Hold My Hand: Impact of Intimate Controllers on Player Experience

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***Abstract*— Intimate controllers are defined as devices that require players to breach their comfort zone and interpersonal boundaries to establish a physical contact between players. We developed a game that requires players to hold each other's hands to perform a special action. The main purpose was to investigate the impact that this alternative controller has on player experience. Two version of the game were created: with and without intimate controllers. We had two groups playing with each version and then fill a survey to evaluate player experience. Player experience was assessed using the Game Experience Questionnaire (Core Module, Social Presence Module and Post-game Module) but given some serious concerns regarding this model, we analyzed the data bypassing the factors and instead focusing on individual answers. The data shows that intimate controllers can lead to a much more engaging experience and feelings of closeness to other players, while eliciting stronger emotions, both positive and negative. There are also unexpected results in terms of increased engagement with the narrative aspect of the game while also reporting a decreased feeling of mastery and skills and increased weariness.**

Keywords—Body Interaction, Player Experience, Play Testing, Social Play, User Experience, Engagement

I. Introduction

This article describes the impact on engagement of a game designed around research on body-play [Marquez 2010, Muller 2017, Muller 2020, Muller 2003], social play [Isbister 2004, Ibister 2016, Dourish 2001] and proxemic play [Muller 2014, Schiphorst 2007]. We developed two versions of the game, one leverages intimate controllers while the other utilizes standard controllers, but both are designed for social play. Intimate game controllers are here defined as devices that require players to breach their comfort zone and interpersonal boundaries to establish a physical contact between players. In order to show the impact that intimate controllers have on engagement, the player experience was evaluated with the Game Experience Questionnaire [Ijsselsteijn 2007 and 2013].

II. Background

Body and movement interactions

The intersection between digital interactive technology for entertainment and the human body has fascinated both game researchers and the game development industry. There have been countless frameworks proposed by the HCI community to design around body interaction and movement [Larsson 2004, Isbister 2014, Locke 2013, Muller 2020, Muller 2003]. At the same time the entertainment industry has produced countless games and hardware peripherals, for example arcade games such as Dance Dance Revolution, or PS Move, Wii fit, Wii-motes, Kinect, etc.

Social Play

Researchers also have pointed out the fact that body play lends itself to social play [Juul 2009; Isbiter 2004, Lindley et al. 2008; Mueller et al. 2003; Stromberg et al. 2002; Wakkary et al. 2008]. According to Isbister [2010], social play is defined as the active engagement with a game by more than one person. Understanding social play is important. In contrast to solo play, social play is shown to provide more positive experiences, less tension, and greater competence [Gajadhar et al. 2008] as well as less frustration [Mandryk et al. 2006]. [DeKort 2008] argued that there is an intrinsic relation between body play and social play potentially leading to unexplored benefits due to the involvement of the body. [Ducheneaut et al. 2006] expanded existing knowledge of social play illustrating how competitive social play can lead players to play "alone together".

Proxemics

Proxemics is the field of study that identifies the culturally dependent ways in which people use interpersonal distance to understand and mediate their interactions with other people [Hall, E.T. 1969]. Researchers have shown how proxemics thinking could also be a useful resource when designing digital games and novel play experiences [Muller 2014]. The most prominent, and probably most utilized aspect of proxemics in HCI is the concept of the four proxemics zones [Greenberg, 2011]. The four proxemics zones describe how people interpret their interpersonal distance, the interpersonal distance can be categorized as follows: the intimate zone (where interpersonal distance is roughly less than 0.5m), the personal zone (with interpersonal distance between 0.5m-1.2m), the social zone (1.2-3.6m) and the public zone (3.6-7.6m). We derived the definition of intimate controllers from the first proxemic zone. One of the main tenets of proxemics is that the expectations of interpersonal engagement and intimacy increase as distances between people become shorter.

III. Designing the game "Mutualism"

Body Play

According to the guidelines identified from the literature on body play, we decided to create a game using alternative controllers afforded by Makey Makey, a device that allows to turn any conductive object into a controller, even the players themselves. The main purpose of adopting the Makey Makey device was the fact that it allows to recognize when players are touching each other. We experimented with different materials and form factors, finally settling on silver as the material that provided the most accurate reading and comfort.

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Proxemics

In order to create interactions based on the intimate zone defined by proxemics, we created two silver rings connected to the Makey Makey device: when the two payers touch each other's skin, the circuit is closed and a button is considered pressed (see figure 1a and 1b). Give the fact that rings can be worn both on the right and left hand without impacting motility and dexterity, we were not forced to partner right-handed and a left-handed players together for maximum play-ability.

