Project Spearhead
Post Mortem - Gesture Tests

Note: The testing done by the Spearhead team is by no means scientific. We aren't researchers, we're game designers attempting to learn as much about a new device as possible in a 6 week crunch period. As a result much of our data is incomplete and many of our conclusions rely on anecdotal evidence. Please feel free to disagree with our conclusions or better yet, continue our testing and refine our methods and results.

Overview

The Oculus Rift Developer Kit is able to track a user's head movement in three directions of tilting. The best descriptors of these motions are tilting forward and back, shaking left and right, and head-tilt-sideways. And while the Oculus cannot track positional motion data, that is motion in the X, Y, Z coordinates, (aka, if you step forward without tilting or shaking your head in anyway, the Oculus won't notice a chance) sensing tilt is should be enough to recognize certain movements of a user's head and create controls based on their gestures. Our 'Gesture Tests' are designed to answer whether it's possible to create working gestures with the Oculus's APIs and whether or not those gestures will be accurate enough and comfortable enough for it's users.

The four tests we conducted were: "Gesture Speed Differentiation", "Gesture Resolution", "Gesture Fatigue", and "Camera Transition and Gestures as Controllers".

Test #1
Gesture Speed Differentiation

Hypothesis:

The Oculus Rift's ability to detect head movement is precise enough to detect variations in the user's gesture (shaking) velocity.

Description:

The Oculus will be in a locked camera position facing two lights that are shut off, one blue, one red. The red is activated by a slow head nod, the blue by a fast head nod. After a period of time getting used to the different speeds and which speed ignites which lights, the test will begin. A text prompt will appear asking the user to activate one of the lights. The user will attempt to do so. This will be repeated 10 times and a score out of 10 will be recorded.

Results:

User 1: N/A (The code broke)
User 2: 6/10
User 3: 10/10
User 4: 9/10
User 5: 8/10
User 6: 8/10
User 7: 8/10
User 8: 2/10
User 9: 10/10
User 10: 4/10
User 11: 8/10
User 12: 8/10

We chose to discount the result of User 1's trial, the error was the fault of our application and not the user. In that case, the average of the data is 7.36.

Test #2
Gesture Resolution

Hypothesis:

The data involved in tracking head motion on the Oculus is precise enough to allow the user to make miniscule adjustments with their head.

Description:

The user will be in control of the forward motion and the rotation of the shape in front of them. Using the Oculus they will have to rotate the shape to match the hole in the wall in front of them. Forward motion will be handled by 'W' and 'S'. They will have to complete this exercise with four different shapes, and this will be timed. They will also complete the exercise without the Oculus, using 'A' and 'D' to control rotation; this will be compared against the Oculus time.

Results:

	Test 2: Tilt Res (Oculus) in secs	Test 2: Tilt Res (Keyboard)
User 1	35	39.7
User 2	118	95
User 3	84	85
User 4	86	79
User 5	105	90
User 6	52	30
User 7	25	35
User 8	159	109
User 9	116	86
User 10	134	108
Average	91.4	75.67

Test #3
Gesture Fatigue

Hypothesis:

Using the Oculus as a gesture detecting input device will cause the user discomfort over time, especially for common actions, such as opening a door.

Description:

The user will be moved through a hallway at a set speed, they encounter a door that needs to be opened with a head gesture (left to right nod). This door is repeated 15 times and they will only be able to open the door when they stop at it. If they do not perform the correct gesture at the right time they will be stuck until they successfully open the door. The user will be timed through the entire course and the number of times they get stuck at a door (for performing a gesture erroneously) will be recorded.

Results:

	Total Time in secs	Times Stuck
User 1	120	3
User 2	50+	14
User 3	66	2
User 4	65	1
User 5	DNF	-
User 6	93	5
User 7	92	1
User 8	80	0
User 9	90	3
User 10	DNF	-
User 11	50.4	1
User 12	83	5
Averages (not counting DNFs)	82.16	3.5

Test #4
Camera Transition and Gestures as Controllers

Hypothesis:

It is possible and comfortable to use gesture inputs in tandem with the standard Oculus camera head-tracking, by creating instances when the Oculus transitions, in-game, from camera to gesture input device.

Description:

Users are allowed to walk around a small room freely and use the Oculus to look around. On one end of the room there is a door with a simple ‘puzzle lock’ on it. When users get close enough to the door, the game forces the camera to move around and lock onto the puzzle. Now, the Oculus no longer can be used to look around, but instead to move a block around within the puzzle to solve it and open the door. This will be a more subjective trial as success or failure will largely depend on the reported comfort of the users.

