Glass Shooter: Exploring First-Person Shooter Game Control with Google Glass

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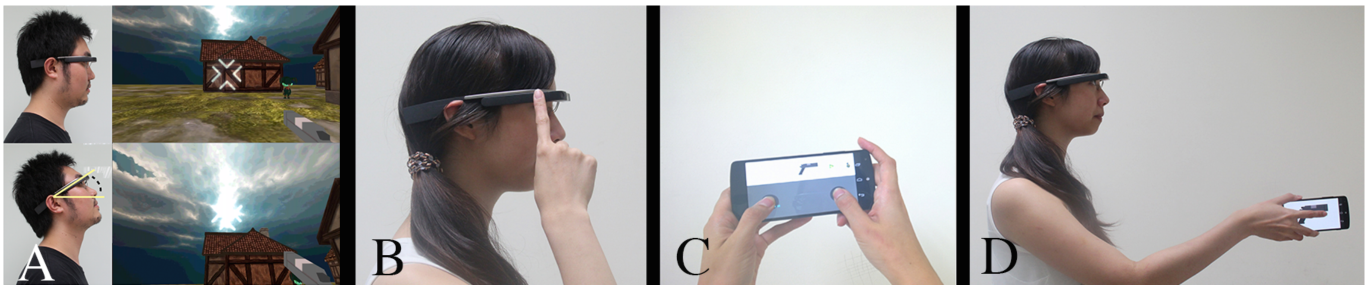

Figure 1. We implement multiple possible control methods for our FPS Game on Google Glass. (A) Our demos uses head mounted gyro to control the first-person viewport. (B) We designed a set of gestures on the touchpad strip. Players can move forward by touching the front half of the touchpad, and move backward by touching the rear half. Weapons can be fired by using taps. (C) Smartphones as virtual controller: two virtual joysticks and buttons to move and to change the viewport and to fire weapons; (D) Considering your smart phone as a small gun. Player can use his phone orientation to aim the target.

ABSTRACT
Smart Glasses offer the opportunity to use head mounted sensors, such as gyroscope and accelerometers, to enable new types of game interaction. To better understand game play experience on Smart Glasses, we recruited 24 participants to play four current games on Google Glass that uses different interaction methods, including gyro, voice, touchpad, and in-air gesture. Study results showed that participants were concerned with comfort and social acceptance. Also, their favorite input method was gyroscope, and their favorite game type was First-Person Shooter (FPS) game. Hence, we implemented a FPS game on Google Glass using gyro for changing the viewport, and divide FPS controls inro four categories: (a)viewport control, (b)aim control, (c)fire control, (d)move control. We implemented multiple control method in each category to evaluate and explore glass game control design.

Author Keywords
Google Glass, Wearable Devices, Game Design, Head Mounted Display, Multi-Modal, Mobile Phone, Gestures, Physical Activity, Mixed Reality, Augmented Reality, Virtual Reality.

ACM Classification Keywords
K.8.0. Personal Computing: General Games

INTRODUCTION
Games are the most popular type of mobile apps, with recent statistics showing that 70-80% of all mobile downloads being mobile games[7, 8]. Although traditional game design has many well-known guidelines [4, 9, 6, 13, 14, 2], game design for Smart Glasses has not been explored.

To better understand game design for Smart Glasses, we recruited 24 users to play 4 existing games [12] on the most popular Smart Glasses, Google Glass. The four games have been selected to span different game types and control styles. Our study showed three design challenges that are not discussed in current game design guidelines: "Limited control", "Eye strain" and "Social acceptance".

Also, compared with other gaming platforms, Smart Glasses lack traditional input method like mouse, keyboard, joystick, or touch screen. However, there are some non-traditional wearable sensors such as camera, touchpad, microphone, gyroscope, and accelerometer. Our study showed that most of the users preferred using gyro, and preferred playing First-Person Shooter (FPS) games on Google Glass. Therefore, we implement a FPS game,"Glass Shooter", with multiple control styles to explore game design space for Smart Glasses and to understand user preference. This demo focuses on exploring the "limited control" issue and compares Glass-only input to Glass+smartphone input.

GAME PROTOTYPE

In order to get deeper understanding of glass game design, we implement a game by ourself, so that we can have some control variable to change directly by ourselves and compare with different settings. According to user imagination from user study 1, there are five different type of game which players suggest. We choose FPS, with the highest number of users who wants to play, as our game type. And FPS also has the most control issues in it's type. We expect that our FPS game can satisfy most user and get useful knowledge by studying and implement this type of game.

Control

There are four main controls in FPS game. The first control is the viewport control, which emphasizes on how user can change camera's perspective and observes the surrounding environment. The second one is aim control, which attaches importance to know how player aim their target or enemy. The third control is fire control, laying stress on how player trigger the fire to beat their enemy. And the last one is the move control, which focuses on how player controls avator's position and dodges the bullet from enemy.