Social play

Player experience research states that adding players to a game session creates a fundamentally different game experience [Isbister 2010]; hence, simply adding additional players is not sufficient to make the game social. Therefore, based on the literature on social play, we wanted the game to be a local coop game with no opposing player teams but mechanics that pressure players to cooperate in order to win.

Fig. 1. Figure 1a shows Makey Makey alligator clip attached to a user's skin, very effective at conducing electricity but not too comfortable. Figure 1b shows the silver rings used to maximize conductivity and offer a comfortable experience.

Theme

Once the silver rings prototypes proved successful, we looked at a theme and a metaphor for the game that would elicit cooperation while also providing a frame for the rings to be a diegetic controller. Hence the idea of using wedding as a theme for the game, where the two players are partners in a marriage, defending the wedding cake from unspecified threats. It takes place in a world, where all characters are colorful blobs. The theme of love and togetherness is an attempt to affect the players' attitude towards each other, to strengthen their teamwork.

Fig. 2 The final game

Core mechanics

The game is a cooperative tower defense where players must cooperate to fend off hordes of monsters from a wedding cake. The two individual players are fast but not too powerful, but they can merge into a single entity that is more powerful and better equipped for defeating heavier enemies even though a bit slower than the two separate entities. When merged, the player on the left controls the direction of movement with the left hand, while the player on the right controls the attacks with the right hand as seen in figure 3, this prevented us from necessitating to partner right-handed and a left-handed players. The players must work together to defeat a number of waves of enemies, which are coming to eat the wedding cake. The players win if they defeat all waves of enemies and the cake is not completely eaten. They have three chances; one for each cake layer. Enemies take away one chance when they reach and bite the cake. Enemies exist in two types: Small, fast and low health; and big, slow and high health. When combined, you move slower but have a more powerful attack, and therefore, players must communicate to figure out if they should be combined or separate against the enemies ahead. When merged, one of the players controls the direction while the other controls the attacks.

Intimate controller and conventional controller variants

As mentioned earlier, the game was developed in two variants a) conventional controller version: for the two players to merge, it is necessary for the players to be within a certain range and for at least one of them to press a button on the controller; b) intimate controller version: for the players to merge it is necessary for them to be in range and to hold hands (while wearing rings connected to Makey Makey. Everything else in the two versions is exactly the same retaining the same cooperative mode, theme, aesthetics and affordances.

IV. Assessing Impact of Intimate Controllers

Method

In order to assess the impact of intimate controllers on player experience we recruited 48 participants (27 male, 21 female, aged from 18 to 39). All participants are university students and were orally informed about the overall purpose of the project, the product of the project (scientific paper) and possible risks and possible advantages of participation, the possibility to withdraw from the study at any time and the fact that all data collected was completely anonymous. We adopted a between-subjects procedure, where 24 subjects played the conventional game version and 24 played the intimate controller version. All subjects played with a partner (see figure 3). After the play session, they all took the GEQ questionnaire, namely the Core Module, the Social Presence Module and the Post-game Module [IJsselsteijn, de Kort, & Poels, 2013]. All three modules are meant to be administered immediately after the game-session has finished, in the order given above. The core module assesses game experience on seven components: Immersion, Flow, Competence, Positive and Negative Affect, Tension, and Challenge. The social presence module, investigates psychological and behavioural involvement of the player with other social entities, on three components: Empathy, Negative Feelings and Behavioural Involvement. The post-game module, assesses how players felt after they had stopped playing on four components: Positive Experience, Negative Experience, Tiredness, Returning To Reality. The total number of constructs are 14.

