Stirring up Experience through Movement in Game Play: Effects on Engagement and Social Behaviour

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ABSTRACT
The recent development of controllers designed around natural body movements has altered the nature of gaming and contributed towards it being marketed as a more social activity. The study reported here compares the use of Donkey Konga bongos with a standard controller to examine how affording motion through an input device affects social interaction. Levels of engagement with the game were also measured to explore whether increases in social behaviour in the 'real world' would result in reduced involvement with the 'game world'. Social interaction was significantly higher when the bongos were used, but this did not detract from engagement. Instead, engagement was also found to increase when body movement was afforded.

Author Keywords
Gaming, engagement, immersion, social behaviour, body movement, co-presence, affordance, input device.

ACM Classification Keywords
H.5.2. Information Interfaces and Presentation (e.g., HCI): User Interfaces – Input devices and strategies.

INTRODUCTION

The design of game controllers has recently seen a shift towards input devices that afford natural movements. The most obvious example of this is the Nintendo Wii [16], while a number of other devices, such as the guitar used in Guitar Hero [7], allow for intuitive forms of input that are specific to the game in hand. The motivation for this shift can be partly understood as an attempt to appeal to a wider market; the Wii in particular has been advertised as a social device that caters for a market other than the dedicated gamer. However, it is of interest to understand what impact these new devices have on the actual experience of gaming. What effect do such controllers have on social behaviour? If they do encourage social interaction with co-present others, does this draw players out of the game and detract from the possibility of them being immersed in play? Or can social interaction and movement combine to support engagement during gaming? The experiment presented here offers a first step towards exploring these questions.

Social Interaction

Controllers that allow for natural movements have the potential to offer greater affordances for social interaction [6], and are therefore likely to affect social behaviour during game play. Simply by using the controller, players display information about their interaction with a game through their body movements, making their use of the device a rich source of consequential communication [18]. Previous work has shown that the social affordances of different interactive displays affect collaboration [17], and that input devices that offer different affordances for social interaction affect conversation during photo sharing [10]. It seems likely that these findings will generalise to gaming; controllers with stronger affordances for social interaction should encourage co-present gamers to interact during play.

Engagement

The use of input devices that respond to body movement also has implications for engagement, considered by many to be an important part of the gaming experience. Brown and Cairns [2] explore different levels of engagement in game play, and propose that initial engagement is followed by engrossment and then by total immersion. They suggest that this experience has links with the concept of flow [4] in that it features a diminished sense of self and is dependent on minimal distraction. Brown and Cairns also contend that appropriate input devices are necessary for engagement to be experienced; invisibility of control is vital.

This would suggest that controllers that encourage natural movements should support the experience of engagement. Indeed, previous research has shown that movements such as reeling, swerving and ducking increase engagement even when they are not registered by the game [15]. Furthermore, Bianchi-Berthouze *et al.* [1] have recently

demonstrated that when movement is encouraged during a game of Guitar Hero, engagement scores are correlated with the extent of overall body motion. However, the relationship between movement and engagement was not straightforward. Bianchi-Berthouze *et al*. suggest that when engagement is akin to 'hard fun' [9] or 'challenge' [12], absorption in the game can result in players limiting their movements. In contrast, when movement is explicitly encouraged, players experience 'easy fun' [9], relating to the simple enjoyment of experiencing a game, and 'altered states' [9], relating to changes in internal experience. It is suggested that this qualitatively different type of engagement can be increased through natural movement.

Bianchi-Berthouze *et al*. [1] did not explore social interaction in their experiment. However, if a controller encourages social interaction it is possible that co-present others will serve as a distraction, drawing the player outside of the game and into the social context in which it is played. Furthermore, an exploration of children's experiences of engagement with an interactive museum exhibit [8] has demonstrated that the requirement of making large movements raises feelings of self-consciousness in the presence of others, which can then act as a barrier to immersion. It therefore seems that controllers which afford body movement may increase engagement by supporting more natural input, but may on the other hand decrease engagement by encouraging communication with co-present others or by increasing self-awareness.

In a study by Mandryk and Inkpen [13], gamers rated engagement more highly when playing against a friend than against a computer. This suggests that in game play at least, social interaction may not be detrimental to the experience of engagement. However, it may have been the presence of a competitor that increased engagement in this case; indeed, it is not clear to what extent social interaction occurred, as communication was not measured. The present experiment extends previous research by examining whether controllers that afford movement and encourage social interaction support engagement in the context of *collaborative* gaming.

