‘Just Do What I Do’: Imitation and Adaptation in *Kinectimals*

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Abstract: Motion-based console games are videogames that are played primarily using gestures and other forms of kinaesthetic input, and include games for Nintendo’s Wii and Microsoft’s Kinect. This pilot study sought to investigate how Kinect’s hands-free system trains players to interact with its interface, and if and how players improve, looking specifically at the virtual pet game *Kinectimals* (Frontier Developments, 2010) for the Xbox 360. The observations gathered during the study suggest that the game involves a period of adaptation in which players continuously adjust their movements in relation to perceived affordances and constraints. Focusing on situations in which participants seemed to have difficulty interacting with the system, this paper argues that while *Kinectimals* might not be useful for teaching specific, transferable skills such as accurate throwing techniques, it may have the potential to improve players’ general ability to imitate and adapt physical gestures.

Introduction

Kinect is a motion sensing peripheral developed by Microsoft for the Xbox 360 videogame console. The device incorporates computer vision and voice recognition technologies, allowing users to interact with the system through gestures and speech, without the need for a physical controller (Gates, 2011). Kinect is considered to be a “natural user interface” (NUI), meaning that the modes of communication used to interact with the technology approach the ways in which human beings communicate in general (Gates, 2011). NUIs are designed to be intuitive and should require very little learning on the part of the user in order to operate effectively (Kratky, 2011).

One of the launch titles (games released concurrently with the device) for Kinect was *Kinectimals*, a virtual pet game developed by Frontier Developments (2010). While the Entertainment Software Rating Board (ESRB) has rated the game for all ages, it is designed specifically for young children. In the game, players interact with a group of animals referred to as the cubs, each of which is based on a different species of wild cat. The game consists of a number of activities such as teaching tricks to your cub, throwing and kicking balls, driving a remote control car, and guiding your cub around an obstacle course. Timed competitions are interspersed with periods of freeform play, and the player is encouraged to accumulate “discovery points” in order to unlock new areas as well as objects such as toys, collars, food, and other amenities.

Many of these objects can be used during play, and require the player to perform different gestures that loosely approximate how they would interact with the object in real life (for example, tossing and kicking a soccer ball). As the player plays with their cub, different challenges appear on-screen, which the player can complete for points. Whenever a new activity is introduced a virtual guide in the corner of the screen, who introduces himself as Bumble, explains what to do and demonstrates the action below written instructions. This anthropomorphic guide is indicative of the limited capacity of Kinect to detect and recognize gestures, and the resulting necessity of teaching players, through tutorials or by other available means, what movements to perform. If a player’s movements do not correspond to some degree to the gestural pattern being demonstrated, the system often responds as if no gesture has been made, and the player cannot progress. Progress is also hindered if players cannot adapt the gestures they have learned in response to changing affordances and constraints.

The ability to continue playing and complete the goals put forth by the game is thus dependent on players’ capacity to imitate gestures, or find creative alternatives, and adjust the position and movement of their bodies to suit different contexts. Based on the observations gathered during this study, I argue that the gestures used to play *Kinectimals* are not necessarily transferrable to other contexts, and may represent a unique gestural repertoire that is developed differently by each individual player. I also suggest that those interested in using motion-based videogames for learning purposes consider imitation, exploration, and the adaptation of movements as forms of embodied competence that can easily be overlooked in the search for transferrable, “real world” skills.

Methodology

The pilot study was carried out over the course of four weeks and involved 17 participants, aged 21-42. Participants were initially recruited through flyers and email lists. Participants were then asked to invite friends or family that might be interested in taking part. Prior to beginning the study the researcher also played the game extensively.

The game, console, and video cameras were set up in a game research lab at Concordia University. Participants came in on an individual basis. After obtaining informed consent, participants were asked to play *Kinectimals* for up to one hour while being videotaped. The researcher remained in the room, but did not provide instructions on how to play, except when it was deemed absolutely necessary (i.e. when the participants appeared to be truly 'stuck' and could not progress in the game). Once the hour was up, or they had signaled that they were finished, participants were asked to fill out a brief questionnaire.

