GLASSASSIN:
A Two-Player Game For Google Glass

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Abstract
In this paper, students of Stanford's Wearable Computing class describe the process of creating a multiplayer game for Google Glass and discuss this project in terms of its relationship and importance to the fields of augmented reality and ludic engagement. We discuss obstacles encountered while creating the game, as well as the solutions discovered during the design process. Finally, we address user reactions to the final game prototype and next steps for the project.

Author Keywords
Google Glass; augmented reality; head-mounted display; ludic engagement; multiplayer game; video streaming.

ACM Classification Keywords
H.5.1. Information interfaces and presentation (e.g., HCI): Artificial, augmented, and virtual realities. See: http://www.acm.org/about/class/1998/

Introduction
Games are not only oft-overlooked applications of new technology, but also oft-dismissed components of American adult life. Indeed, despite the benefits of ludic engagement to adults—positive sociologic and emotional interactions[6], and even larger cultural innovation[3]--many adults consider creative play strictly a children's domain and thus avoid prioritizing games in their own lives.

We argue that Google Glass is inimitably positioned to forward the field of adult multiplayer games. For one, the allure of a remotely affordable pseudo-augmented reality (AR) platform is undeniable to many adults; such cache is likely to convince some otherwise non-gamers to enter the Glass game market.

We also argue that a multiplayer game design for adults would encourage innovation and improvements to Glass technology, simply by converting tech-savvy non-users into the user category. And importantly, self-conscious consumers might feel that the stigma in some communities of wearing Google Glass is lifted when the

clear purpose is play. Finally, the motivation and engagement of a game would likely encourage knowledgeable players to pinpoint weaknesses in Glass and attempt to create ways around them. This is particularly the case if the game mechanics prioritize the most highly valued Glass components.

In short, we find that a multiplayer game for Google Glass is a logical step that is potentially valuable to the technology user and the technology itself.

Related Work

Mobile adult games related to video and AR are certainly not untouched: 2002's ARQuake was capable of transporting players into a first-person AR game situation[5], but used Garmin GPS for geolocation where Glass simply use its built in location components. In terms of AR totems and video-based information granting, many games demonstrate that it is possible to create a pleasing experience by having players interact with a prop in their physical surroundings, allowing a camera to orient imagery around the surroundings[1].

Of course, Glass is not a true AR platform. Due to its size and location, Glass's "glanceable" video screen is more appropriate for accessing information while generally remaining focused on the physical world. Given that it has been used in emergency medicine training for EMTs and doctors in residency, with no reports of occlusion of either virtually displayed or real world detail, we imagine that it can serve a useful function in mobile gaming, where agility and awareness of surroundings are critical[7].

As for popularity among the target audience, recently members of an MIT Media Lab hackathon demonstrated that by combining the Pebble smart watch, Myo wrist band—which controls electronics with gestures—and Glass, they could create an active multiplayer version of Pokémon in the context of adult games[4]. The popularity of their resultant game indicates that there is an eager college-plus audience for Glass games.

Ideation

We inventoried Glass technology, searching for the components that would be most readily incorporated into a game and exciting to a user. These consisted of Glass's accelerometer, gyroscope, magnetometer, and GPS—all useful for tracking player movement—its front-of-eye display, and its ability to record video and photographs with a voice command. Aware of Glass's short battery life, we resolved to make game play short: winnable in 5-10 minutes. We also wanted to encourage a narrative that logically incorporated likely "seams" in function—blips such as video freezing[2].

Needfinding

We then identified a group of target users—attendees of a Stanford game design class—and game them a brief survey examining their excitement about the components we identified in our earlier inventory. As anticipated, we found that the features perceived as unique or valuable to Glass—AR, video display, communication with other Glass—were also rated as more exciting than features such as posting and photographing that could be accomplished with another device. Figure 1 displays the results of this survey.