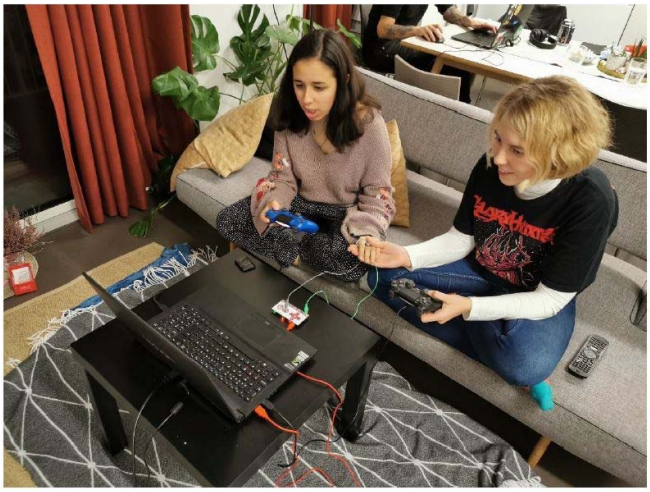

Fig. 3 The experimental setup

There are serious concerns for using an instrument such as GEQ, as it was very well articulated by [Effie et al. 2018]. First of all, it lacks a formal peer-reviewed publication, instantiating several undocumented versions of the instrument. Secondly, upon further attempts to validate the model, the 7 factors of the core module fail to explain the variance of a new dataset of 633 users collected by the authors. Nevertheless, we chose to use that instrument because we are not trying to explain or model the player experience but simply, we are interested in looking at the differences in the answers provided by the two groups that played the two versions of the game. The focus on the deltas of individual items and not on the factors themselves means that using a freely accessible instrument such as GEQ is acceptable as long as we do not make claims based on the values of the factors and the constructs.

Results

The average play session was 9 minutes and 40 seconds long for players with intimate controllers and 9 minutes and 14 seconds long for players with traditional controllers. Both the group playing with intimate controllers and traditional controller utilized the merge mechanics to the same degree, around 1/3 of the time. Fourteen (14) sets of paired-samples t-tests (2-tailed, $p < .05$) [Welch, B. L. (1947)] were conducted to compare GEQ Measure means (Pair1-14) in using conventional controllers (condition 1) or intimate controllers (condition 2). Cohen's d [Cohen, J. (1988)] for the two samples of using conventional controllers (sample 1) and intimate controllers (sample 2) were also calculated for determining the effect size of the mean differences. Significant mean differences were prevalent when comparing GEQ measures between the two conditions, as visible in Table 1.

COMPETENCE; $t(23) = 1.58$, $p = .128$, $r = -.008$, although passing the conditions for significance in the t-test, mean differences ($\Delta M_{alt\text{-}conv} = -.325$) only yielded medium effect size and low correlation coefficients, hinting that inferring causality by testing conditions could not be adequately supported by the statistical evidence. Cohen's d for Competence sample means was also $d = .36$ (small to medium effect size).
IMMERSION showed the most significant difference (Cohen's $d = 1.98$) between using the Intimate controller ($M = 2.31$, $SD = .38$) and Conventional controller ($M = 1.6$, $SD = .32$) conditions. The t-test had the p value of .000 for the degree of freedom of 23 which resulted in $t = -6.46$ and $r = -.132$.
CHALLENGE; $t(23) = -6.38$, $p = .000$, $r = .42$, had the second largest effect size (Cohen's $d = 1.48$) when comparing interaction with the Intimate controller ($M = 2.23$, $SD = .69$) and Conventional one ($M = 1.41$, $SD = .38$).
EMPATHY; $t(23) = -5.41$, $p = .000$, $r = .32$, rejected the null hypothesis of the insignificant differences between mean scores for using the intimate controller ($M = 3.15$, $SD = .51$) and the conventional controller ($M = 2.65$, $SD = .30$). Cohen's d for Empathy sample means was $d = 1.23$ which shows a large effect size.
POSITIVE AFFECT; $t(23) = -3.71$, $p = .001$, $r = -.2$, also showed a large effect size (Cohen's $d = 1.17$) when comparing means of the sample 2, using the intimate controller ($M = 3.33$, $SD = .32$), with sample 1 that used a conventional controller ($M = 2.91$, $SD = .39$).
TIREDNESS; $t(23) = -4.01$, $p = .000$, $r = .00$, had the effect size of Cohen's $d = 1.16$ (large) resulted by comparing mean scores of using the intimate controller ($M = 1.21$, $SD = 1.08$) as compared to a conventional controller ($M = .25$, $SD = .44$). Negligible Correlation coefficient of the two conditions indicates that testing conditions may have not been related to the significant change in means.
POSITIVE EXPERIENCE; $t(23) = -4.56$, $p = .000$, $r = .36$, yielded a large effect size (Cohen's $d = 1.09$) when comparing mean scores for interaction with the Intimate controller ($M = 2.65$, $SD = .7$) and a Conventional controller ($M = 2.03$, $SD = .42$).
BEHAVIOURAL INVOLVEMENT; $t(23) = -3.35$, $p = .002$, $r = -.15$, produced Cohen's d of $d = 1.03$ which is a large effect size for the significant difference between means of sample 2 (Intimate, $M = 3.25$, $SD = .67$) and sample 1 (Conventional, $M = 2.59$, $SD = .6$).

