system interprets that.

3.2 What is the Peppers Ghost Effect?

Peppers ghost is an effect that was originally created by John Henry Pepper, using physics and the properties of materials such as glass. If a pane of glass is oriented 45° to someone's vision and an object. It will appear to the user that this object exists on the other side of the glass[3], this can cause some minor holographic appearances.

3.3 What is the Leap Motion?

The leap motion is a device being developed by a company of the same name. This device allows for relatively robust hand tracking, giving the ability easy track some gestures.

3.0   Designing for a hand gesture only interface

3.1 'SignPlay' our design methodology and my role within the team

For the creation of 'SignPlay' I was team leader and a programmer on the project. As such I had a hand in a large portion of the programming. Because a large portion of the project was front end work on making the UI for 'SignPlay' suitable for the target audience, I also have had a hand in many of the design decisions. As such I have a good perspective on designing the gesture interface both from a programmer and designers view.

As we built 'SignPlay' a programmer first approach was taken. We felt that getting the detection and hand sign input working was the most important part of the project. Because of the way the team progressed, very little design work was done pre-emptively, as was instead done as backend components were finished. This lead to short time frames for design. Instead of thinking about user's experience from the very start of the project it was instead confined to build a UI with the current backend we had.

I feel this occurred because we as a team were disjointed at times. While programming work was being done no design work was being done. I believe this is because while I am happy with the work I put in as a programmer and designer, I feel I did not perform well as a team leader. I should have spent more time delegating work to team members instead of focusing on the work I had set myself.

3.2 Object Manipulation.

'SignPlay's design revolves around using only Sign Language and grabbing motions to interact with the system. As stated by Johnson[4] user's perspectives of how they should interact with an interface will be biased depending on their previous experiences, the current context, and their goals. As such a large element of the system is the grabbing mechanic. When this system was initially designed it used only one hand and a single pinching motion. However, after some user testing it was clear that a simple pinch motion was too restricting when given the instructions to grab letters. In the final version of Sign

Play both hands were usable as well as a full grabbing motion or pinching motion would allow a user to grab the hands.

3.3 Sign Input

When designing the Sign input for 'SignPlay' there was concern that users would accidentally create hand signs while moving 3D objects. If users were able to create hand Signs by mistake when they did not intend too this would go against the Activation design principal discussed earlier. As such an input area was added, only when wants were in this area would sign language be detected. While hands were in this section colours would be displayed corresponding to different states of the system. This was to ensure correct feedback and feedforward, users would be able to interpret what what happening based on their input.

Removing your hands from the system would stop the process taking you back to the first state when you enter them again. This allowed the system to adhere to the Error recovery.

3.4 'Holographic' effect

During development in an attempt to make the user feel more engaged and interested in the project a pepper's ghost effect was implemented, having the main display be reflected off a piece of clear acrylic, this combined with a black fabric covering was meant to give users the feeling that the 3d space existed within the back of the acrylic, and was being interacted with virtually. This was done to make users feel more comfortable with the 3d object manipulation attempting to tap into previous experience as Johnson[4] mentions.

3.4 Success Criterion

To gauge the success of 'SignPlay' it must be put against a success criterion. This criterion will evaluate how well 'SignPlay' performed in terms of UI from a gesture stand point. This criterion will not look at the learning outcomes or other possible success criterion that could be put up against 'SignPlay'. These criteria are as follows:

Criteria	Description
Intuitive	Is the system intuitive? This will gauge how much help users need in figuring out the system. This will be gauged by how many unprompted questions users asked and discussion.
Fatigue	How fatigued do users get while using the system? This will be gauged by user feedback and discussion.
Feedback and Feedforward	How aware are users that their actions are having an effect? This will be observed mostly though observation and if any confusion arises from the users as to what is occurring.

Isaac Hill 43171877

Reliability	How reliable is the system? Are users able to repeat actions easily? This is gauged but observations, the difficulties they have while exploring the system will be noted.

3.5 Observations

During an exhibition held at the end of semester we were able to test 'SignPlay' with a large range of users, due to the nature of the event only observational notes were able to be taken along with in depth discussion with users when possible. The following are observations and notes taken with the corresponding success criteria.

