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# The Woods: A Mixed-Reality Cooperative Game

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**Abstract:** While loneliness in our real lives is increasingly recognized as having dire physical, mental, and emotional consequences, cooperative games have been shown to build empathy and provide positive social impact. In this paper, the authors present "The Woods," a local cooperative, mixed-reality game using augmented reality and 4-channel audio spatialization panning that provides players with face-to-face interactions in pursuit of a shared goal. This paper discusses the narrative, mechanical, and sonic components of the game, as well as the game's development process and the players' experiences. The goal of our team is to develop a narrative-driven AR game that promotes collaborative problem-solving and engages players in an emergent physical and digital experience.

## Introduction

"The Woods" is a mixed-reality, two-player cooperative game that addresses the perils of social isolation by promoting connections between people and actively engaging them through play. Using augmented reality (AR) and 4-channel audio spatialization panning, players choreograph their movement in real-world space while interacting with birds, clouds, and other objects in virtual space. In pursuit of a shared goal, players experience an immersive sonic narrative of rumbling storm clouds and disconnected voices that culminate in stories of hope and reconciliation. The design intent behind "The Woods" is to illuminate human connections to others and to celebrate this through collaborative play [1].

Since the 1980s, the percentage of American adults who say they are lonely has doubled from 20 percent to 40 percent [2]. Research has also indicated that increases in mobile phone use and online networking in contrast to face-to-face interactions have had a negative impact on children's health, specifically citing screen time, "phone addiction," and lack of physical activities as potential health-related challenges. These same challenges can be detrimental to a young person's mental and social well-being; can lead to isolation, depression, and cyberbullying; and can contribute to increased suicide rates. While loneliness in real life is increasingly recognized as having dire physical, mental, and emotional consequences, the goal of "The Woods" is, through creative inquiry, to examine how technologies can be reimagined to strengthen connections between isolated persons through play and collaboration, and to create a dialog at the intersection of the arts, humanities, and human-centered technology [3],[4],[5].

Expressive, playful, collaborative, and physical, "The Woods" illuminates our connections to one another and communicates the importance of fostering positive social interaction through face-to-face engagement and the power of the human voice (see Figure 1).

**Figure 1**
"*The Woods*" being played in The Urban Arts Space, Columbus, Ohio.

### Narrative

The narrative of "The Woods" is built around the broken relationship of two adult siblings who have been separated and out of contact with each other for a considerable amount of time. One of the siblings, in a desperate attempt to reach out and reconcile with the other, is heard leaving a voicemail. In the beginning, players hear only fragments and distorted chunks of the voicemail message and are unable to decipher meaning or intent. However, as the game progresses through player collaboration, the message becomes clearer. Ultimately, players hear the message in its entirety and learn that, although the two siblings haven't spoken in years, both yearn to mend their severed ties and reconnect.

This narrative of reconciliation between these estranged siblings informs the mechanics of the game itself, with the players coordinating their efforts with one another in pursuit of a common goal. The game is designed such that it is not enough for one player to do all of the work. Rather, success requires the combined work of both players. As players engage one another and contribute to the goal together, the game rewards them with the unfolding narrative of the siblings reconnecting with one another. However, even if players fail to find success during the game, the mechanics reinforce that the two players are still connected to each other.

### Mechanics

As a two-player game, "The Woods" is unique in how it enables players to physically collaborate with their whole bodies. A client-server model exists between the players' phones and the Photon Unity Network where each client renders the game based on its shared positional data. We accomplish this by tracking the positions of each phone relative to an AR marker located on the floor as players move about the 12-foot diameter game space with their positions synched over the network. Based on the calculated positions of each client, we connect the players together by placing a virtual branch at their midpoint (see Figure 2). As players move their phones through

physical space, the branch simultaneously moves accordingly in virtual space. Thus, players must choreograph their movement and, by extension, the branch to provide a perch for virtual birds to land on. The game checks for collisions between the branch and two other virtual objects. If a collision occurs between the branch and a bird, then the bird will land on the branch and a new fragment of the aforementioned voicemail will play. Alternatively, if a collision occurs between the branch and a storm cloud, then a crash of thunder erupts, and any birds that had been caught scatter and fly away. These game mechanics are designed to parallel the narrative of the isolated siblings who are navigating their own obstacles in order to reconnect with one another.



**Figure 2**
"*The Woods*" being played in The Urban Arts Space, Columbus, Ohio.

**Audio**
"The Woods" employs the human voice as a mechanism for expressing motivation and intent in the narrative. Our idea in "The Woods" is for the voice to trace a path from isolation to communication while creating an immersive narrative experience. The real-time soundscape of "The Woods" also uses both samples and synthesized sounds and a combination of such spatialization techniques as point-source spatialization, vector-based amplitude panning, and ambisonics to create immersion. We use two channels of audio (home performance) or four channels (installation performance), and the number of channels can be further extended. The sound engine is the open-source graphical programming environment Pure Data (PD), interfaced with the Unity3D game engine via OSC messages sent on a local network.