	Mean delta	Std. Deviation	Std. Error Mean	Sig. (2-tailed)	Cohen's d
Competence	0,325	0,634686	0,129555	0,020	0,73
Immersion	-0,70139	0,531562	0,108505	0,000	1,98
Flow	-0,45833	0,72826	0,148655	0,005	0,77
Tension	0,013889	0,789295	0,161114	0,932	0,03
Challenge	-0,825	0,633314	0,129275	0,000	1,48
Neg. Affect	0,229167	0,710621	0,145055	0,128	0,53
Pos. Affect	-0,41667	0,549835	0,112235	0,001	1,17
Empathy	-0,50694	0,492649	0,100562	0,000	1,23
Neg. Feelings	0,716667	0,543472	0,110936	0,000	0,36

Behav. Involvement	-0,65972	0,966191	0,197223	0,003	1,03
Pos. Experience	-0,625	0,67073	0,136912	0,000	1,09
Neg. Experience	0,108333	0,503826	0,102843	0,303	0,3
Tiredness	-0,95833	1,16951	0,238725	0,001	1,16
Return to Reality	-0,38889	0,699666	0,142819	0,012	0,85

Table 1 Mean delta between the 14 factors reported by 24 players that interacted with intimate controllers and 24 players that interacted with conventional controllers. Also includes standard deviation, standard error mean, significance and Cohen's d for the 14 pairs of constructs with intimate and conventional controllers.

In RETURNING TO REALITY; $t(23) = -2.72$, $p = .012$, $r = -.17$, the negative correlation and marginally large effect size (Cohen's $d = .85$) still produce a significant difference between the mean value of the two conditions of Intimate ($M = .67$, $SD = .52$) and Conventional ($M = .28$, $SD = .39$) controller.
Comparing mean differences for FLOW; $t(23) = -3.08$, $p = .005$, $r = .26$, in two conditions of using the intimate controller ($M = 2.47$, $SD = .66$) and a conventional one ($M = 2.01$, $SD = .53$) had a medium to large effect size (Cohen's $d = .77$).

This study, however, was not successful in rejecting the null hypothesis when comparing Tension; $t(23) = .086$, $p = .932$, $r = -.454$, Negative Affect; $t(23) = 1.58$, $p = .128$, $r = -.341$, Negative Feelings; $t(23) = -1.203$, $p = .241$, $r = -.060$, and Negative Experience; $t(23) = 1.05$, $p = .303$, $r = .053$ between the experiment conditions. We did not find enough evidence to conclude that the reported differences in population means are statistically significant. Cohen's d for these measures was $d = .03, .53, .36, .3$ respectively which are all small to medium effect sizes.

V. Discussion

As mentioned above, the GEQ instrument is flawed and it's impossible to elaborate in depth on the true difference of the player experience under the two conditions (intimate and conventional controllers). At the same time, it is very indicative the large effect size found for 8 of the 14 factors, in ascending order they are: Immersion, Challenge, Empathy, Positive affect, Tiredness, Positive experience, Behavioral Involvement, Return to reality. In this discussion we will not examine the factors of GEQ but only the items.

In order to attempt to investigate the nature of the experience in the two test conditions, we tried to bypass the flawed factors and look at the most salient individual items in the questionnaires. Saliency for the items is defined as the biggest difference (delta) between the two conditions. For the core module, the items selected are visible in table 2.

There are 33 items in the core module, the ones with the largest effect size are 16. Players interacting with intimate controller reported a much higher interest in the story and aesthetics of the experience, they also thought it was more fun, enjoyable and impressive and they felt more imaginative. They also indicated feelings of losing sense of time and place typical of flow. At the same time, they also describe increased perceived difficulty and challenge, noting a decreased feeling of success and mastery and a higher tiredness.

