

# User-Defined Game Control with Smart Glasses in Public Space

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## ABSTRACT

Without specific game controller and direct-touch, game control on Smart Glasses differs with existing console and mobile games. Although current game control set on Smart Glasses is explored by developers based on system limitation, the set is not reflective of user behavior. To create better game control, we presented an user-defined game control study in public space to collect user behavior. In all, 2448 game controls from 24 participants were logged, analyzed, and paired with think-aloud data for 17 commands performed with 3 interaction methods (On-Body, In-Air and Phone) and 2 glasses forms (Google Glass and Epson BT-100). Our findings indicate that users choose area relatively unobtrusive to perform the game control, and glasses form does influence how users creates game control. We also present a complete user-defined game control set with agreement scores and taxonomy. Our results will help designers create better game control sets informed by user behavior.

## Author Keywords

Guides; instructions; author's kit; conference publications; keywords should be separated by a semi-colon.

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## INTRODUCTION

### RELATED WORK

#### Game Control

#### Glass Input

#### Gaming in Public Space

#### User-Defined Gesture

### DEVELOPING A USER-DEFINED GAME CONTROL SET

#### Overview and Rationale

#### Game Task Set

Casual game is one of the game categories with most players[3], it is shown high potential in public gaming[5, 6, 2]. We choose top 90 casual games[8] from existing platforms, including PC, console and mobile games (30 games for each) by crawling and analyzing the sale and download count data from famous gaming websites[1, 9, 7, 4]. We invited 3 experienced game developer to review these top 90 casual games. They find out totally 26 game tasks, and removed 9 tasks which only be used once in specific games. At last, we get a general casual game task set with 17 tasks, which can completely support 90% of our top casual games. We describe our general casual game task set in Table 1.

#### Participants

We recruited twenty-four participants from the general public for our study. Twelve were female. Average age was 23.2 ( $sd = 2.72$ ). All participants are right-handed and none of them had used a Smart Glasses. About their gaming experience, according to our investigation, most participants play games at least one time per week (see Figure 1). It takes 1.36 hours ( $sd = 0.89$ ) for participants to play games a time. Moreover, 58% of them indicated that their main gaming platforms were on mobile phones, 38% were on PCs, and only 4% were on consoles. Another important factor of gaming experience is the familiarity of game controllers. The result showed that, compared with joysticks, most of them were more familiar with keyboards, mice and touch screens (see Figure 2).

#	Description	Used in Famous Game
1	Single select	Clash of Clans, Plague Inc.
2	Vertical menu	Puzzle&Dragon, PeggleHD
3	Horizontal menu	Clash of Clans, PeggleHD
4	Move left and right	Temple Run, Super Mario
5	Move in 4 directions	1943, RaidenX
6	Switch 2 objects	Candy Crush, Bejeweled
7	Move object to position	World of Goo, The Sim
8	Draw a path	Draw Something, P&D
9	Throw an object (in-2D)	Angry Birds, PeggleHD
10	Note highway	RockSmith, Deemo
11	Rotate an object (Z-axis)	Zuma, PeggleHD
12	Rotate an object (Y-axis)	Spore, The Sim
13	Avatar jump	Temple Run, Super Mario
14	Avatar 3D move	Spore, Tintin
15	Avatar attack	Minecraft, Terraria
16	Avatar squat	Temple Run, Minecraft
17	3D Viewport control	The Sim, Spore

Table 1. Summary of our general casual game task set. We named several famous games which uses these tasks.

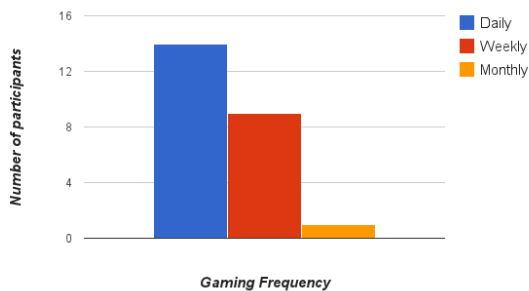


Figure 1. With Caption Below, be sure to have a good resolution image (see item D within the preparation instructions).

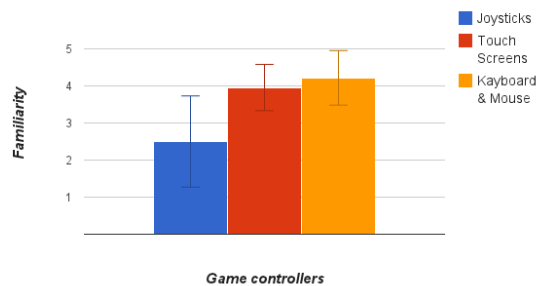


Figure 2. With Caption Below, be sure to have a good resolution image (see item D within the preparation instructions).

## Glass Forms

## Interaction Methods

## Procedure

## RESULTS

Our results include game control taxonomies, the user-defined gesture sets, user rating, subjective responses, and qualitative observations for each interaction methods.

## Preference Between Interaction Methods

## Behavior with Different Glasses Forms

## Classification of Game Controls

## User-Defined Game Control Sets

### Agreement

### Conflict and Coverage

### Properties of the User-defined Gesture Sets

### Taxonomic Breakdown of User-defined Game Controls

## Mental Model Observations

### Social Acceptance and Control Area

### Metaphor from Existing Game Control

## DISCUSSION

### Users' and Designers' Gestures

### Implications for In-Air Gesture Technology

### Implications for On-Body Input Technology

### Implications for User Interfaces

### Limitation and Next Steps

## CONCLUSION

## ACKNOWLEDGMENTS

## REFERENCES

1. App Annie. <http://www.appannie.com>.
2. Biskupski, A., Fender, A. R., Feuchtnner, T. M., Karsten, M., and Willaredt, J. D. Drunken ed: A balance game for public large screen displays. In *CHI '14 Extended Abstracts on Human Factors in Computing Systems*, CHI EA '14, ACM (New York, NY, USA, 2014), 289–292.
3. Essential Facts About The Computer And Video Game Industry. [http://www.theesa.com/facts/pdfs/esa\\_ef\\_2014.pdf](http://www.theesa.com/facts/pdfs/esa_ef_2014.pdf).
4. GameStop. <http://www.gamestop.com>.
5. Jurgelionis, A., Nap, H. H., Gajadhar, B. J., Bellotti, F., Wang, A. I., and Berta, R. Player experience and technical performance prospects for distributed 3d gaming in private and public settings. *Comput. Entertain.* 9, 3 (Nov. 2011), 16:1–16:19.
6. Reis, S. Expanding the magic circle in pervasive casual play. In *Proceedings of the 11th International Conference on Entertainment Computing*, ICEC'12, Springer-Verlag (Berlin, Heidelberg, 2012), 486–489.
7. Steam. <http://store.steampowered.com>.
8. Top 90 Casual Games List. <http://ppt.cc/h02j>, Analyzed at 2014-08-14.
9. VGChartz. <http://www.vgchartz.com>.