Criteria	Observation
Intuitive	After Explanations from myself or other team members most users still seemed confused by how the system works without a demonstration, a majority of the confusion occurred when users were trying to navigate the 3d space with their hands or trying to figure out the confirm/deny system.
Fatigue	There were few complaints from users who spent a short time with the system. However, users who used the system for longer periods of time, roughly 3 minutes of more, would occasionally complain of sore arms. Some users would remark having sore arms as a reason they stopped.
Feedback and Feedforward	Users did not seem to notice the colour system on first time use. After one to two completed word spelling users would usually grasp what to do.
Reliability	Users had difficulty signing the letters they intended to sign, as well as some users had difficulty picking up letters, with some hands appearing in the wrong location.
General Observations	Users seemed to disregard the holographic effect, or at least seemed to get nothing from it. No users seemed commented on it, or when asked about the experience seemed to think of it as anything more then a screen.

4.0   Conclusion

Isaac Hill 43171877

The purpose of this report was to highlight the design choices made to design a gesture only interface. After discussing the design choices made for different aspects of the project, object manipulation, signing letters, display. A success criteria was made that would be put against the current system. The success of the project was measured by its interaction with users from the public exhibit. The meaning behind these observations will answer how well 'SignPlay' performed as an intuitive gesture only interface.

4.1   Findings

The observations will be analysed and discussion on how successful they are in each of the criteria will be decided on.

Intuitive

From the feedback observed it seems that 'SignPlay' is not successful with how intuitive is it. As very few users seemed to be able to grasp how to interact with it, without a guide stepping them through the process or without a demonstration. However, given the exhibit location and time frame each user had with the system, users were unable to have periods of time to see if they were able to figure out the system on their own. Users also had experts in the form of myself and the team around to ask questions, most users would default to asking questions instead of attempting to figure it out themselves. Overall I believe the system needs some improvement but would require additional testing to see how well in performs in terms of intuitive use.

Fatigue

From the feedback it seems that the majority of users had little trouble using the system for the time required to complete the system. However, some users did feel fatigue towards the end of use. Fatigue is somewhat unavoidable with extended use in this system as it requires users to hold there arms up for extended periods of time. While a somewhat unavoidable issue I believe there are few improvements that could be made here.

Feedback and feedforward

Feedback showed that even with a demonstration or guide users usually did not immediately grasp what the different colours meant and how they should respond, after one or two times through the main interaction they were able to grasp what to do. The users grasping the concept may have been less to do with figuring out what the colours meant and more to do with becoming use to system and understanding the steps before they get to them.

Reliability

Observations showed that the system was not very reliable. Mostly due to the way that the leap motion would interpret some people's hands, generating certain hand signs would sometimes prove very difficult. On top of this, the leap motion would occasionally interpret other body parts, such as a head, as the user's hand, causing lots of issues. While these are all issues that come with the hardware chosen rather then any design choices made. It still causes the system to fail this criterion badly.

Overall

Isaac Hill 43171877

Overall I believe that the while 'SignPlay' was well received by the public, its overall usability purely from a UI perspective is not very high, too many issues with reliability and how intuitive the system is come into play. Ideally these issues could have been address had more user testing been done closer to exhibit date to give us a better idea of what kind of sections users were having difficulty with.

5.0 References

[1] I. Golod, F. Heidrich, C. Möllering, and M. Ziefle, "Design Principles of Hand Gesture Interfaces for Microinteractions," in *Proceedings of the 6th International Conference on Designing Pleasurable Products and Interfaces*, New York, NY, USA, 2013, pp. 11–20.

[2] T. Baudel and M. Beaudouin-Lafon, "Charade: remote control of objects using free-hand gestures," *Commun. ACM*, vol. 36, no. 7, pp. 28–35, Jul. 1993.

[3] T. B. Greenslade, "Pepper's Ghost," *Phys. Teach.*, vol. 49, no. 6, p. 338, 2011.

[4] J. Johnson, *Designing with the Mind in Mind : Simple Guide to Understanding User Interface Design Rules*. Amsterdam: Morgan Kaufmann, 2010.