Several authors have argued for a situated approach to studies on learning and digital games (Arnseth, 2006; Squire, 2003). Hans Christian Arnseth states that "what is missing from research on computer gaming are more naturalistic studies of how players experience gameplay, how gaming is related to other activities in young people's lives and the diverse practices players engage in when gaming." The same might be said of motion-based videogames, which generate context-specific practices that involve players' bodies and their physical environments in relatively new and complex ways. While this exploratory study was conducted in a lab under contrived conditions, effort was made to allow participants as much freedom as possible in directing their own gameplay. The questionnaire was then used to gather information about what other activities participants were engaged in and how they recalled and articulated their gameplay experiences in writing. Though the small sample size and wide variation in experiential backgrounds made it difficult to draw any conclusions from the written data, the purpose of the questionnaire was partly to test the method and determine whether or not it might be effective in combination with videotaped observations.

From Embodied Cognition to Embodied Gameplay

Recent theories of embodied cognition support the notion that previous experience with physical activities such as dance and sport might have an impact on how players perceive, interpret and respond to information while playing motion-based videogames. Embodied cognition has arisen partly in response to abstract models of cognition and artificial intelligence that downplay the role of specific input and output devices (Anderson, 2003). According to Margaret Wilson (2002), "Proponents of embodied cognition take as their theoretical starting point not a mind working on abstract problems, but a body that requires a mind to make it function" (625). From this point of view, the body's sensorimotor functions and the routine ways in which we interact with our environment have a profound impact on cognitive processing (Wilson, 2002).

Wilson (2002) notes that embodied cognition is a general approach that involves multiple distinct claims, several of which are encapsulated by J. J. Gibson's notion of affordances. Affordances are elements of the environment that invite particular actions and are directly related to the action potential of an organism's body (Wilson, 2002). In game studies, the term is often used to describe the potential actions made available to players by the material and formal properties of a game (Jenson & de Castell, 2009; Bayliss, 2007; Gee, 2007). Peter Bayliss (2007) combines Gibson's ecological approach with Dourish's work on embodied interaction and Norman's concept of natural mappings to develop a theoretical model of gameplay as an embodied phenomenon. Bayliss (2007) argues for an expanded model of gameplay that includes the physical space and body of the player, as well as the material, conceptual, and software components of the game and the interface. According to him, the relationship between these elements gives rise to affordances, and the players ability to perceive and react to these affordances may be considered as a set of embodied skills that allow the player to understand and internalize the logic of the game's rules. Bayliss (2007) also suggests that the more conceptually and functionally close the controls are to what they seek to emulate, the easier it will be for players to "form a functionally accurate understanding of those controls and deeper levels of the game" (101), presumably because the actions used to play the game are already familiar to players and have been used in a similar context outside the game. He goes on to add that, "there are always going to be some-degree of learning curves in videogames, but forms of enactive embodied gameplay, where appropriate, will…lessen the effect that this barrier might have to the player's enjoyment" (101).

Other authors such as Derek Burrill (2010) and Seth Giddings and Helen Kennedy (2010) also attribute significance to the changing relationship between players' bodies and videogame interfaces, noting that the macromovements involved in playing games such as *Kinectimals* mark a distinctive shift from the tiny micromovements that characterize traditional videogames. For Jennifer Jenson and Suzanne de Castell (2009), this change is an epistemological one, redefining gameplay in such a way that imitation, as opposed to simulation, becomes the central element. While these two terms are often conflated, simulation creates an "as if" scenario and depends to a certain extent on the absence of the real. Imitation, on the other hand, depends on physically performing the activity being imitated, so that rather than pushing a button "as if" jumping, players must jump themselves in order to jump in the game (Jenson & de Castell, 2009).

The term imitation is often used in a commonsense way to describe the process by which an observer duplicates the actions of a model, however Richard Byrne (2005) argues that it is important to distinguish between *learning by copying* and *social mirroring*, each of which serve different purposes. Learning by copying allows for the acquisition of new skills and involves the decomposition of complex behaviour into simpler components that can already be performed by the observer, and the subsequent recomposition of those components into a new programme of behaviour. Social mirroring, on the other hand, may support mutual identification or empathy, and includes forms of imitation in which an observer matches the current behaviour of another through the performance of similar actions (for example smiling back at someone who is smiling). Though the underlying connections between observed behaviour and the actions performed by an observer are not well understood, studies have shown that imitation plays an important role in strengthening interpersonal relationships, facilitating communication, and enabling the learning of new skills and behaviour (Meltzoff & Williamson, 2008; Byrne, 2005).