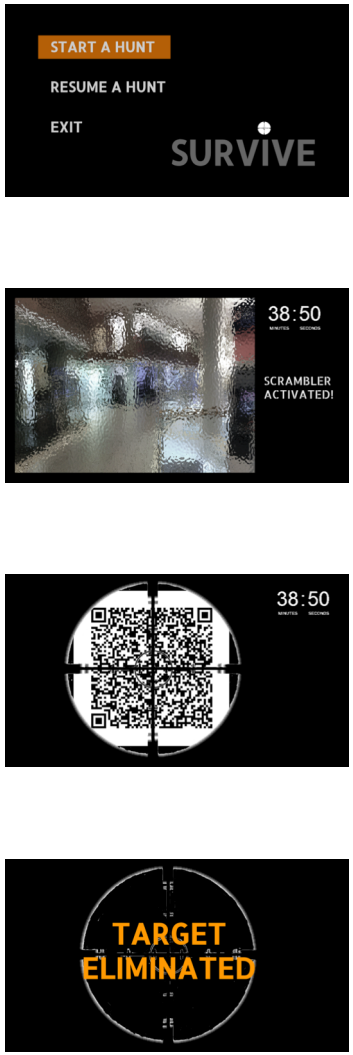

Figure 2. Survive! UI templates: Prototype 1.

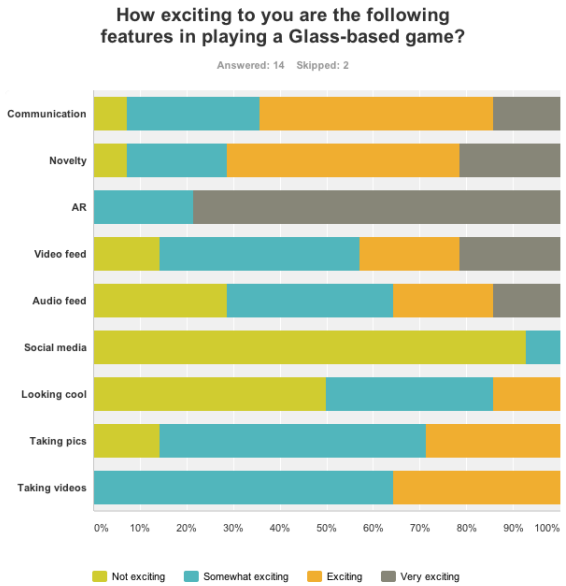

Figure 1. Game design survey.

Conceptual Prototype

Centering on video feed as the best combination of alluring technology component and design feasibility, we created a conceptual prototype of a game titled Survive!, in which one player chases another using the other's video feed.

For video sharing we considered using AddLive but were stymied when we discovered that they had been recently acquired; likewise for Google Hangouts API, which was made unavailable. We thus turned to OpenTok for video feed sharing. This proved to be sufficient.

Capitalizing on players' mental models of dramatic chases, we pursued an aesthetic that would remind them of "Alien" or "Predator." Figure 2 displays a sample of the UI templates from this prototype.

Functional Prototype

Our next step was creating a functional prototype. With quick testing we found that we had overestimated the video screen real estate and needed to reduce our on-screen text in order to incorporate the real visual focus.

The final version of the functional prototype incorporates audio effects (ticking) and uses a "tap to capture" function that allows the player to simply tap the swipe bar in order to register that he has captured his opponent.

Use Testing

We used informal interviews and participants observations for use testing. We gave a group of target users the final prototype and had them test it at realistic speed in a feasible office space setting.

The design was clearly functional, but we observed conceptual design flaws:

- Players can choose to stay put, making the game more like hide and seek than chase.
- Players can leave the game play boundaries.
- Tap-to-capture lets players register a capture at any point, though they weren't likely to do so.

In Future Work we discuss our plans for future prototypes given these observations.

