Envisioning the Future of Wearable Play: Conceptual Models for Props and Costumes as Game Controllers

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ABSTRACT

In this paper we discuss the difficulties faced by designers attempting to create new engaging embodied interactions in games. We argue that the inability of embodied game interfaces to move past the "novelty hardware" stage and into the mainstream of gaming lies not with a failure of technology, but with a need to develop more mature design frameworks. In this paper we propose a series of conceptual models intended to help fill this void in the design space. We locate this work under the broad banner of *wearable game controllers*, an area of inquiry that is just starting to take shape. Drawing on theories of wearable computing, tangible interaction, embodied cognition, and the performing arts, we propose three new approaches to the design of wearable interfaces that incorporate costumes and props as mediating artifacts for embodied game play.

Categories and Subject Descriptors

K.8 Personal Computing: Games; H.5.2 HCI: User Interfaces

General Terms

Design, Human Factors

Keywords

Costumes, Props, Wearables, Game Interface, Game Controllers, Narrativised Interface, Embodied Interaction

1. INTRODUCTION

When Nintendo released the Wii in 2006, many hailed it as the paradigm shift that was going to revolutionize gaming by opening up console games to audiences that had never held a controller. The advent of gestural control was seen as an opportunity to overcome the entrenched controller literacies that had long made console gaming the province of young men (at least within the public's perception of gaming). "Wii Invades Retirement Home", an article on Daily Tech proclaimed, enthusing about the presence of the Wii at an AARP convention [21]. The New York Times attributed a rise in senior citizen oriented games to the popularity of the Nintendo Wii [13]. USA Today identified "Alpha Moms" as a major demographic targeted by the Wii [4]. The appeal of a non-standard controller and a console targeting a casual player set an arms race in motion, and by 2010 Sony and Microsoft had unveiled their own gesture based interfaces: the Playstation Move and Kinect sensor, respectively. Prior to the Wii there had been numerous attempts to develop peripherals that could harness the power of the body, perhaps most notably the Nintendo Power Glove, the Sega Activator, and the Playstation EyeToy, but none of these systems were ever more than curiosities. The Wii did something that had not yet been done with a gestural control scheme: it put it front and center rather than treating it as a sideline or an add-on to a core gaming experience. Concurrent with the rise of these gestural control systems was an explosion of highly specialized controllers, driven by the success of games like *Guitar Hero* and *Rock Band*.

Almost a decade later the Playstation Move doesn't really command a mainstream audience, due in part to a lack of fully developed experiences that take advantage of the technology [5]. Sales of the new Xbox One doubled after Microsoft dropped the required Kinect sensor from the package [12], indicating that animosity towards the peripheral outweighed any remaining enthusiasm. And the new WiiU has shifted away from a purely gestural interface and towards one that is a hybrid of mobile gaming and console gaming. The fake plastic instrument craze has also died down. Embodied interfaces briefly expanded the interest of a broader gaming public, or at least they told a convincing story about new gamer demographics. Is their decline indicative of this community losing interest in games? Or is it indicative of a lack of interest on the part of developers in catering to this expanded market?

What happened to the future of "gaming experiences for everyone" that seemed right around the corner in 2006? Why have we been unable to overcome the inertia of the controller paradigm or the keyboard and mouse? The technology for nonstandard interfaces is more mature now than it has ever been, which means that the problem is not one that can be solved purely through engineering more accurate sensors. What, then, is the missing piece of the puzzle, the solution that could resurrect the vision of play that briefly animated the world of games?

1.1 Two possible explanations for the decline of embodied interfaces

We suggest two reasons for the unsustainability of the more utopian visions of embodied and gestural game interface, including an inability to overcome the novelty factor of these early systems and a systematic failure to fully engage with these

Proceedings of the 10th International Conference on the Foundations of Digital Games (FDG 2015), June 22-25, 2015, Pacific Grove, CA, USA.
ISBN 978-0-9913982-4-9.

interfaces as a mediator of narrative meaning and semantics. These two critiques are meant as explorations of the problematics of embodied interface systems and should not be taken as experimentally validated claims. They serve to illustrate a set of starting assumptions that we bring to this work.

1.1.1 Novelty is not sustainable

With only a few exceptions, the games which best take advantage of the unique affordances of these gestural systems tend to be "mini-game" bundles, designed to capitalize on the novelty of the control scheme. In the case of many cross-platform titles, the support for gestural interaction is tacked-on and gimmicky: an afterthought rather than a central component of the experience. Consequentially, the design vocabulary for these kinds of games has remained static, even as the capability of the systems has increased. For instance, most Kinect games involve moving one's body in order to match the motions of a humanoid figure on the screen. The context of this puppeteering interface may change from dancing to martial arts to exercising, but it's all just puppetry. We contend that the lure of novelty and the lack of an articulated interactional vocabulary for gestural play has led to a stagnation of these interfaces, rather than the renaissance that was predicted when they were introduced.