Results:

For this test we were unable to collect large amounts of objective data, but out of 12 subjects 11 were able to find their way out of the room. The one who was unable to open the door lock expected the unlocking mechanism to respond to head-tilt-sideways movements instead of twisting left and right. Beyond that we found that 7 of the 12 people were able to operate the lock without any prompting. And finally only 2 out of the 12 participants found the forced camera move to be uncomfortable or nauseating.

Gesture Tests Conclusion:

The major focus of these tests was to explore the possibility of using the Oculus as an input device. Could your primary display also work as your controller? The short answer is yes, the Oculus is perfectly capable of being implemented as a controller, especially when you only look at the usability of the data that comes from the device. When you take the view into account the answer gets more complicated.

In our first test we asked whether or not the Oculus provided the type of data that would allow us to track differentiations in velocity for the user. We learned that this is completely possible, 100%, but it can be difficult for the user to utilize this type of input. The first issue we noticed was that it took a few attempts to understand what speed of 'head shaking' was needed to activate each light. Fast and slow head movements mean different things to different people and many of our users had trouble staying consistent, at first. After they fell into a rhythm and began to get comfortable with the concept of head shaking as an input we invited them to start their 10 official attempts to activate the blue and red lights. The final result was an average of 75% accurate attempts. Before we move on we'd like to mention that during our prototyping phase we often use a head shake input to begin a game or advance through a start screen. It takes some experimentation to find the right speed that is both, slow enough to be easily reached by the average user and quick enough that users don't accidentally skip through a menu option as a result of idle head movements; but in our experience this is a perfectly acceptable mechanic.

Our second asked the question of whether or not the Oculus was capable of head tracking accuracy on a minute level. The data we got showed that going through our test course using Oculus controls was, on average, 15 seconds slower than using traditional keyboard controls. We want to bring up that during our testing we had an issue where some of the obstacle required the users to turn their heads greater than 90 degrees (not an easy feat) and this arguably lead to slower times. This issue has since been fixed in later versions of the test, but we have not done any formal data collection with the new version. What we've learned, regardless of whether or not Oculus control is 'slower' than keyboard control, is that the Oculus provides an impressive amount of head tracking accuracy. Users are able to hold their position steady within a few pixels and match the angle of an in game object with their head orientation with ease, and more importantly without discomfort (though we must warn, games with head-tilt-side mechanics such as this test employes, are highly susceptible to simulator sickness).

The gesture fatigue test gave us perhaps, the most dichotic data in this category of tests. We asked if repeated physical motions, in the case of the test, shaking your head, to complete a

task, would become uncomfortable overtime. The answer is, without a doubt, yes. Out of 12 users we had 2 complain of discomfort and elect not to complete the test. Other complained of nausea, headaches, and that the Oculus would shake around on their head and the eyepieces would smash into their noses. Despite this, the accuracy of those that did complete the test was remarkable. In our testing of those who completed the test, users got ‘hung up’ on a door only an average of 3.5 times out of 15 doors. If it’s possible to operate that accurately under uncomfortable scenarios we feel that with a better motion (something not as violent as head-shaking) repeated gestures could serve as a unique mechanic, especially if used sparingly.

Finally our last test was really asking two questions: could users go from using the Oculus as a first person camera to using it as a gesture based controller, and would a forced camera move during the transition of camera to controller be uncomfortable. The former question was informed by the fact that 11 out of 12 of our users were able to leave the room. All of our users understood that when directed to the door lock the Oculus’s role in the world had changed and was no longer a camera. Only one was unable to figure out that they needed to look up and down, left and right, to move the mechanism around. This is arguably a result of our poor directions and in-direct control; the subject did try several times to operate the mechanism through ‘head-tilt-sideways’ movements before giving up. In regards to our second question, whether or not a forced camera move was nauseating to the user. This is something that has been discussed at length in reference to the Oculus Rift’s usability. It’s often remarked that any movement of the in-game controller, not controlled by the user is a terrible idea. We find this not to be the case at all. In almost every case the user didn’t realized that the camera was moving, only that they were now locked on the door lock object. Only 2 users took issue with the camera movement, leading us to believe with some careful animation and playtesting you could move the camera a great deal without upsetting the user.