Design Challenges

Indeed, the greatest challenge was creating a reliable method of capture that did not require Player 1 to physically restrain Player 2. We began with a method in which Player 2 generated a quick response (QR) code on his phone and kept the phone displayed in a badge holder during play. Finding this too cumbersome, we moved to Bluetooth recognition; when Player 1's Glass recognized Player 2's Glass via Bluetooth, a "capture" would be automatically recognized. As Bluetooth's range was roughly 30 feet, however, this made capture easy even when players were not in the same location. Settling on a tap-to-capture mechanic, we hope to move to a Wifi recognition method in future prototypes.

We also encountered system limitations when testing our final prototype. Continuous video streaming causes the Glass headset to overheat within about five minutes of game play. Similarly, battery charge depletes in roughly twenty minutes. Neither problem prohibits users from playing one full game, but both limit consecutive use.

Discussion

Our movement through prototypes and testing clarified that successful Glass game design requires working around both conceptual and technical limits. We're forced to stick with short play and to encourage speed within a small range.

Future Work

While Glassassin is a functional prototype, it does not yet offer a seamless game experience. Our future designs would include the following improvements.

First, we would continue to improve the capture mechanic by switching from a "tap-to-capture" option to a Wifi one. This would both reduce the likelihood of cheating or accidentally registering a capture, and reduce the distance at which players can record a capture. We expect player engagement to increase as the win state becomes more difficult, but still feasible, to achieve.

Additionally, we would impose a standard game play boundary and encourage player movement using location tracking; players would need to stay within the bounded game space but also need register consistent movement in order to remain in the game. This location mechanic would urge players to move within an appropriate range rather than abscond or simply hide.

An added component to game play would be power ups, which would be location-based and would allow players to collect more play options with game time. We expect this feature to motivate initial play and to improve players' likelihood of returning to the game.

Finally, we can imagine more expansive team play as Glass's battery life extends. Longer game play will also be increasingly accepted as individual users adapt to wearing Glass.

Conclusions

Our Glassassin prototype demonstrates the possibilities of even a few components working together to create a pleasing game experience. Choosing video as the central mechanic compels potential users and focuses the game design. And in adhering to short game play, we skirt the issue of minute battery capacity and overheating without

having to ditch the very mechanic—continuous front-of-eye video display—which users found exciting.

It is clear that Glass offers a platform for adult game play that was heretofore infeasible. We look forward to seeing what innovations will result from Glass play.