Bumble Says…

One way to examine imitation in motion-based console games is to focus on areas where it seems to fail. Observations revealed that swiping in order to scroll through menu options was perhaps the most challenging gesture to learn overall, especially in the initial stage when participants were required to select their cub before proceeding with the game. During this phase the virtual guide began by advising players that, "If ever you're not sure what to do, just follow me and do what I do." He then repeatedly demonstrated the swiping action in the corner of the screen and provided spoken instructions. While participants generally moved their hands around in response to the prompt, Kinect often failed to recognize their motions as "swiping," either because they weren't moving quickly enough, or because they weren't moving their hands in the right direction (horizontally right to left with the right hand, and vice versa with the left).

Rather than swiping, many participants seemed to draw on their previous experience with virtual menu navigation, and tried to push the left and right arrow buttons bracketing their current selection by holding their hand out in front of them. While this was a logical solution, the arrow buttons in this case were non-interactive, and only served to indicate that there were other options available. Because the game required that players swipe with both the left and the right hand before they were allowed to move on, participants were stuck trying to execute what should have been a routine task.

There are a number of potential reasons why participants had difficulty with this gesture. Aside from language barriers and a lack of familiarity with videogame tutorial scenarios, one significant factor is that there is no obvious "real life" counterpart to swiping. While the motion is similar to flipping through the pages of a book, the gesture demonstrated by the guide in *Kinectimals* originates at the elbow rather than the wrist. Participants who did not immediately notice or understand the instructions appeared to learn the gesture either through trial and error, or by asking for help and watching the researcher, who would demonstrate the movement and say something along the lines of "like this." While it is difficult to know exactly why the researcher was able to successfully teach the movement while the virtual guide was not, possible reasons include an increased level of attention directed at the researcher's movements and the three-dimensionality of the demonstration. While the virtual guide can only be seen from a front-on perspective, participants were standing to the right of the researcher and could watch the gesture from above.

The situation described above suggests that learning by copying, even for a relatively simple gesture, is not guaranteed, and may be dependent on a number of factors including the familiarity of the gesture being demonstrated, a correlation between the context in which the gesture is being performed and the context in which the gesture has previously been used, the observer's awareness that she is meant to be imitating the gesture and her willingness to do so, the amount of attention directed at the person or character demonstrating the action, and the ability of the observer to translate what she or he sees into an embodied understanding of how and where to move. *Kinectimals* also lacks a sophisticated feedback system that could instruct players on what they were doing wrong and offer suggestions. Though participants were able to infer a great deal from what was going on in the game, they were sometimes unsure whether the error lay with them or with Kinect, and often turned to the researcher for help or reassurance. The inability of the game to communicate to the player precisely if, what, and how they were doing something "wrong," and the resulting confusion, suggests that even relatively high-tech devices cannot replace a human coach or instructor, though future studies comparing the two methods of teaching might provide interesting results. On the other hand, the context set up by the game, which is often humorous and light-hearted, may afford more freedom for players to "goof around" and explore just what their bodies are capable of doing—a valuable learning activity in and of itself, particularly for young children.

Variability of Gesture

The potential for error demonstrated in the above example is attributable in part to the many degrees of freedom afforded by the human body, which also allows for a wide variation in movement patterns. None of the participants had played *Kinectimals* before participating in the study, and each developed a slightly different technique for swiping, throwing, kicking, and otherwise interacting with the game. The variation in throwing strategies was particularly obvious. While most players began by using overhand (above the shoulder) throws, some seemed to be applying a great deal of force to their swing, while others used a technique that would be better described as flicking.

