TEI 2011 Bodies, boogies, bugs & buddies: Shall we play?

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TEI'11, Work-in-Progress Workshop
Jan 23–26, 2011, Madeira, Funchal, Portugal.

Abstract
Movement based interaction is a growing field especially within games, such as the Nintendo Wii and Kinect for Xbox 360. However, designing for movement-based interaction is a challenging task in mobile settings. Our approach is to use context design for designing such games and in this paper we present the experiences from a workshop targeting the design of social full-body dance games. The workshop explores how movement based games can be supported by social interaction and external influences (in particular music and beats) in addition to the sensing and feedback capabilities of a limited device, to create a complete and engaging experience. Although basing our design on an existing device, our focus is on the context of its use rather than its functionalities, to encourage an engaging behavior. Findings from this first workshop form the basis for a design exercise where we suggest a range of full-body interaction games.

Keywords
Body interaction, gestures, movement, body, BodyBug, workshop, experience, design process, game, dance, children.

ACM Classification Keywords
H5.m. Information interfaces and presentation: Miscellaneous.

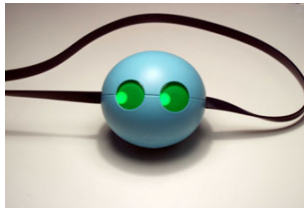

Figure 1: The BodyBug

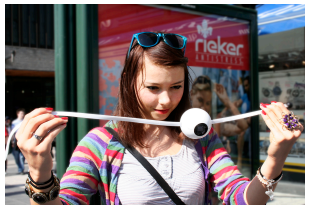

Figure 2: Playing with the BodyBug

Introduction

Current movement-based games create fun by mimicking real-world movements in the game (e.g. a hook in boxing in Motionsports [10]). Thus, much of the research effort focuses on the development of more sophisticated sensing technologies embedded in the game platform to support accurate measurements of player movements (i.e. Kinect for Xbox 360 [5], or PlayStation Move Motion Controller and Eye Camera [12]). However, it is hard, if not impossible, for a machine to sense the meaningfulness of human gestures with all its nuances, attributes, and richness. In order to create meaningful experiences, it does not suffice to rely on the technology as such. The technology is not yet, and may never become, ready to be compared to our proprioceptive and kinesthetic awareness [6].

In this paper, we challenge the premise that the fun needs to be exclusively sustained and supported by sophisticated sensing technologies. Our starting point is an existing sensing device, the BodyBug (see Figure 1), whose limited sensing capabilities encouraged us to reformulate and rephrase the problem of designing and sensing a kinaesthetic game. Instead of encouraging behavior merely through technology design and implementation, we propose an alternative approach in which we also utilize *context design*. Although the functionality of the BodyBug lies at the core of our design process, the intention is to design not only its function but also the context of its use, to encourage an engaging behavior. Our claim is that contextual support for action may cater to the richness and meaningfulness which technology fails to provide on its own.

Background

The BodyBug [4] is a small movement companion (see Figure 2) developed by Movinto Fun [11] and originally created by Moen [8, 9] as a result of interdisciplinary research merging interaction design and dance education. The current prototype is a portable and mobile sphere-shaped device running on a non-elastic leash (see Figure 1). The sphere contains a three axial accelerometer, a motor and a gearbox. The device senses the user's movements and provides feedback in terms of sound, light (by means of two eyes consisting of 6LEDs each), an OLED monochrome display, and its own movement along the leash.

The problem

As stated by Benford [2], the movements of a user in relation to a moveable, physical or mobile system can be analyzed in terms of what is i) expected (movements independent of any specific application, naturally performed by the users), ii) sensed (movements that can be measured by the system, due to available sensing technologies), and iii) desired (movements required by a given application). The BodyBug was created in order to support free and natural full-body movement interaction [8, 9]. Therefore, the desired movements ideally overlap with the expected movements, and should also be possible to sense (see Figure 3).

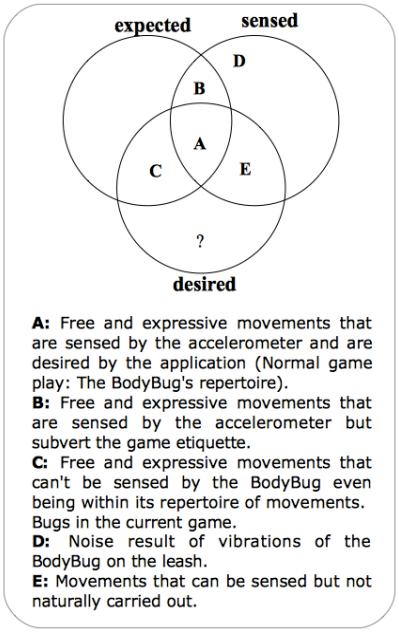

Figure 3: The expected, sensed and desired for the BodyBug

However, as with many other systems [7], such an overlap is difficult to achieve. Even if the accelerometer could sense almost every movement the user performs, it would be out of the reach of the BodyBug's computational capability to identify and classify the movements properly and provide the meaningful response and feedback the user would expect. Thus, if the performance of a design relies on the technology to perform well and the capabilities are limited as in this case, a breach in the interaction with the system can be expected with the consequent frustration on the side of the player. This effect was apparent in a previous user study with the BodyBug [16, 17].