Hypotheses

It is predicted that controllers that afford natural movements will encourage more social behaviour due to their stronger social affordances, and will also be associated with higher levels of engagement. Taking the findings of [1] and [13] into account, we hypothesise that the increases in social interaction will complement the experience of engagement with the game, rather than detracting from it.

METHOD

Levels of engagement and the degree of social interaction between collaborators were explored for a game of Donkey Konga [5]. The input devices were bongos, which afford natural movements, and a standard game controller, which does not. When bongos were used players were encouraged to tap the bongos and clap their hands in time with the music; when the controller was used these actions were performed through button presses using fingers and thumbs.

Participants

The participants were 10 pairs of female university students, with a mean age of 21.3 years (std. dev. = 1.3), who were recruited as friends. They had all played video games prior to the study, but considered themselves to be novices. None had previously played Donkey Konga. Female novices were chosen because controllers that support natural movements are often marketed to an audience other than the traditional gamer.

Experimental Design

A within-pairs design was adopted so that individual differences in engagement and social behaviour would not obscure behavioural differences resulting from the type of controller used. The independent variable was the controller, with two conditions: Donkey Konga bongos and a wireless GameCube controller. The order of the two conditions was counterbalanced across the pairs. The dependent variables were the level of engagement and the amount of social behaviour (both verbal and non-verbal).

Materials

Donkey Konga (developed by NamCo) was played on a Nintendo GameCube using a Nintendo bongo controller and a wireless Nintendo GameCube controller. A 21" Panasonic television was connected to the GameCube. A video camera was used to record the participants. Instruction sheets were used to ensure that all participants received the same information on how to play the game.

A revised [cf. 1] version of Chen *et al*.'s Engagement Questionnaire [3] was used to give an engagement score out of 168. Items unrelated to game play were removed and the language was modified to fit the context of gaming.

Procedure

Participants played the cooperative mode of Donkey Konga, entitled 'Jam Session', in two-player mode ('Duet'). The easiest skill setting, 'Monkey', was used. In each condition the pairs worked their way through a pre-determined sequence of eight songs. The experimenter left the room while they did this. Once the eight-song sequence was over for the first condition, the engagement questionnaire was filled in. The second condition was then undertaken, and the engagement questionnaire completed for a second time. Throughout the experiment participants sat 135 cm from the television and 45 cm from each other.

ANALYSIS

The Engagement Questionnaire scores for each participant were totalled (after reverse scoring items that measure a lack of engagement). The scores for the participants in each pair were then summed to give an engagement score out of 336 for each condition. The pair was treated as the sampling unit for all analyses because one participant's

behaviour cannot be said to be independent of that of their partner (e.g., players may be distracted by a disinterested partner, or speak more if their partner is talkative).

Videos of the participants were coded to give measures of social behaviour. The 10 minutes of video that followed the first two songs of each condition were analysed (the first two songs were treated as a practice phase, although participants were unaware of this).

The participants' verbal and non-verbal behaviours were coded using definitions based on the Autism Diagnostic Observation Schedule [11], which has also previously been used for analysing the behaviour of adults of normal intellectual ability. Verbalisations were categorised as *speech* or *other utterances* (e.g., laughter and groans), and the length of time that each participant spent producing speech and other utterances was measured. These totals were summed for the two participants in each pair, producing a single score for each pair.

Non-verbal behaviours were also classified according to two categories. *Instrumental gestures* were defined as those in which the action conveys a clear meaning or directs attention (e.g., pointing, shrugging, and nods of the head). *Empathic gestures* were defined as those in which the action is emotive (e.g., placing the hands to the mouth in shock). The number of gestures made in both categories were tallied and summed to give a score for each pair.

RESULTS

To ensure that differences were not due to variations in performance, scores on the game were compared across the two conditions. A Wilcoxon's two-tailed matched-pairs signed-ranks test showed that the type of controller had no significant effect on performance ($Z = -0.889$, $p = .414$). All further differences were evaluated for statistical significance using Wilcoxon's one-tailed matched-pairs signed-ranks tests, with the pair as the sampling unit.

Effects of Controller on Social Behaviour

The amount of time each pair spent making verbalisations classified as speech and other utterances, and the number of instrumental and empathic gestures, are given in Table 1.