Items – Core module	**Mean cond. 1**	**Mean cond. 2**	**delta**
I felt content	3,416667	2,833333	-0,58333
I was interested in the story	2,666667	1,916667	-0,75
I thought it was fun	3,625	3,083333	-0,54167
I found it tiresome	0,625	1,208333	0,583333
I tough it was hard	1,791667	0,791667	-1
I was good at it	2,625	3,208333	0,583333
I felt successful	2,583333	3,208333	0,625
I felt imaginative	1,791667	1	-0,79167
I enjoyed it	3,666667	3,041667	-0,625
I felt challenged	2,708333	1,958333	-0,75
I found it impressive	2,916667	1,916667	-1
I was concentrated	3	1,791667	-1,20833
It was a rich experience	3,375	1,875	-1,5
I lost connection with the world	1,416667	0,916667	-0,5
I felt time pressure	2,375	1,333333	-1,04167
I had to put effort into it	2,5	1,416667	-1,08333

Table 2. Core Module, Condition 1: intimate controller; Condition 2: traditional controller. Only items showing large effect size are selected

Regarding the social presence module, the items with the biggest difference between the two testing conditions are shown in table 3.

Items – Social Presence module	**Mean cond. 1**	**Mean cond. 2**	**delta**
I empathized with the other player	2,958333	2,041667	-0,91667
My actions depended on the other actions	3,208333	2,416667	-0,79167
The other's actions were dependent on my actions	3,291667	2,5	-0,79167
I felt connected to the other player	3,416667	2,583333	-0,83333
The other paid attention to me	3,041667	2,291667	-0,75
I paid close attention to the other	3,25	2,666667	-0,58333
When the other was happy, I was happy	3,416667	2,875	-0,54167
I influenced the mood of the other	3	2,458333	-0,54167
What I did affected what the other did	3,291667	2,625	-0,66667

Table 3. Social Presence Module, Condition 1: intimate controller; Condition 2: traditional controller. Only items showing large effect size are selected

There are 17 items in the social presence module, the ones with the largest effect size are 9. Generally, players report a much stronger sense of empathy and connectedness with considerable amount of attention paid to each other and a feeling that each player actions had direct impact on the course of the game and on the player experience. Overall, the intimate controller amplified the positive feelings but had little impact on negative ones such as envy or schadenfreude.

Items – Post Game module	Mean cond. 1	Mean cond. 2	delta
I found it a waste of time	0,375	1,125	0,75
I felt energized	3,041667	1,958333	-1,08333
I felt satisfied	3,25	2,583333	-0,66667
I felt exhausted	1,541667	0,208333	-1,33333
I felt powerful	2,333333	1,166667	-1,16667
I felt weary	0,875	0,291667	-0,58333
I felt proud	2,416667	1,625	-0,79167
I had a sense that I returned from a journey	1,166667	0,5	-0,66667

Table 4. Post game module, Condition 1: intimate controller; Condition 2: traditional controller. Only items showing large effect size are selected.

Regarding the post game module, the items with the biggest difference between the two testing conditions are shown in table 4.

There are 17 items in the post game module, the ones with the largest effect size are 8. Players that interacted with the intimate controller feel considerably more energized, proud, satisfied and powerful, but they also report a sense of weariness and exhaustion. Additionally they seem to attribute more value to the game when connecting physically to the other player as shown by the difference in responses regarding feeling that the game was a waste of time.

We deliberately chose not to look at items that show either medium or small effect sizes on the delta between the two conditions.

Overall we can comfortably say that intimate controllers increase the feeling of connectedness between players and the game and between players themselves, they all seem to care more for the story and for the game but it also has an impact on perceived mastery and weariness after a play session.

VI. CONCLUSION AND FUTURE WORK

Based on research from body and movement interaction, proxemics and social play we designed a game intended to leverage intimate controllers. The purpose of this research was to assess the impact of intimate controllers on the player experience. In order to do so we utilized GEQ, an instrument with obvious flaws and shortcomings, but since we chose to focus on the individual items and not on the underlying factors, we are convinced that we could circumvent the limitation of the GEQ model. The results show that intimate controller have a positive impact on the enjoyment of the story and aesthetics of the game, on the feeling of flow and perceived player imagination while affecting negatively feeling of self-efficacy and mastery and they perceive the game as more difficult. Regarding the social aspects of the game, intimate controllers elicit a much stronger sense of empathy and connectedness. Intimate controllers also let players feel considerably more energized, proud, satisfied and powerful, but they also report a sense of weariness and exhaustion. Overall, the intimate controller amplified the positive feelings but had little impact on negative ones.

This research has proven that intimate controllers do indeed have a considerable impact on player experience and we also managed to shed light onto the nature of this impact.

Given that we chose a somewhat flawed instrument to assess the impact on player experience, we are planning to replicate this research with alternative instruments and a bigger sample.

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