1.1.2 Lack of narrativized interface knowledge

Second, we would argue that many of the games for these gestural systems fail to take into account the role of the body as a site for narrative meaning. Bizzocchi et al. have written about the different ways in which narrative manifests at the level of a game's interface [2]. They argue that that game interfaces can become sites for narrative meaning not just at the level of aesthetics but also at the level of function: that interfaces can encode narrative logics such as character and emotion into their fundamental operations. Tanenbaum and Bizzocchi provide a case study of embodied interfaces in Rock Band, arguing that the design of the controllers can serve to reinforce the narratives of rock music in the game by placing the player into postures that invoke social and cultural stories of rock and roll [15]. While the potential of embodied interfaces to elicit sense and muscle memory seems clear, the dominant paradigm for these systems remains assiduously neutral in design, requiring the mimicking of actions on the screen, but failing to further explore the narrative possibilities of the player's body. It is here that we see an opportunity for a design intervention.

1.2 A need for new conceptual models

Underlying the critiques above is a more fundamental commitment: that the decline in embodied interfaces for games stems from an absence of well-articulated conceptual models for the design of these systems, rather than any specific shortcoming of the technology. Simply put, we still do not know what to do with novel interfaces that is meaningfully better than what we can already do with conventional ones. We contend that there are still exciting design possibilities within this space that remain relatively unexplored. In this paper we propose a trio of conceptual models intended to help fill this void in the design space. We locate this work under the broad banner of *wearable game controllers*, an area of inquiry that is just starting to take shape. Drawing on theories of wearable computing, tangible interaction, embodied cognition, and the performing arts, we propose three new approaches to the design of wearable interfaces that incorporate costumes and props as mediating artifacts for embodied game play.

Isbister has explored wearable game controllers from the perspective of movement-based and socially oriented games [6,7,8]. Isbister sees movement as being closely linked to emotion; alternative controllers and sensor systems offer the possibility of moving away from the cramped, damaging posture of keyboard and standard console use towards a more expressive and engaging set of interactions that promote positive and healthy experiences [6]. Similarly, she points out that even the ostensibly social and expressive group dance games of recent years mostly encourage a focus on screen-based feedback and mimicry of on-screen avatars rather than true interaction and engagement between people and bodies [7]. In recent work in collaboration with artist Kaho Abe, she has more explicitly incorporated the role of costuming into her work to foster transformation and social connection in the lightening bug game [8]. Our work takes a slightly different approach to this space by looking at the role of costumes as a pathway to narrative and ludic engagement.

2. CONCEPTUAL MODELS FOR WEARABLE GAME CONTROLLERS

We propose three distinct conceptual models that we contend have utility for the design and evaluation of new control schemes. We present each model along with a brief discussion of possible designs that it could motivate. We see these models as preliminary explorations of this new design space, and seek to outline a research agenda for continued design and study of the uses of props and costumes as game controllers.

2.1 Props and Attachment

One of the distinguishing properties of tangible and physical computing devices is that they stay where they are put until moved. This might seem like a pedestrian observation, but when considered through the lens of design it has some interesting implications. Physical objects can occupy a desired state without requiring attention from a user until they are needed, and their spatial arrangement is a source of meaning that is readily mapped to common game mechanics.

Many games have systems of "equipment" whereby the player assigns various items or abilities to her character by switching out weapons, items, clothing, and other accessories. These are often buried behind menus that require the player to pause the game or stop a particular activity in order to reconfigure a character's "load out." For example, in the game *Transistor,* the player collects a range of different attacks and abilities, which can be assigned to different buttons on the controller. These different abilities can be combined in various ways: each ability can be used as an active attack or power, or attached to another active ability to augment it in a passive way. The interface for this in-game is a menu screen with a series of boxes that the player can fill with different abilities. We can imagine a version of this interface where the boxes are actually physically represented on a table in front of the player, and the special abilities represented by different tangible tokens. Reconfiguring the state of the game then would involve re-allocating the physical resources on the table, and could be done without pausing the action to view a separate menu. This kind of design change has direct ludic impact on the play. Transistor as designed only allows players to switch around configurations at specific "terminals" in-between encounters with the enemy. Allowing these reconfigurations to occur in real time meaningfully changes the game itself. Thus, we can see how allowing for these kinds of material interfaces requires us to consider the new modes of play that they facilitate. Consider, for instance, the social and collaborative/competitive implications of a system where the capabilities of the player may be manipulated in real time in the physical world by a friend (or adversary).