References

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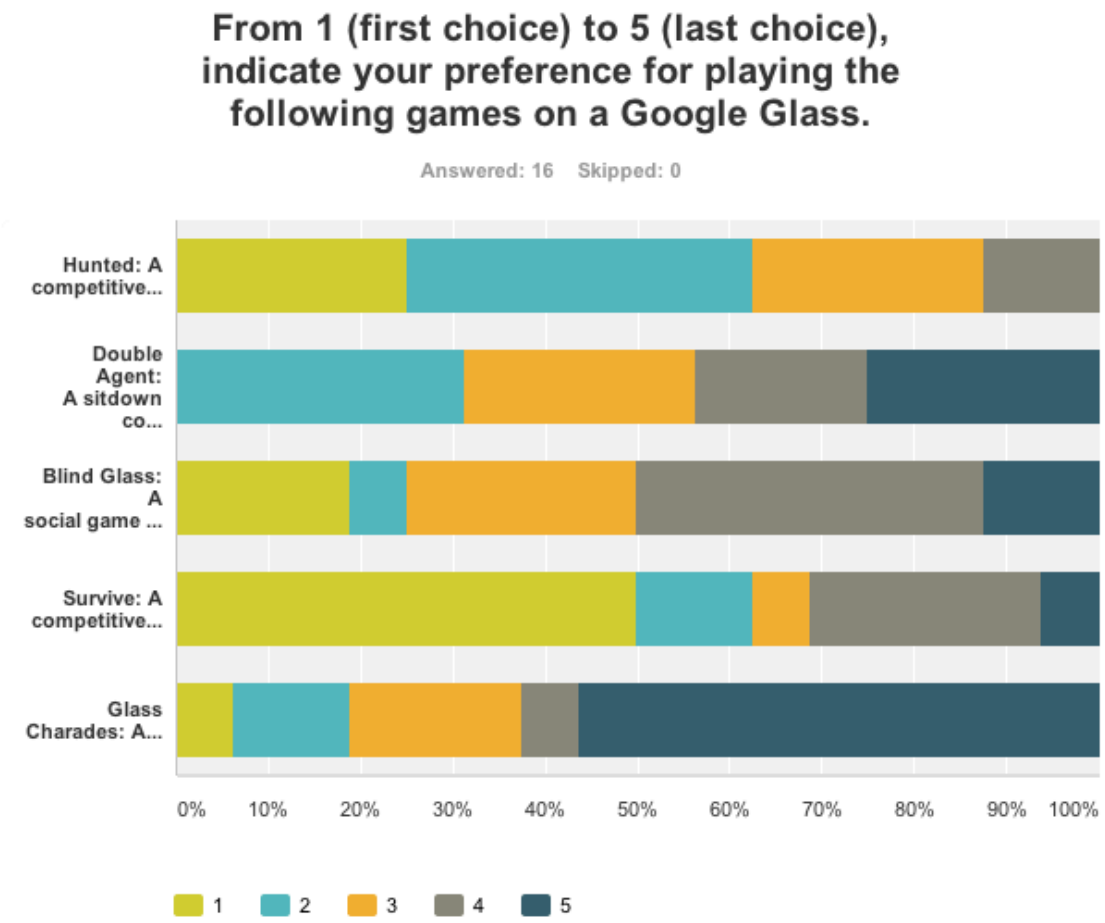
Appendix - Full results of needfinding survey



	1	2	3	4	5	Total	Average Ranking
Hunted: A competitive multiplayer game between a player using Glass and multiple participants using their cell phones to hunt him down.	**25.00%** 4	**37.50%** 6	**25.00%** 4	**12.50%** 2	**0.00%** 0	16	3.75
Double Agent: A sitdown code passing social game with one Glass player and multiple players on their phones.	**0.00%** 0	**31.25%** 5	**25.00%** 4	**18.75%** 3	**25.00%** 4	16	2.63
Blind Glass: A social game in which a Glass player's movements remotely control a character in a classic top-down arcade game (for instance PacMan), but the player can't directly see the game, and is instead	**18.75%** 3	**6.25%** 1	**25.00%** 4	**37.50%** 6	**12.50%** 2	16	2.81
Survive: A competitive chase game for two Glass players who use each other's live video feeds to track each other down.	**50.00%** 8	**12.50%** 2	**6.25%** 1	**25.00%** 4	**6.25%** 1	16	3.75
Glass Charades: A unique version of Charades tuned around the POV perspective of a Glass user.	**6.25%** 1	**12.50%** 2	**18.75%** 3	**6.25%** 1	**56.25%** 9	16	2.06

Considering the game you ranked as your first choice, please explain why you'd prefer to play it over the other choices.

Answered: 16 Skipped: 0

Responses (16) | Text Analysis | My Categories

Categorize as... | Filter by Category | Search responses

Showing 16 responses

kdahfkljf
5/2/2014 2:26 PM View respondent's answers

Chasing is fun. And Survive sounds like it could just be done through a regular video feed anyway (and would be played to figure out where someone is in a mall or something).
5/1/2014 2:14 PM View respondent's answers

I'm intrigued by the idea of trying to interpret other people's first-person views to find them... That said, as a Glass user myself, I'm concerned that the constant video streaming might lead to overheating very quickly. The other ones could be very good, but they're too vague to tell (like Double Agent's current description)
5/1/2014 2:12 PM View respondent's answers

