

WiiArts: Creating collaborative art experience with WiiRemote interaction

Hyun-Jean Lee, Hyungsin Kim, Gaurav Gupta, Ali Mazalek

Synaesthetic Media Lab, GVU Center

Georgia Institute of Technology

Atlanta, GA 30332 USA

{ hyunjean.lee, hyungsin, gupta.gaurav, mazalek }@gatech.edu

ABSTRACT

WiiArts is an experimental video, audio and image processing art project that makes use of pre-existing sensing technologies provided by Nintendo WiiRemotes and a Sensor Bar. Currently, most WiiRemote-based physical interactions have been designed to mimic the gesture of body movement in sports and other action-based games. These Wii games are generally competitive in nature, and players interact by responding to predefined interaction rules in either a single-user or multi-user mode. Making use of the WiiRemote as a pre-existing tangible and embedded interface, we explore applications that can engage participants in active and expressive art creation in a collaborative manner. In this paper, we describe several prototype applications based on this concept: *Illumination (draWiing)*, *Beneath (Waldo)*, *WiiBand*, *Time Ripples*. In these applications, three interactors can work together to compose both images and sounds.

Author Keywords

WiiRemotes, interactive video and sound, collaboration, multi-user interaction, creative and expressive art experiences.

ACM Classification Keywords

H.5.1. [Information interfaces and presentation]: Multimedia Information Systems--*Audio input/output, Video (e.g. real-time image processing)*; H.5.2. User Interfaces---*interaction techniques, input devices and strategies, Screen design* H.5.3. Group and Organization Interfaces---*collaborative computing*; J.5 [Arts and Humanities] *Fine Arts, Performing arts (e.g., dance, music)*.

INTRODUCTION

These days, computer games are no longer just a single

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genre of entertainment for individuals. As they increasingly spread across the daily life experience of individuals, they also make big impacts on society, both commercially and socially. As a result, game culture and technologies are drawing research interest from many fields, such as graphic design, computer science, and HCI. Also this growing attention from diverse fields leads mass-market computer game applications and consoles to make use of up-to-date methods of player interaction. The recently released Nintendo WiiRemote interface reflects this trend of novel interaction techniques, by providing motion sensing capabilities integrated into a tangible remote control device. Using the WiiRemote, game players can achieve embodied interaction within the range and accuracy constraints provided by the sensing technology. This form of interaction provides a greater freedom of body movement than single-user GUI-style mouse interaction in front of a computer screen. In addition, this interface offers multi-user game experiences with the help of its wireless physical interfaces. Nintendo named the system ‘Wii’, which sounds like ‘We’ and is represented with a combination of two ‘i’ characters, evoking the idea of a wireless (Wi-Fi) gaming service [5]. As Don Norman pointed out, this trend can be interpreted as the return to physical devices, where we control things through physical body movements, by turning, moving, and manipulating the appropriate mechanical devices [8].

On the other hand, whether they are single- or multi-user, we found that the themes and goals of games still tend to be competitive in nature. For example, even though many multi-user physical interaction-based games developed for the Wii console have a strong potential for collaborative play, they are still very goal-oriented and tend to focus players on competition, e.g. earning the highest scores. Moreover, although physical movement is the main method of interaction in WiiRemote-based video games, the actual movement in these games mimics the gestural movements in sports games, for example, throwing a bowling ball or swinging a baseball bat. The direct one-to-one relationship between the virtual action on the screen and the real-world action of the player reinforces the invisibility or “transparency” of the interface, rather than redirecting the user’s “reflexive” awareness toward their own body [1, 7].

We propose to use the WiiRemote as a pre-existing game interface to explore possibilities for constructive cooperation between interactors. Therefore, the use of the interface can be extended to non-competitive applications. Particularly, we want to use multiple WiiRemotes simultaneously to incorporate more expressive interactions. Thus our WiiArts project explores the possibilities of using a game console for creating collaborative, active, expressive and creative art experiences. Based on this concept, we have built several WiiArt prototype applications, including *Illumination (draWiing)*, *Beneath (Waldo)*, *Time Ripples*, and *WiiBand*. In these applications, up to three interactors can work together to compose both images and sounds. In this paper, we first describe related works that experiment with and repurpose the Wii console for other uses, and then examine the possible parameters for WiiRemote interactions. Next, we demonstrate each of our WiiArts applications as a series of individual design experiments exploring possibilities of artistic experiences. Finally, we discuss the future work for WiiArts.