	Bongos	Wireless controller
Speech (s)	277.04 (143.67)	212.52 (101.68)
Other utterances (s)	57.58 (35.90)	24.01 (14.92)
Instrumental gestures	5.4 (4.67)	1.8 (1.55)
Empathic gestures	5.5 (5.62)	0.8 (1.23)

Table 1. Means (and standard deviations) for the number of seconds each pair spent making speech and other utterances, and the number of instrumental and empathic gestures made.

The participants produced more speech ($Z = -1.478$, $p = .08$) and significantly more other utterances ($Z = -2.599$, $p < .01$) when using the bongos. Although the difference for speech does not reach significance, it does approach it, and it seems likely that with a larger sample a significant difference would have been obtained.

Participants also made significantly more instrumental ($Z = -1.895$, $p < .05$) and empathic ($Z = -2.5273$, $p < .01$) gestures when using the bongos than the wireless controller, lending further weight to the idea that there was more social interaction in this condition.

Effects of Controller on Engagement

The scores derived from the Engagement Questionnaire were averaged across the 10 pairs for each type of controller. The participants rated themselves as experiencing a significantly higher level of engagement ($Z = 2.803$, $p < .01$) when using the bongos (mean = 248.80, std. dev. = 23.03) than the wireless controller (mean = 198.50, std. dev. = 25.33). This suggests that the increase in movement afforded by the input device made for a more engaging experience, and that this was not compromised by the increase in social interaction.

DISCUSSION

The results show that the amount of social interaction with a collaborator is higher when an input device affords natural body movements. The increase in empathic gestures, which are used to express emotion rather than communicate specific information, along with utterances such as laughter and groans, suggest that when using the bongos the players became generally more expressive. Furthermore, the increase in instrumental gestures and the trends for speech indicate that deliberate attempts to communicate information were also affected. In this experiment the pairs were collaborating, and the increase in communication may have facilitated cooperation.

It is of interest to speculate how social behaviour might alter for pairs in competition with one another, or when a player is in the presence of an observer. It seems likely that social interaction with observers might increase when body movements are required by a game, as there is more scope for communicating through the device. The case of competitors is perhaps more interesting; by using a controller that encourages large movements, strategies and techniques for playing the game become more obvious. Players may be less likely to exaggerate their movements when competing to avoid giving an advantage to their opponent. This is a question for future research, which might usefully take an ethnographic angle to complement the experimental approach taken here.

It seems probable that by encouraging social interaction, players will in some sense have been drawn out of the game environment and into the 'real world'. However, this did not have adverse consequences for engagement. Instead, engagement was found to increase alongside social

behaviour. This is in keeping with Brown and Cairn's [2] suggestion that invisibility of control supports engagement, but does not conform to their proposal that engagement has links with highly focused attention. Perhaps this can be explained by recognising that engagement is multi-faceted, and may not always act as a first step towards immersion.

Bianchi-Berthouze *et al.* [1] suggest that the engagement experienced by their participants was qualitatively different to the conventional experience that is akin to 'hard fun' [9]. In this study too, it seems that engagement may have been dependent on aspects of the experience other than pursuit of a goal. By affording realistic movements, the bongos may have facilitated a willing suspension of disbelief during game play, and their flexibility may have promoted enjoyment by encouraging clapping and dancing. It has also been suggested that interfaces that require exertion promote engagement, as well as being a vehicle for social bonding [14]. Further work is needed to tease out these possibilities.

This latter point also emphasises that the increases in engagement and social interaction may not be separate effects of the change in controller, but could in fact be interlinked. While Mueller *et al*. [14] propose that the arousal associated with physical movement might support social interaction, Mandryk and Inkpen [13] have shown that the presence of a friend results in higher engagement. Lindley and Monk [10] have argued further that social behaviour and experience are intertwined to the extent that measures of conversation can be used to tap into unfolding experience. It could be argued that in this study the bongos were simply more fun, and that this is reflected in both higher engagement scores and increased social interaction.

These findings have implications for both the games industry and the research community. They ask questions of existing definitions of engagement, and lend further credence to claims that qualitatively different forms of engagement can be encouraged by controllers that afford motion. This in turn suggests that more sensitive methods of measuring engagement, which take into account different elements of this experience, are needed. The results presented here could also be extended by exploring how players other than female novices will react to input devices that afford natural movements. For example, how might gamers who are used to a standard controller or that play for hard fun react to a radically different device?

In conclusion, this study has shown that social behaviour is more fully afforded and levels of engagement increased through the use of a controller that supports natural movements. The results suggest that input devices that encourage body motion go beyond being a clever marketing tool, and make a novel contribution to improving and extending the gaming experience.

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