I think it's more unique experience
5/1/2014 2:12 PM View respondent's answers

I really like geography games like geoguessr and map click game, where I have to figure out location from video and photo. I would be caught between trying to find them and them knowing where I am. It also reminds me of the fun of watching multiple people play a pvp video game.
5/1/2014 2:12 PM View respondent's answers

2 reasons: it sounds like the most fun, and it's the one my friends would want to play (ie. easy/fun to recruit people)
5/1/2014 2:11 PM View respondent's answers

no phones involved integrates the tech best sounds dope reminds me of "screen cheating" when playing multiplayer COD with friends - looking at their view to figure out where they are and track them from behind
5/1/2014 2:10 PM View respondent's answers

I think it'd be cool to have the two different technologies pitted against one another.
5/1/2014 2:09 PM View respondent's answers

Both players have the same advantage
5/1/2014 2:09 PM View respondent's answers

-
5/1/2014 2:09 PM View respondent's answers

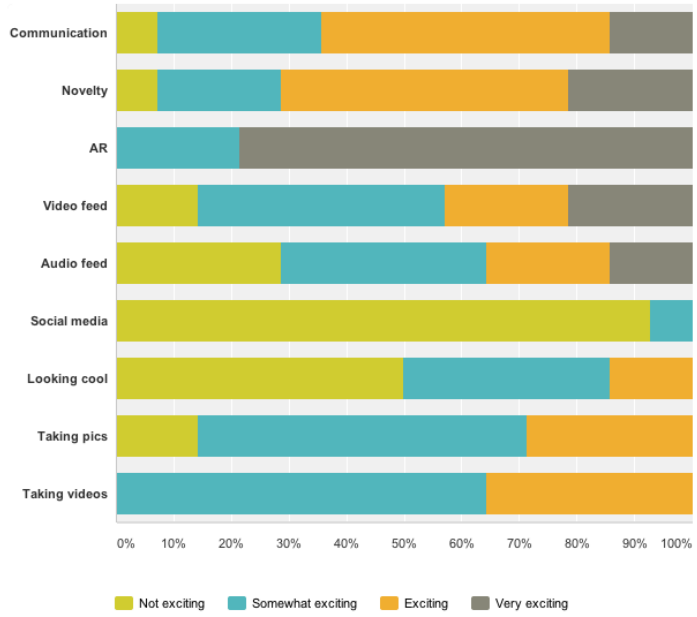
It seems to take more advantage over the interesting environment that the Glass would offer
5/1/2014 2:09 PM View respondent's answers

IT's more or less immersive VR

-	5/1/2014 2:09 PM View respondent's answers
It seems to take more advantage over the interesting environment that the Glass would of	5/1/2014 2:09 PM View respondent's answers
IT's more or less immersive VR	5/1/2014 2:09 PM View respondent's answers
I honestly wasn't really excited about any of them.	5/1/2014 2:09 PM View respondent's answers
Assymmetric play is fun, could think of fun Alien style motion tracker mechanics, tension,	5/1/2014 2:08 PM View respondent's answers
It seems like more fun for everyone involved.	5/1/2014 2:07 PM View respondent's answers
It seems like it could be an interesting spin on the game.	5/1/2014 2:07 PM View respondent's answers

How exciting to you are the following features in playing a Glass-based game?

Answered: 14 Skipped: 2



Anything else you'd like to suggest for a Glass-based multiplayer game?

Answered: 3 Skipped: 13

Responses (3) | Text Analysis | My Categories

Categorize as... | Filter by Category | Search responses

Showing 3 responses

Game mechanics that couldn't otherwise be done with any cell phone video feeds or anything of the sort. Basically, platform-specific to Glass.
5/1/2014 2:15 PM View respondent's answers

If battery/cooling becomes an issue, making an asynchronous game could be interesting!
5/1/2014 2:14 PM View respondent's answers

keep in mind people get self-conscious really easily.
5/1/2014 2:09 PM View respondent's answers