

Propinquity: Exploring Embodied Gameplay

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ABSTRACT

Consumer game platforms are realizing Ubicomp's vision of seamless, sensor-based, embodied interaction with computation. Here we present *Propinquity*, a full-body dancing/fighting game using proximity and touch sensing. Relying primarily on auditory feedback, *Propinquity* attempts to reconfigure sensor-based gameplay as an activity where players orient towards one another rather than a central screen. By presenting this particular demo, we hope to stimulate discussion of embodiment, expressiveness, play, performance, and social production in both ubicomp interaction and game design.

Author Keywords Play, Gaming, Proximity Sensing, Embodied Interaction, Wearable

ACM Classification Keywords H.5.2 User Interfaces: Input Devices and Strategies; H.5.m: Miscellaneous.

General Terms Design, Human Factors, Theory.

INTRODUCTION

As Ubiquitous Computing technology increasingly plays a role in everyday life outside of the research lab, gaming and game controllers have made notable strides. The sensing and gesture-recognition technologies originally popularized by the Nintendo Wii have been expanded upon, and arguably surpassed, by Microsoft's Kinect and Sony's Eye. These systems attempt to involve players' whole bodies, actively, in their videogame play. They also tend to impose particular orientations onto players' bodies, by continuing to design for screen-based interactions, and by expecting cameras or "sensor bars" to be placed atop those screens.

Here we present *Propinquity*, a game prototype based on the proximity and rhythmic movement of two players. In this game, each player, by wearing accelerometers and soft proximity and touch sensors, becomes the other player's game controller. Like commercial games and gaming systems based on Ubicomp technologies, *Propinquity* senses players' embodied movements in order to drive gameplay. Unlike these commercial systems, we take a different approach to supporting deep collaboration, by orienting players to one another rather than towards a screen or a camera.

Propinquity, while on the one hand a working technical prototype, also crucially serves as an "object to think with".

By engaging conference attendees in embodied experiences of our prototype, we hope to raise questions about what is and is not being accomplished by commercial embodied game controllers. We aim to highlight themes important to collaborative interaction with ubiquitous computing and to cutting edge videogame design: embodiment, expressiveness, play, performance, and social production.

PROPINQUITY

Propinquity's gameplay is based on a simple play-along mechanic, similar to commercial rhythm games such as Dance Dance Revolution or Guitar Hero. Each player wears four sets of proximity and touch sensors, on their wrists and shoulders by default. Depending on players' comfort level, these wearable sensors could also be attached to hips, backs, knees, heads, etc. using safety pins or ties. Each player must trigger the sensors on the other player's body as indicated by LEDs on each sensor patch. One, two, or three lit LEDs indicate that their patch will come up soon in the sequence; four blinking LEDs urge the player to trigger the patch. Sensors are triggered by proximity – the closer a player gets, and the longer they maintain that closeness, the better they score. Touching the sensor patch, however, results in point loss. Players' scores are augmented if accelerometers on their ankles show that they are moving.

While a screen shows each player's score and some abstract visuals, *Propinquity's* most important feedback mechanism is auditory. Rounds begin with a basic drumbeat to facilitate rhythmic movement. As the players follow along, each "strike" triggers instant audio feedback and layers an additional loop onto the soundtrack. An accidental touch triggers a mildly unpleasant buzzing sound. While one player might play drum loops, the other would trigger bass loops, allowing the music to provide an ambient indicator of how well each player is doing. As the game progresses, the music increases in intricacy as a result of player action. Within this simple mechanic, the game provides ample space for improvisation and expressive performance.

Implementation

Player movement is detected using 3-axis accelerometers worn on the ankles. Proximity is detected using Sharp GP2D120XJ00F Infrared near-range proximity sensors, optimized for distances of four to thirty centimeters. In order to make these proximity sensors easier to wear, we designed compact PCBs and created custom fabric touch sensors. Two lengths of conductive thread were stitched over a piece of neoprene such that the threads were closely

juxtaposed, but never touched. A finger or hand brushing the surface completes the circuit.

Sensors are read and coordinated by Arduinos worn on players' bodies. Xbee RF modules allow for wireless communication between the Arduinos and a central computer that coordinates the music loops and scores the players. Scoring, music, and ambient visuals were programmed using Processing.

DISCUSSION

We focus on the intersection and elaboration, through research/creation, of several core concepts: embodiment, expressiveness, play, performance, and social production.

Embodiment

Within HCI and Ubicomp there is now a well-established interest in the body and physical space [3] as well as in tangible, ambient, and haptic interactions with computation [5]. We are increasingly concerned with the ways that subjects are politicized and socialized in their embodied relationships with and through technology. A focus on embodied interaction does not necessarily imply the design of interfaces for unencumbered physical movement (such as the Microsoft Kinect), but rather an understanding of bodies, and their social embeddedness, as loci of action, knowledge and collaboration. *Propinquity* explores socially and physically embodied aspects of play by attempting to orient players towards each other, and by creating ludic constraints based not just on speed and coordination but on the relationship of bodies *with each other*.

Expressiveness

While digital systems are typically thought of as tools for symbolic representation (i.e. text, code, icons), we are interested in how such systems may support *expressiveness* that is not necessarily representational. Here we focus on non-symbolic expression that occurs in the space for interpretation around code and symbol systems – the contextually meaningful that cannot be said in so many words. In space, this may manifest as the production-in-action of the space [2], as opposed to the static, designed configuration of it. In embodied interaction this can manifest as an “excess” of gesture beyond that which controls the interface. *Propinquity*'s minimal gameplay requirements were formulated explicitly to leave room and provide the opportunity for such expressiveness.

Play

HCI and Ubicomp have seen an increasing emphasis on play as a core design concern and an important mode of interaction through and with technology [4]. Play here can be thought of in the usual sense of enjoyable recreational activity. But we would argue that “play” in the mechanical sense, meaning looseness, or wiggle room, is also a useful concept [1]; indeed that “wiggle room” is what allows for expressiveness and play-in-the-usual-sense. *Propinquity* investigates how play can be supported (or not) by material, interactional and symbolic properties of designed systems. While play is obviously a core concern of game systems

such as this, we contend that playfulness also has a role in the design, use, and appropriation of all technical systems.

Performance

Collaborative systems depend on users' performance of collectively visible, accountable and interpretable actions beyond that needed as computer input, as resources for others as well as ourselves [7]. *Propinquity* posits performance as enabled by and contributing to collective play and expressiveness, where the acting out of physical and social embodiment fosters the mutual understanding needed to perform comprehensibly. Coupling and interaction enable performance *through* a digital system.

Social Production

Social production is typically concerned with the ways in which collective human interaction gives meaning to technologies in their social contexts. We agree with the importance of such processes, but we also take “production” more literally. There is an increased interest in low cost, hackable and repurposable technologies [6] and design for appropriation by users or non-specialists. We both use such technologies in our prototyping process, and wish to support our users' collective repurposings. By changing the locations of sensors, or their own style of movement, players may interpret *Propinquity* as either a dancing or a fighting game. We aim to support end-user level design, and to make code and hardware transparent to users, enabling them to play with our system at any level, including hacking and appropriation.

CONCLUSION

Propinquity is both a game and a design intervention, or “object to think with”, aimed at exploring issues of embodiment, expressiveness, play, performance and social production, that are important for Ubicomp interaction in general. As a demo, it provides us with an opportunity to encounter these issues in an embodied, rather than textual, fashion.

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