A study on gesture game interface

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Abstract—This study categorizes gesture games that use the players' motions as input signals for game play, unlike traditional gaming with a joystick or a keyboard, and measures the players' satisfaction level to understand the relationship between the interface of such gesture games and the gaming experience, immersion, and satisfaction level. As the interface of gesture games differs depending on the technological element that is used for reading the motions, this study ultimately aimed to understand the relationship between technology and user experience. The results showed that the motions differed depending on the types of gesture game interface, it did not influence the gaming experience in a positive way.

Keywords—gesture game, gaming experience, game interface

I. INTRODUCTION

Gesture games are based on the gamers' movements and at the same time give feedback to the gamers' senses. Therefore, the gaming experience differs depending on the interface. Such changes must be noted because the method of game play directly mediates the users' motions and movements.

According to the empirical-experience structure, experience has a two-layer structure that includes a bodily • physical layer and a psychological • abstract layer. Based on the bodily • physical-layer experience, the experience for the psychological • abstract layer is created. The structure shows that all human experience is based on the process of embodiment. As gesture games are based on bodily movements, the games can diversify the bodily • physical-layer experience compared to the existing PC/online-platform games. Each type utilizes a different technology, however, and the interface differs depending on such utilization, which can influence the users' game play. In an earlier research a game's interface is an important factor inciting the players' immersion and therefore call for the players' reaction [2]. As the interactivity can be limited based on the game technology's innate characteristics, the level of satisfaction with the user interaction and gaming experience can be different [3].

Based on the foregoing facts, a gesture game's interface can differ depending on the technology utilized, and the influence of the interface difference on the game play can be looked into.

II. LITERATURE REVIEW

A. Interface Analysis of Gesture Games

Although the interface is generally simply understood as including a method of operation, such as a menu, it is necessary to use a device or media. The interface is defined, however, as "a device, keyboard, or display that connects a computer and its human user" [7].

In a broad sense, the interface can be defined as a device that can enable the users to communicate and use a computer or a program, similar to other devices, such as joysticks, dials, OS commands, or graphic expression formats. A GUI (graphical user experience) that provides a visual communication method is generally understood as an environmental engineering structure, emphasizing a higher satisfaction level and user convenience.

Thus, an interface is a device that enables two devices to communicate in an effective way by providing an appropriate physical connection, and as technology is developing, various looks and functions of interfaces are currently being used.

The interface for gesture games is a device that enables gamers to control the game, most generally a gaming pad that includes a joystick and buttons. Remote control devices with cameras and motion sensors are also currently being used. The gesture game interface is a device that uses gamers' motion information in game play, and that reflects various technological aspects in measuring such movements of players.

The gesture game interface can be categorized into three types depending on its purpose and function: the tracking function, control function, and comprehensive function.

<table>
<thead>
<tr>
<th>TABLE 1. Input interface types [8]</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of dimensions</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>Prope rty se</td>
</tr>
</tbody>
</table>

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### III. Research Hypothesis and Method

The experience of bodily movement depending on the interface of the gesture game can decide the range of motions or precision of the users, and the satisfaction level can differ through such difference. This study aimed to help in understanding the influence of interface difference on the satisfaction level.

#### A. Research Model and Hypotheses

The user motions according to the gesture game interface can be categorized based on the range, frequency, precision, and success rate, and the game satisfaction level can differ depending on the game control experience and immersion. Below are this study's hypotheses.

- **Hypothesis 1**: The bigger the motions are, the higher the game control experience and immersion will be.
- **Hypothesis 2**: The more frequent the motions are, the higher the game control experience and immersion will be.
- **Hypothesis 3**: The bigger and more frequent the motions are, the higher the game control experience and immersion will be.

![Model for user motions and game satisfaction level depending on the gesture game interface.](image)

**Fig. 1.** Model for user motions and game satisfaction level depending on the gesture game interface.

#### B. Research Method

To prevent unique motions depending on the characteristics of different contents, this study limited the motions for the same content, “table tennis.” The movements for basic motions were categorized based on the units of bodily movements. The up-down, left-right, and diagonal motions were combined with the wrist-moving snap and shoulder-moving swing motions, setting six movements for analysis.

### B. Relationship between Bodily Movements and Gaming Experience

Cognitive science holds that the brain stores information about the environment through a psychological representation, and that the brain controls action, emphasizing a more situational and detailed cognitive approach. The following are the two methods for a gamer to have an ego identity. First, the gamers themselves think about their actions merely as the brain controls action, emphasizing the brain and bodily movements, explaining that the brain defines the bodily movements first, and that actions merely follow the signal.