The workshop

This paper reports on the experiences from a design workshop (see Figure 4), which is the first stage of an iterative design project targeting the design of social full-body dance games. The aim of the workshop was to create an engaging context through the design of a game activity using social interaction and the use of external stimuli in terms of music and sound. These stimuli, due to their profound and strong bound to dance, are chosen to enhance a playful context and guide the user through the game. For the workshop, we designed multiplayer games in which social interaction, rather than the BodyBug, could partially assume the control over the rules and goals of the game, alleviating the burden on the BodyBug. In an attempt to shift the focus from the device itself to the social environment surrounding the players and to the unfolding activity per se, we decided to switch the BodyBugs off. Findings from this workshop are used as a basis for the next game design stage with a certain degree of implementation, as will be further described in the last section of this paper.

Participants and structure

The project targets players in the age range of 10-12. At this age, children are old enough to grasp the rules of a game [1, 3]. Inspired by "Head Up Games" [13, 14, 15], we designed four small games, to be performed with and without the BodyBug and with and without music. During the workshop we also included some older children aged 13-14 to compare the kinesthetic awareness of the two groups and get a feeling for the right difficulty level for the game. In total, 20 children of ages 10 to 14 years participated in the workshop. Two children were boys. All participants were recruited from a dance school and hence familiar with physical expression. The most important findings were found in relation to the game "The Mirror", in which participants in pairs were asked to mirror each other's movements (one would play the role of movement 'generator' and the other one would play 'the image' and try to mimic the movement of the first one), and the game "The Bomb" in which the children were asked to pass an imaginary bomb between them until it exploded.

Findings

Video analysis and on-site observations from the workshop yielded a number of interesting findings. Here we focus on those relevant to contextual design.

Social interaction – cooperation, competition, strategy and revenge

The different ages of the participants did affect, to a large extent, how the game design influenced the activity. The attitude, kind of movements, the degree of influence from external stimuli (music, beats and contextual sound), and even the way of having fun showed to be all quite age dependent.

Figure 4: Workshop Games. From top to bottom: "The Bomb" (younger children); "The Mirror" with the BodyBug and beats (older children); "The Mirror" with music and without the BodyBug (younger children).

Older children focused more on cooperation and collaboration among the group. The music in "The Mirror" was very fast (i.e. "Bad Romance" by Lady Gaga) and difficult for 'the image' to mimic accurately. Therefore collaborative tricks were common among this group, such as 'the generator' often repeating short sequences of movements, until 'the image' managed to repeat that sequence; or 'the generator' using a slower pace when initiating a new movement, and then speeding it up once 'the image' was able to perform that movement.

Younger children, on the other hand, were less interested in their 'image' mirroring their movements accurately. Instead, they focused more on dancing in keeping with the fast music and tended to forget the BodyBug, which was often just hanging in its leash from their wrists. Sometimes, the 'image' performed similar but not identical movements to those performed by 'the generator', trying to maintain the main features and quality of the movements, but in a free way (e.g. moving the same body parts and in the same rhythm, but, where 'the generator' would shake the shoulders up and down, 'the mirror' would shake the shoulders forwards and backwards).

In the game "The Mirror", competition was introduced by the only male pair, who took turns to perform their movements with increasing difficulty, as if they were in a dance battle. In the game "The Bomb", strategy and revenge were also apparent among this group (e.g. one boy would keep the bomb until the very last moment before the explosion and then he would throw it to somebody else who, in turn, would return it back. This same situation would be repeated again and again and every single player would return the bomb to the first boy). Younger children were more engaged in this game than the older ones.

External stimuli – music, beats and contextual sound
External influence, such as music, beats (beeps that marked slots of time for turn taking) and contextual sound (beeps and a bomb explosion sound) were quite significant to help building and enhancing a rich context for the games. When "The Mirror" was performed without music but beats in the background, the movements were less fluent and more like sets of single easy steps and arms gestures. The lack of music also led to a higher focus on using the BodyBug. The beats seemed to help the children by giving them time to think about the next movement and time to memorize a sequence of movements to repeat later on.

In the game "The Bomb" the players used their BodyBugs to pass an imaginary bomb to each other around the circle in where they were placed. Using sound (a repeated beep that increased in frequency) in "The Bomb" helped to create a believable story. The stress introduced, due to the increasing frequency, seemed to ask for fast actions and reactions, causing much laughter and intensified attention from the players.

Lessons learned and next steps

Findings described above suggest that both the social interaction through the multiplayer function and the external sound and music enriched the experience and helped in creating a context for game. We will therefore include both beats and sound in the next stage of the game implementation to both guide the players through the game and help to build context around the activity. Younger children were more susceptible to engage in

competition, strategy and revenge, especially seen in the game "The Bomb".