Strategies for throwing balls continued to change during the course of the play session, as some participants began to abandon traditional throwing techniques in favour of a slower, shorter swing, which seemed to be better suited to the game. The differences between the motion required to accurately throw a real ball and the motions used to play *Kinectimals* suggests that the game would not be useful in teaching advanced throwing techniques ("How to throw," 2011). This is in part because Kinect cannot detect when the player is attempting to release the ball, and in part because the game guides the ball to a certain extent in order to make it easier to hit targets. The disjuncture between the player's physical space and the illusory space on the screen may have an impact on players' perceptions of angles and distance as well. Also, because there is no physical object being thrown, the player lacks the haptic input that would allow them to determine the weight, size, and shape of the ball, and adjust their movements accordingly.

As Ian Renshaw et al. (2010) point out, however, movement variability is not in itself detrimental to motor learning. In fact, the opposite is true, as "variability in movement patterns permits flexible and adaptive motor system behaviour, encouraging free exploration necessary in dynamic learning and performance contexts" (125). Accurate throwing, for example, depends as much on the ability to alter the angle of the throw as it does on the ability to follow a predefined pattern or set of mechanics. Thus the ability of players to adjust previously learned movement strategies to fit the context afforded by the game and the interface could be approached as a skill in its own right—one that could potentially be improved through the use of motion-based videogames.

The two related claims in embodied cognition that "perception is for action" and "cognition is situated" suggest that context and purpose not only affect how people act, but also how they think (Wilson, 2002). If players are repeatedly encouraged to experiment with new movements and perform them in different situations for different purposes, it is possible that this may change the way they perceive their body and its capacities, as well as their environment. "Kicking the ball around" comes to take on new meanings when it becomes part of a repertoire of movements used to interact with a virtual environment, as well as something we do on the soccer field or in the arena.

While many videogames use avatars as a sort of stand-in for the player within the game space, the only representation of the player's body in *Kinectimals* is a pair of semi-transparent, disembodied hands. The player's ability to change their viewpoint or move around in the virtual space is also limited, which in turn limits the ways in which activities like jumping, ducking, and spinning can be incorporated into the game. This limitation is resolved in part by replacing a player avatar with the cub. In order to perform tricks in *Kinectimals*, players must first perform a specific gesture, which their pet will then "copy." During the study, jumping was the first trick introduced, and while some participants were initially unsure what to do, they quickly realized that they themselves had to jump in order to make their cub jump. The "spin" trick, which required the player to spin in place, was then followed by the "play dead" trick. For this last trick, participants were instructed to lie on their backs, or say, “Play dead.” If they were successful, participants were rewarded with an animation of the cub flopping over on his back.

This sort of one-to-one relationship between the players’ actions and the actions of the cub later proved to be misleading. When the “lie down” pose was introduced, most participants naturally assumed that they should also lie down, and were confused when the cub either performed the play dead trick or refused to do anything at all. In fact, the lie down pose was performed by leaning forward and patting both hands on the ground. Much like the swiping gesture, the lie down pose made a certain amount of sense in retrospect, since cats often lie down by tucking their legs beneath them. By establishing a link between everyday human actions and the cub’s actions, however, the game may have cued participants to draw on their own experiences of lying down, rather than copying and learning the action demonstrated by the guide.

Several participants also prompted their pet to perform tricks that were not demonstrated by the guide, either accidentally or through deliberate experimentation. The beg pose, for example, was often triggered by participants holding their hands close to their chest while watching the screen. Once they realized their movements could potentially trigger a trick, some participants began to try out new gestures. Aside from encouraging players to explore new movements, Byrne’s (2005) description of social mirroring suggests that the tricks activity might also have been designed to encourage players to develop an empathic relationship with their cub. The cub’s ability to mimic the player helps to establish a two-way relationship based on synchrony and mutual recognition. If the cub “sees” and responds to the player, the player may be more likely to see and respond to the cub, as well as other agents in the virtual world. When successful, imitation in *Kinectimals* can potentially create a feedback loop in which the player learns to copy the guide and the cub learns to copy the player, providing a fictional gloss that may help to naturalize the somewhat uncomfortable process of learning to jump and flail about in front of Kinect’s cameras.