With regard to human-computer interaction, researches are conducted focusing on the interaction with games, and the main focus of discussion is the user experience using a gaming device or contents, unlike in cognitive science, which focuses on the brain-body relationship. Numerous researches have already been conducted about the gaming experience of existing games, but the research on gesture games is only at the beginning stage. Especially on the matter of the level of satisfaction with games, researches have been mainly about gaming motivation and game utilization.

Such research can have two broad types: how the controller's symbolic meaning influences the gaming experience for gesture games, and whether the range of motions or precision influences the gaming experience.

For the controller's symbolic meaning, researches have been conducted on how experience-based controllers change gamers' gaming experience, as input devices normally represented as remote control devices are being developed as drum-, automobile-handle-, guitar-, or gun-like objects. For the researches on how the range of motions or precision influences the gaming experience, the gaming motivation and satisfaction level can be studied with regard to such purpose, based on the gamers' movement experience when playing.

**Table 1.**

<table>
<thead>
<tr>
<th>Device</th>
<th>r</th>
<th>stylus</th>
<th>orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motion</td>
<td>Treadmill</td>
<td>Mouse</td>
<td>Trackball</td>
</tr>
<tr>
<td>Pressure</td>
<td>Torque sensor</td>
<td>Isotonic joystick</td>
<td>Spaceball &amp; spacemouse</td>
</tr>
</tbody>
</table>

To prevent unique motions depending on the characteristics of different contents, this study limited the motions for the same content, “table tennis.” The movements for basic motions were categorized based on the units of bodily movements. The up-down, left-right, and diagonal motions were combined with the wrist-moving snap and shoulder-moving swing motions, setting six movements for analysis.
KAIST students in the 20s-30s voluntarily participated in the experiment, and the test subjects were assigned to four categories of gesture game platforms as distinguished by the technological aspect of the game interface. There was no major difference among the test subjects, including in their game preference and past experience of playing gesture games.

Table tennis games were played in each group's platform, and each test subject's game play was recorded for analysis. A survey was conducted about the gaming experience after the completion of the game play.

IV. RESULTS

A. Relationship between Range of Motions and Game Control Experience

The range size was not very different in a statistically meaningful way for the four categories of gesture game platforms. With regard to the motion range per unit area, however, the game platforms that enable motion input without controllers showed the biggest range of motions. The game control experience and immersion difference depending on the motion range size was statistically not meaningful. Hypothesis 1 was not proven to be true.

<table>
<thead>
<tr>
<th>Motion</th>
<th>Game platform</th>
<th>Average frequency (motion/minute(s))</th>
<th>df</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up-down swing</td>
<td>Wii</td>
<td>5.45</td>
<td>3</td>
<td>12.8</td>
<td>.000*</td>
</tr>
<tr>
<td></td>
<td>Wii Motion Plus</td>
<td>4.80</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PlayStation Move</td>
<td>14.51</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Microsoft Kinect</td>
<td>1.13</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. Relationship between Frequency of Motion and Game Control Experience

The frequency difference was statistically meaningful in up-down swing, left-right swing, and diagonal snap depending on the game platform, but there was no meaningful difference for the game control experience and immersion according to such frequency. Therefore, hypothesis 2 was also not proven to be true.
The game motion range and frequency differed depending on the interface difference, but the game control experience and immersion were not different depending on such range and frequency difference. This means that the motion difference according to the game interface does not influence the game control experience or immersion.

### C. Relationship between Motion Range/Frequency and Game Satisfaction Level

With regard to the difference in the game satisfaction level depending on the motion range and frequency, the game satisfaction level was low when the motion range was bigger and when the frequency was higher. The game satisfaction level was the highest for the groups where the motion range was bigger while the frequency was lower, and when the range was smaller while the frequency was higher (F=3.462, P<.05). Therefore, hypothesis 3 was also not proven to be true.

Although this research expected to find that the difference in gesture games’ interfaces will cause a difference in the users’ game motions and through such difference will cause a difference in immersion for game play, gaming experience, and the game satisfaction level, the results showed that there is no meaningful difference depending on the motions. Thus, the difference in motions does not influence the game satisfaction level because the players are already interested in their unusual body movement when playing gesture games.

This research found, however, that the motion range and frequency was influenced by the controllers (i.e., whether the players are required to use one or not). Playing such gesture games without a controller enabled the users to move more freely, and they used more specific motions.

It is suggested that the experiment that was performed in this study be done again but on a larger scale, and that an experiment design be developed for limiting the motions within the same game platform, so that a deeper research regarding the motion-user experience relationship can be conducted.

### References

[6] Naver korean dictionary