Older children were more open to cooperation, such as when they developed tricks in "The Mirror" to cope with the fast music. The movement awareness and accuracy within the younger group was observed to be not as developed as within the older group. The youngest were, on the other hand, more enthusiastic about the games. Regarding the final game development, this greater enthusiasm and engagement in the game seen in the younger group, take priority over a higher degree of accuracy in movements seen in the older children. Therefore our target group remains children of ages 10 to 12 years, which means that we may deal with children doing different movements that they think are the same, as observed in the game "The Mirror". This lack of accuracy in performing movements adds an extra difficulty if the BodyBug is to be designed for movement recognition and classification. Therefore, this gives us another reason to discard any design that requires detailed recognition of precise movements and rather aim for building a rich context through social interaction and external stimuli.

Next stage of our project will take these findings as a basis for a design and implementation phase, in which three small full-body interaction games will be developed, some of them partially implemented, and played with an active - turned on - BodyBug. The BodyBug will be responsible for reacting to movements and guiding the players through the different stages of the game, rather than determining the outcome or the fulfillment of the game rules. Instead, we will rely on the social context of the game – the players themselves – to decide the outcome and to ensure that the game rules are adhered to. These new games will be studied in a second workshop.

One concrete design example, that we are in the process of implementing and testing, is a game which rewards fast interaction in line with the game "The Bomb". Each child will pick a movement with which to be identified as if it was her tag. Every child will perform her movement during a slot of time marked with beeps by the BodyBug. Then, the BodyBug will select randomly a leader within the group to whom the rest will immediately mimic as accurately as possible. The leader, rather than the BodyBug, will decide and point to the child who first and most accurately mimicked the leader's movement correctly and this child will introduce manually, or rather bodily by means of a gesture like shaking, the score in her BodyBug's scoreboard. In this way, the BodyBug will guide the children through the different stages of the game by means of sound and light (marking the different slots of time and choosing a leader), but it will be released from the responsibility of both judging the children's movement and making sure the rules are fulfilled; responsibilities that will lean on the players instead.

Example citations

[1] Acuff, D.S. What Kids Buy and Why. The Psychology of Marketing to Kids. The Free Press, New York, USA, 1997.

[2] Benford, S., Schnädelbach, H., Koleva, B., Anastasi, R., Greenhalgh, C., Rodden, T., Green, J., Ghali, A., Pridmore, T., Gaver, B., Boucher, A., Walker, B., Pennington, S., Schmidt, A., Gellersen, H. and Steed, A. Expected, Sensed, and Desired: A Framework for Designing Sensing-Based Interaction. ACM Transactions on Computer-Human Interaction, Vol. 12, No. 1, 2005, 3- 30.

[3] Bergen, D. and Fromberg, D.P. Play from Birth to Twelve and Beyond: Contexts, Perspectives, and Meanings. Garland Publishing, Inc., New York and London, 1998.

[4] BodyBug®. http://www.bodybug.se

[5] Kinect for Xbox 360. www.xbox.com/en-US/Xbox360/Accessories/Kinect/kinectforxbox360

[6] Lephart, S.M, and Fu, F.H, Proprioception and neuromuscular control in joint stability, Human Kinetics (2000), XVII.

[7] Loke, L., Larssen, A.T., Robertson, T. and Edwards, J. Understanding movement for interaction design: frameworks and approaches. In Per. Ubiquit. Comput. (2007)

[8] Moen, J. KinAesthetic Movement Interaction: Designing for the Pleasure of Motion. Doc. Thesis, KTH, Num. Anal. and Comput. Science, NADA, 2006.

[9] Moen, J. From Hand-Held to Body-Worn: Embodied Experiences of the Design and Use of a Wearable Movement-Based Interaction Concept. In TEI (2007), Chap. 6, 251-258.

[10] MotionSports. www.motionsportsgame.com

[11] Movinto Fun AB. http://www.movintofun.com

[12] PlayStation Move Motion Controller and Eye Camera. www.us.playstation.com/ps3/accessories/

[13] Soute, I. HUGs: Head-Up Games. In Proc. Doc. Consortium IDC 2007, ACM Press (2007), 205- 208.

[14] Soute, I. and Markopoulos, P. Head Up Games: The Games of the Future Will Look More Like the Games of the Past. In IFIP 2007. INTERACT, LNS 4663, Part III, 2007, 404-407.

[15] Soute, I., Markopoulos, P. and Magielse, R. Head Up Games: combining the best of both worlds by merging traditional and digital play. In Pers. Ubiquit. Comput. 2009.

[16] Tholander, J. and Johansson, C. Body, Boards, Clubs and Bugs: A study on bodily engaging artifacts. In CHI 2010. ACM Press (2020), 4045-4050.

[17] Tholander, J., Johansson, C. (2010). Design qualities for Whole Body Interaction – Learning from Golf, Skateboarding and BodyBugging. NordiCHI'10, October 18 - 20, Reykjavik, Iceland, ACM Press