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.
Optional section to be included in your final version, but strongly encouraged.

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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, mouses 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.

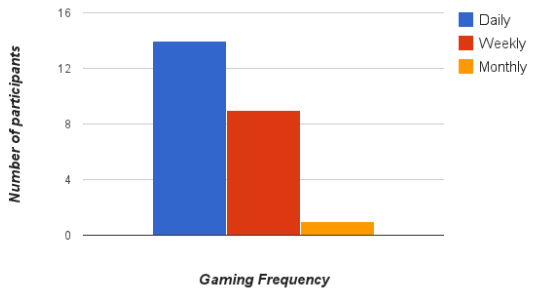

Figure 1. With Caption Below, be sure to have a good resolution image (see item D within the preparation instructions).

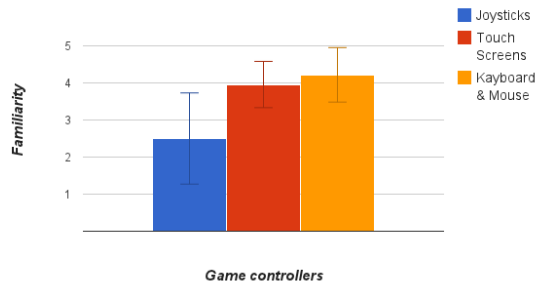

Figure 2. With Caption Below, be sure to have a good resolution image (see item D within the preparation instructions).

Glass Forms

There are many Smart Glasses with different screen sizes and screen placement on current market. To observe the effect of different display designs upon users' evaluation, our study conducted on two famous Smart Glasses, Epson and Google Glass. The display of Epson BT-100 is located in front of the user's eyes with 960×540 resolution (equivalent of a 320" screen from 20 m away). And Google Glass locates its display above the user's right eye with 640×360 resolution (equivalent of a 25" screen from 2.4 m away).

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
Taxonometric Breakdown of User-defined Game Controls

Mental Model Observations

Social Acceptance and Control Area
Metaphor from Exisiting 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

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