An example of a less successful implementation of these logics is *Disney Infinity,* where the characters and abilities available to the player are modified by placing different tokens and character models on a tangible "reader" platform connected to the game console. While functionally similar to the idea sketched out above, the implementation of this system only allows physical interactions in constrained circumstances.

Tangible controllers also have interesting affordances as props and costume pieces. Tangibles can be designed as modular items: a light saber in a Star Wars game could be modified by switching out different tangible "crystal" power supplies; a firearm could be augmented with a bayonet, a silencer, or a specialized scope. Depending on the constraints and affordances built into the objects, they might have different properties or be configurable in different ways. This can also be a form of narrative interface, extending the diegesis of the world into the material context of the player. These kinds of interfaces could allow for a richer, more sophisticated embodied interaction space using the Kinect or similar technology by augmenting the continuous signals from the player's body with a set of configurable templates and "modes". Props can change the silhouette of the player in ways that are relevant at both the ludic and the narrative level by altering player posture and augmenting how the camera perceives the player's body. Utility belts, masks, weapons, and power-ups all become different "attachable mechanics" from this perspective. This opens up a new design space for gameplay that goes beyond the shallow mini-games of the Wii and Kinect. Some examples include a pair of goggles with different "lenses" that switch the game through different visual modes, or a utility belt that activates abilities when different items are clipped onto it.

Other research work on embodied and tangible computing has looked at elements of these ideas in board games, museum spaces, LARPing and more [10,17,18,20]. These explorations are interesting and provide insight into specific experiences and systems, but have not as yet added up to a comprehensive theory for understanding how the use of tangible and wearable props influence gameplay and engagement with ludic systems. What theory has been developed has had little impact on the game industry at large.

2.2 The Body as a Collection of Switches

This conceptual model treats the body as a mechanical system that can contain a variety of circuits and switches that may be closed or activated by reconfiguring its own mechanics. It's easy to forget that in most cases the human body is the most sophisticated and flexible machine within an interactional feedback loop, which means that many physical capabilities are overlooked in the design of embodied interfaces [3,11].

When Sony launched the Playstation Move, one of its central critiques of the Kinect was the lack of *buttons* in the interaction. This is an important point, and one that Sony was correct to emphasize: camera-based systems are continuously gathering data about the bodies in front of them. This data is fundamentally analog. It produces curves and paths and traces that bleed together into a continuous expression. A player stopping to scratch her back or answer the phone doesn't immediately signal to a Kinect that her actions are not intended as *game actions*. Almost everything we know about interactions with computers assumes a discrete, digital, individuated expression of intent in the form of a click, a drag and release, or a button press. Game design before embodied interaction could safely isolate different interaction events from each other. With camera-based interfaces this is no longer even remotely the case. Without buttons or other discrete forms of digital input, interactions with camera-based systems are mushy, awkward, and unending. The only way to stop sending signals to these systems to is to get out of sight of the camera.

The best solutions designers have been able to develop are uncomfortable, distinctive, and improbable postures for the player to hold for unusually long durations in order to signal to the system that it needs to pay attention, or stop following along, or shift to a menu. This solution is problematic, making interactions with menus halting and tiring affairs that discourage extended engagement with the system. Sony, by blending the discrete input of buttons with the continuous motion tracking of a camera vision system, sought to address the accuracy problems of the first generation Wii Remotes and also eliminate the "mushiness" of the Kinect. While aspects of this design were quite successful, the lack of dedicated games and the fringe nature of the platform prevented it from taking center stage.

We propose an alternative approach to the challenges of continuous interaction here. In our recent workshops on wearable game controllers [16], we introduced our participants to a simple tangible prototyping platform called the MaKey MaKey [14]. The MaKey MaKey is a success story from the MIT Media Lab. Developed by Jay Silver and Eric Rosenbaum, the board allows the user to quickly wire up simple "switches" between any two conductive surfaces. These switches are mapped to common keyboard and mouse events by default, so within minutes one can prototype and build a working game controller interface out of a pencil sketch, a bowl of fruit, or (in the case of our workshop) scraps of conductive fabric attached to clothing using safety pins, and connected to the MaKey MaKey using alligator clips. This allows for extremely rapid prototyping of wearable interactions that treat the human body as a collection of switches, to be triggered by connecting up body parts in different ways.