Discussion

Jenson and de Castell (2009) suggest that, “Imitative play…engages players directly with the forms and functions of the real” (6), however many of the activities in *Kinectimals* are a long way from being “just like” the “real” activities they pretend to emulate. The observations gathered during this study indicate that participants quickly learn to perform gestures that are effective for accomplishing certain goals in the game, but would be unlikely to have the same effect outside of the game’s virtual environment. Overall, the game neither encourages nor necessarily affords precise, directed movement patterns. Many of the gestures used to throw the virtual tennis ball, for example, lacked the physical force and follow through needed to accurately throw a tennis ball in real life. While *Kinectimals* may not be particularly helpful in teaching specific movement patterns that can be used in other contexts, the capacity to imitate an observed action and adjust one’s movements according to a set of affordances and constraints might themselves be considered as forms of “embodied competence” (Jenson & de Castell, 2009) that can be developed through imitative play.

The shifting gestural patterns that occur as players familiarize themselves with the interface and the game activities may also be indicative of an exploratory, communicative process in which players learn to detect what the game “wants” them to do, and modify their movement patterns and strategies in order to produce something it “understands.” In other words, the game relies on a loose gestural repertoire, which players must learn and enact in order to play the game. Often, players performed these gestures in order to manipulate objects in the game, blurring the distinction between gestures used to convey information and communicate with another agent, (Cook & Tenenhaus, 2009; Broaders et al., 2007; Goldin-Meadow & Singer, 2003), and non-communicative gestures used to manipulate or interact with objects (Montgomery et al., 2007). Though Kinect may provide the illusion of direct interaction thanks to the very short interval between the player’s action and the movement of the object in the virtual space, that interaction is dependent on communication as well as physical cause and effect.

Despite being designed for young children, playing *Kinectimals* involves a complex process of imitation, exploration, and adaptation as players contend with the limitations of the technology and the functional requirements of the game. Understanding this process will require a great deal more research, particularly given the enormous number of variables involved. While it might be easy to dismiss the situations above as examples of players not paying attention or not following instructions, it is far more interesting to ask what players were doing instead, and why.

Future Research

The exploration of people's experiences and perceptions of new gaming technologies such as Kinect is one area in need of more in-depth research. Though the questionnaire used in this study was adequate for gathering basic demographic information, it tended to raise more questions than it answered about participants' perceived experiences and beliefs. A more effective approach might be to combine interviews with participant observation, and to extend studies over a greater period of time and to different locations. Additionally, researchers might look at how motion-based gaming is portrayed in the media, and what impact this has on players' expectations about what they can and should do when engaging in motion-based play. While such research might seem to be unrelated to learning, some have noted that in today's world, people can learn how to interact with new technologies long before they actually encounter them (Brooker, 2010). Although there may be plenty of anecdotal evidence to support this statement, specific studies investigating if, when, and how this occurs are still needed. Familiarity with high-tech devices, both those which exist already and those which are still in the realm of science fiction, may have a significant impact on the capacity of people to learn to play with Kinect and other motion-sensing systems.

Marking players' progression through a motion-based game, noting where they have difficulties, how they adapt to overcome them, what information they're given to help them do so, and how the margin of error impacts play, can not only provide valuable information for the development of future games, but may be used to develop teaching strategies which are better suited to promoting different sets of embodied skills (Hsu, 2011, Kissko, 2011). To advance the study of digital game-based learning (DGBL), close attention to the player needs to be combined with close attention to the game being played, and in the case of field research in particular, to the space in which it is played. Furthermore, DGBL research must be expanded beyond computer games to incorporate new interfaces and new modes of interaction.

If we accept that players are learning *something* from motion-based videogames, there is still the question of how applicable this learning is to other situations. Previous research has looked for improvements in areas such as surgical skill (Boyle et al., 2011; Hogle et al., 2008), golf putting technique (Downs & Oliver, 2009), and stepping ability in the elderly (de Bruin et al., 2010). While the results generally indicate that motion-based systems can be beneficial, they are not always a suitable replacement for real-life environments. The purpose of this paper is not to suggest that the transfer of learning from motion-based videogames to specific and externally defined tasks is impossible or unimportant, but rather that researchers and educators might benefit from a more holistic approach to embodied competence as something which involves the ability to dynamically alter gestures, as well as repeat them.

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