RELATED WORK

The WiiMedia study examines how the WiiRemote can be used in order to enlarge non-professional game development environments with an innovative new game controller. For their case study, they developed several applications such as *AceSpeeder2Wii*, *JaWii's Virtual Fencing*, and *Papier Poupee Painter* [10]. This study focuses on the development of motion analysis for better motion detection. The Pinocchio project tries to build a system to enable children to experience and develop an understanding of classical music by conducting a virtual orchestra with a WiiRemote [2]. *Wii Music: Orchestra*, a part of Nintendo's Wii series, also simulates playing musical instruments using the WiiRemote [13]. *Wii Music* is similar to our *WiiBand* in its use of the WiiRemote to control music, but instead of composing music, players conduct pre-existing music and are assigned a score as a measure of their performance. In this sense, *Wii Music* creates a game experience from the artistic act of conducting music. The *Wriggle* project also repurposes the WiiRemote for a different environment, by allowing multiple players to use their body movements to create expressive emotional traces [6]. However, this project remains geared toward game-play. In contrast, our WiiArts applications experiment more with the possibilities of using the WiiRemote as a tool for creating collaborative and expressive art experiences.

WIIARTS PROJECT

Project overview

WiiArts is an experimental video, audio and image processing art project that invites viewers into a collaborative and expressive art experience. It uses pre-existing sensing technologies provided by Nintendo's WiiRemotes and a wireless Sensor Bar. In its current form, three interactors can work together to create and compose images and sounds.

All of these applications provide an environment in which multiple people play together in front of a large projection screen. Since WiiArts aims to promote collaboration among multiple users, the projection screen functions as the primary means of shared visual output. In comparison to a TV screen, it provides users with a more immersive feeling in their interactions with the virtual world. Also, since this is an art project, we envision putting these applications in museum or gallery settings. For this reason, multiple participants can interact together while other viewers engage with the piece by watching the interactors' performance. Currently all WiiArts applications are built in Max/MSP/Jitter.

Interaction Parameters provided by the WiiRemote

As the primary controller for Nintendo's Wii console, the main feature of the WiiRemote is its motion sensing capability through accelerometers and infrared detection. These capabilities allow the user to interact with and manipulate items on screen via movement or pointing. Thus, interactors use the WiiRemote to control the image through pitch, yaw and roll, by moving their hand up/down, side to side, and by twisting their wrist. In addition to motion sensing, the WiiRemote has buttons (up/down, left/right, A/B/C, etc.) that can be used as direct inputs, e.g. for menu selection. The controller connects to the computer using Bluetooth. Based on this diverse set of interaction possibilities, we have designed several interactive WiiArts applications.

WIIARTS DESIGN EXPERIMENTS

Illumination: Tracing with candlelights



Figure 1. *Illumination* screen capture based on single Wiiremote interaction with a live image of candlelight.

Illumination is a real-time video art piece that draws fluid candlelight traces (Figures 1 and 2). In its current form, the projection screen becomes a shared drawing canvas, and up to three users can draw simultaneously with their own WiiRemotes. The candlelight source imagery is captured from three burning candles in real-time. Thus, the three candlelight traces drawn by three interactors can be composed together to create a dynamic drawing. Since this drawing uses light in a dark space, the overall process of drawing provides a contemplative aesthetic experience.

Illumination is our first implemented scenario for the broader *draWiing* application. *draWiing* is a painting or drawing tool, similar in concept to the Papier Poupee Painter application described above. In contrast however, it uses real-time imagery captured from a camera as the visual source for the brush. As seen in Ryokai's *I/O Brush* [9], the expressions created with captured imagery can be different from those which use pre-existing drawing textures, such as pre-programmed crayons or pastels. However, in the case of *Illumination*, the source imagery is captured from a static camera over time, rather than explicitly selected from the environment in a short moment. Like Jackson Pollock's drip painting created through physical actions on a canvas, interactions with the WiiRemote are marked as traced images of bodily movements over time.



Figure 2. The composed image that is captured from a real candlelight in *Illumination*.

Beneath: Revealing the image beneath the surface

Beneath is another video piece created with real-time image processing in Jitter. The WiiRemote controls a flashlight or magnifying lens that viewers can use to expose portions of the image hidden beneath a black top layer. Depending on the images hidden beneath the dark layer, the revealing experience can evoke emotional responses from viewers, e.g. a sense of fear or guilt, similar to the perspective provided by the camera eye in films such as Hitchcock's *Rear Window* (1954).