Although smart glass is new wearable device to interact with users and will be more powerful in the future, it does not meant that smart glass will replace smart phone[11]. With these two different typies of device, they should complement each other to make up their own deficiency. Furthermore, google glass is designed to always connects with smart phone through bluetooth. So we can include smart phone as controller for our game designs and control scheme intuitively.

According to previous work[1, 5, 3, 15], using head orientation as a viewport control is undoubtedly intuitive. And user prefered because of the metaphor of moving our own head. However, we can't confirm whether using head orientation is really suitable for users to aim the target. So we supposed 3 different aim control schemes to test which would be the most favorite control for user. Three different aim control schemes are listing below:

1. Viewport aiming scheme: The most traditional method we choose. Game designer just need to put a sight bead in the center of viewport. Player can aim the enemy by using their head to move their viewport. In other words, player are using head orientation to aim the target.
2. Gun aiming scheme: Considering your smart phone as a small gun. Player can use his phone orientation to aim the target. The sight bead will show on the google glass screen to help user aim at even micro movement.
3. Phone joystick scheme: Using smart phone as a joystick to move the sight bead on the glass screen.

We also bring up 3 different firing controls as below:

1. Phone trigger scheme: Using touch screen on mobile phone as the firing trigger. Player can just fire by tapping their phone touchscreen.
2. Glass tapping scheme: Player uses fingers to tap on glass touchpad to trigger gun fire.
3. Voice control scheme: Player uses voice control, such as the sound of "Bang", to tirgger gun fire.
4. Blink eye scheme: Player uses intentional eye blinking as a fire trigger.

We propose 3 moving control scheme :

1. Head gesture scheme: We borrow the control style from the work of Hinkel et al.[10], and implement the system in our FPS game control system.
2. Phone controller scheme: Using smart phone as a joystick to move the player by manipulating the touch screen.
3. On track moving scheme: This is a trick one. We can't exclude the possibility that control player's movement is not suitable for glass game. Therefore, we design a pre-defined track for player in this scheme, and player will move on the track automaticlly. So player can focus on aiming and fighting, rather than the movement control.

CONCLUSION AND FUTURE WORK

To explore the complete game design space on Google Glass, we will accomplish a series of user studies to evaluate these two issues we found in our previous study in the following months.

ACKNOWLEDGEMENTS

We thank our advisor Prof. Mike Y. Chen and the faculty and staff of National Taiwan University. We should also like to express our gratitude towards all players and testers who have helped us in our many (buggy) iterations.

REFERENCES

1. Arun Kulshreshth, Joseph J. LaViola, J. Evaluating performance benefits of head tracking in modern video games. In *SUI'13* (2013).
2. Christian Bertelsmeyer, Erik Koch, A. H. S. A new approach on wearable game design and its evaluation. In *NetGames '06*, ACM Press (2006).
3. Corey Pittman, Joseph J. LaViola, J. Exploring head tracked head mounted displays for first person robot teleoperation. In *IUI'14* (2014).
4. David Pinelle, Nelson Wong, T. S. Heuristic evaluation for games: usability principles for video game design. In *CHI'08*, ACM Press (2008).
5. Dingyun Zhu, Tom Gedeon, K. T. Exploring camera viewpoint control models for a multi-tasking setting in teleoperation. In *CHI'11* (2011).
6. Elena Mrquez Segura, Annika Waern, J. M. C. J. The design space of body games: technological, physical, and social design. In *CHI'13*, ACM Press (2013).
7. Gaming on Mobile Phone Statistics 2011. `http://itechvision.blogspot.com/2011/08/gaming-on-mobile-phone-statistic`.
8. Infographic, Mobile Game statistics. `http://www.digitalbuzzblog.com/infographic-mobile-gaming-statistics-stats-2011/`.

9. Hannu Korhonen, E. M. I. K. Playability heuristics for mobile games. In *MobileHCI'06*, ACM Press (2006).
10. Hinkel, J. B. Head-guided wheelchair control system. In *ASSETS '10* (2010).
11. CHI 2014 GlassClass Lecture Notes. `https://docs.google.com/presentation/d/1hoda7iBO7Lv3I_prEKgdg-mP0-Y81e8ueDZ1jCRa0jo/`.
12. Glass Mini-Games. `http://developers.google.com/glass/samples/mini-games`.
13. Penelope Sweetser, P. W. Gameflow: a model for evaluating player enjoyment in games. In *CIE'05*, ACM Press (2005).
14. Richard Wetzel, Rod McCall, A.-K. B. W. B. Guidelines for designing augmented reality games. In *Future Play'08*, ACM Press (2008).
15. Stefan Greuter, D. J. R. Controlling viewpoint from markerless head tracking in an immersive ball game using a commodity depth based camera. In *DS-RT '11* (2011).