Conceptualizing the body as a set of switches sidesteps the problems of continuous interaction by reading bodily actions as discrete events. This can lead to interactions that involve different poses, postures, and movements that elicit communicatively salient associations: a player might place her hands on her hips in order to activate a special ability, or click her heels together to trigger a teleportation spell. Multiple players may need to coordinate bodily interactions to succeed at a cooperative or competitive game, as in the case of Williams et al.'s *Propinquity* [19] where players must dance in and out of proximity with each other in a projected light "arena".

2.3 Identity Expression and Constitution

The third and final conceptual model that we believe can expand the design space of wearable game controllers has to do with the expressive work that costumes, clothing, props, and masks do to both communicate a particular identity and to help support an experience of cognitive transformation into a character. Clothing and costume are essential to how people construct, enact, and experience social identities. What we wear is an indispensable component of how we are perceived by others. Clothing is expressive, often telegraphing details about how we want to be perceived, and how we perceive ourselves. In theater practice, costumes and masks play a significant role in supporting an actor's identity transformation into a character. In particular, masks play a significant role in evoking new body language and character behaviors [9].

Masks operate according to a logic of theater practice known as "outside->in" transformation. This works by emphasizing the contexts and activities of the actor (such as setting, props, costumes, make-up, dialogue, body movement, and social interactions) in order to elicit a mental transformation into the character. Outside of theater practice, this phenomenon goes by many names. In particular, we connect it to Adam and Galinsky's concept of *enclothed cognition* that looks at how different clothing can modulate our own self-perception and identity performance, often at unconscious levels [1]. Enclothed cognition holds that "wearing clothes triggers associated abstract concepts and their symbolic meanings" [1]. The authors argue that wearing clothes can help people to embody the symbolic meanings of their outfits. For instance, they found that participants in a study who were wearing lab coats were half as likely to make mistakes on a selective attention task as those wearing their normal clothes.

Thus, wearables can both express and constitute an identity. Clothing can modulate mood and self-perception. It can make a person feel attractive or frumpy. It can support a process of identification with a character in a game, or it can enhance a performance at a specific task. Understanding these dimensions of clothing provides designers with a powerful tool for engaging players within both the fictional and ludic aspects of their games. A cloak and a hood can help a player feel more connected to Alastair in *Assassin's Creed*. A set of fairy wings or a crown could make a player feel more like the character of Aurora in *Child of Light.* A spiky headdress could make a player feel closer to *Sonic the Hedgehog* and a floppy hat and green tunic would change how a player interacted with Link in *Legend of Zelda*.

3. CONCLUSION AND FUTURE WORK

In this paper we have discussed the difficulties faced by designers attempting to create new engaging and embodied interactions in games. We have argued that the inability of embodied game interfaces to move past the novelty hardware stage and into the mainstream of gaming lies not with a failure of technology, but with a need to develop more mature post-controller design frameworks. We have singled out one area within this space to explore through some speculative design work, wearable controllers, and presented three conceptual models for how to approach full body design using costumes and props as game controllers.

While each of our three conceptual models suggests some limited new directions for the design new game interfaces, we argue that these techniques are most helpful when considered within a broader framework of wearable play. We envision a gameplay experience in which players are *literally* transformed into the characters within the game. In this vision of wearable play, the props and costumes used by the players are magical portals into the world of the fiction: they are material, tactile, wearable manifestations of the work that shape the bodies of the players, and thus their own perception of the game and the actions that are possible within it.

Of course, the real test of these conceptual models is to put them into practice. This paper represents a first attempt to articulate a set of principles that can guide ongoing design explorations within the space of wearable play. We are already undertaking experimental studies of some of the ideas explored within this work, including comparative studies of players in and out of costume to explore the role that clothing plays in the player's self-perception, social performance, and success within the game.

4. ACKNOWLEDGEMENTS

We wish to thank our excellent co-organizers for the *Costumes and Wearables as Game Controllers* workshop at TEI: Kaho Abe, Luigi Anzivino, Katherine Isbister, and Anne Sullivan, as well as our very enthusiastic and creative participants: Beverly Ball, Kate Compton, Heather Faucett, Lone Hansen, Ryan Jenkins, Simon Koch, Anne McClard, Roberto Pugliese, Kate Ringland, Alexandre Silveira, Gillian Smith, Boris Smus, Simon Stusak and Stavros Vassos. MaKey MaKey generously donated several MaKey MaKey boards for the workshop.

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