Based on this concept, yet with a more playful intent, we also allow users to examine a *Where is Waldo?* illustration by Martin Handford [4] through a collaborative revealing process. Waldo illustrations usually engage viewers in the process of finding a small and hidden Waldo amongst crowds of people. Three interactors, each holding their own WiiRemote, can collaboratively search for Waldo on the projected image, as if they were searching for a lost friend in a dark place. In fact, this experience of finding Waldo could become a form of game-play in the sense that it encourages interactors to be the first to find Waldo. Yet we

are more interested in collaboration, and instead encourage viewers to help each other in finding Waldo. To support this, the interactors are all jointly rewarded when Waldo is found, as the three magnifying lenses simultaneously increase in size to reveal the entire illustration. As a result, the overall experience is designed to promote collaboration between people rather than leading them to have competitive feelings. We also believe that this can be extended to applications like collaborative “Easter egg hunts,” e.g. looking for hidden treasures such as three-character-words like “CAR.” If three interactors each highlight one of the letters at the same time, they might be rewarded with appealing visual animations or effects.

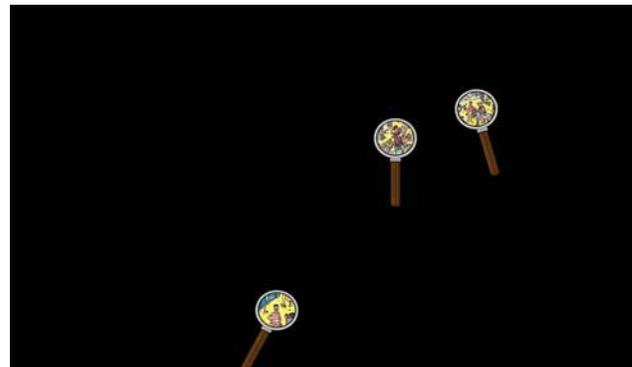


Figure 3. Waldo screen image with three Wiiremotes interaction.

Time Ripples: Space/time mapping

Time Ripples is our first prototype of a real-time video-processing artwork that explores experimental time/space mappings. Viewers can point from a certain location on the projected video image to another in order to reveal different moments of time at that section of the video frame. This revealed time slice automatically shrinks as time passes, creating a ripple effect as the surface returns to the original time (Figure 4). In Camille Utterback's *Liquid Time Series*, the viewer's body distance from the screen determines the video flow, varying the space/time relationship in the video image: as the participant moves closer to the projection screen they push deeper into time, and as they move away the fragmented image heals in their wake [11]. *Time Ripples* provides similar perceptual experiences by manipulating time within video imagery. Another related piece, *Khronos projector*, manipulates time and space in complex ways by cutting them in a volume [3]. While the above two pieces use pre-recorded video as the source imagery for temporal manipulation, in *Time Ripples* we use cameras that face different spaces, providing a means to capture different moments of a real-time space.

WiiBand

WiiBand is a prototype version of real-time MIDI audio-processing application that is built in Max/MSP. Three interactors collaboratively create music using WiiRemotes. The control of the Y-axis (pitch) changes the volume of the sound and the control of X-axis (yaw) changes the pitch of

the sound. Twisting movements (roll) of the WiiRemote change the instruments. The three-person interaction thus becomes a real-time musical performance, like a band. Eventually, the piece will also provide projected visual feedback to accompany the music.



Figure 4. *Time Ripples* screen capture based on two user WiiRemote interaction.



Figure 5. Three user interaction with *Time Ripples*.

FUTURE WORK

In our current art/design experimentations, we have found that most interactions have focused on surface navigation using the X-Y axes movement with WiiRemotes. In the future, we plan to explore ways of more actively using the button control and 'roll' interactions. For example, we believe we can achieve more delicate and sophisticated interactions in our *draWiing* applications (e.g. *Illumination*) by providing an extra parameter through twisting movements of the WiiRemote (roll). For instance, 'roll' interactions could be used to provide different stroke weights. Also, we plan to embed multiple Sensor Bars throughout the room in order to enable a greater range of body movements, such as the full extension of both arms. Our art/design experiments are still in the early stages of development, and as such we also hope to install them in shared spaces, such as galleries and exhibitions in order to gather participant feedback and further refine our interactive designs.

CONCLUSION

In this paper, we have introduced several applications from the WiiArts project, which experiments with the possibility of using physical interactions with multiple WiiRemotes to provide expressive and creative experiences. These applications demonstrate the reuse of a mass-market game console which can serve as a potential platform for creative works. Our exploration of the WiiRemote in an artistic context also demonstrates the potential for art to be experienced through an inter-relationship between the human body and computational media. Therefore, the WiiArts project provides a new means to bridge our interactions across the physical and digital worlds through physical embodiment, and in this context can inspire more people to experience the aesthetic world.

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