Our audio configuration (see Figure 3) is designed to expand virtual space beyond the phone screen, making the storm clouds into sonic experiences as they drift by the players, underscoring the obstacles that can make connecting with others difficult. In contrast to the global sounds of the storm, the sibling's voicemail that is delivered by the birds after they have perched on the branch is played only through the phone speakers, providing a more intimate and private experience for the players.
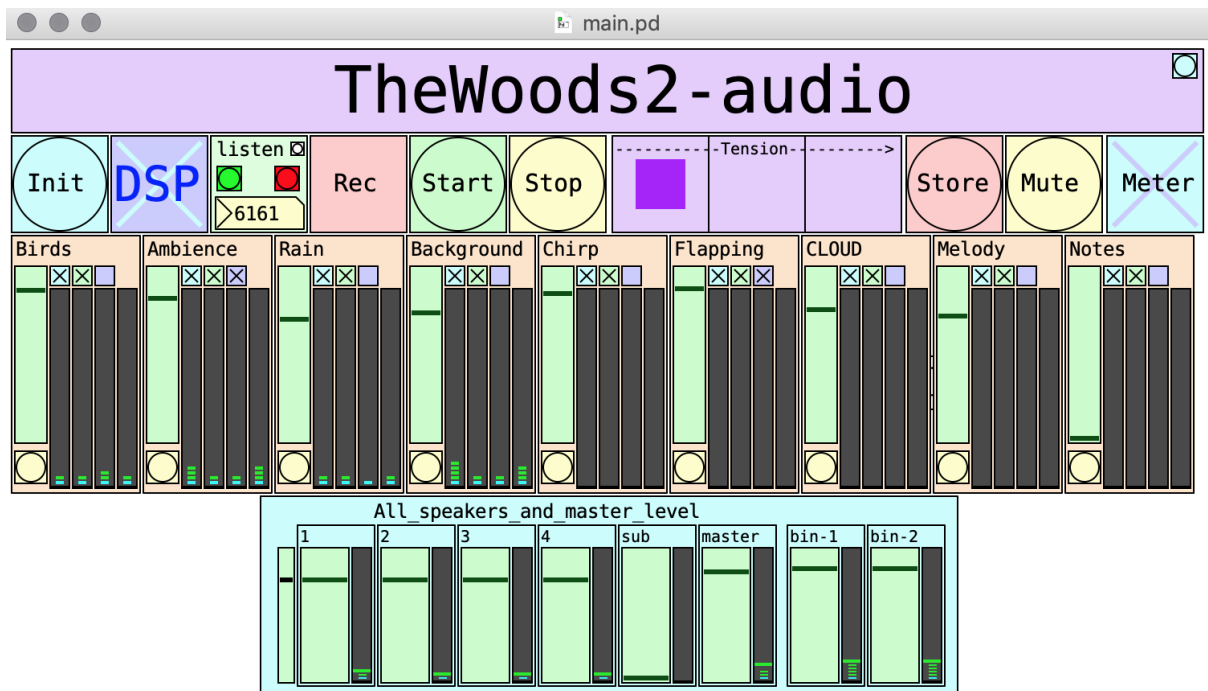
**Figure 3**
Screenshot of the open-source graphical programming environment Pure Data (PD).

**Comparison to Other AR Games**

Traditional tabletop games are social, but the static nature of their physical media limits the scope of realizable games. On the other hand, some claim that one drawback to most computer games is that they lack face-to-face social interaction. Therefore, with "The Woods," we seek to combine the benefits of computer and tabletop games to provide new and engaging gaming experiences.

In fact, as a cooperative AR game, "The Woods" promotes face-to-face interactions over screen-based interactions. It can only be played in person because the game is built upon the players' adjacency to one another. Furthermore, the phone as an AR device is not the focus of interaction with the other player. After the start of the game, there is no direct interaction with the phone other than holding it and using it as a viewport. In "The Woods," the player's interaction with the other player extends beyond the phone and into the space in which they are playing together. There are no touch-based or gesture-based interactions. Rather, the primary purpose of the phone in "The Woods" is to provide the players with feedback and encourage verbal and physical collaboration as they negotiate the game environment together, locating birds in flight, moving the branch toward birds to provide a perch for them to land on, and evading storm clouds.

The emphasis on physical over screen-based interactions and a deeply interwoven narrative help to distinguish "The Woods" from other contemporary AR applications. While games like "Codename Neon" and the more recent "Secret Oops!" have helped to redefine AR games as physical experiences, the interactions with other players and various game objects are still primarily on-screen. In "Codename Neon," 3D space is translated into 2D space in order to detect "hits" when engaging other players by touching the screen [6]. In "Secret Oops!" players interact with the game by pressing large colored buttons on their phones [7]. In contrast, "The Woods" does not offer a non-AR mode and cannot be played alone. Rather, it can only be played in a physical space that the players must continually negotiate together.

**User Experience**
"The Woods" is a collaborative effort, each player's experience of the game is a direct result of verbal and physical coordination with the other player. This face-to-face experience has been central throughout the development of "The Woods" and occurs almost continually during gameplay. Because each player controls one end of the branch, neither player can effectively move the branch through space alone. Rather it requires both players. Whether players are in pursuit of the birds or evading storm clouds, their experiences of their coordinated efforts deepen significantly because of this connection between them (see Figures 4 and 5).



**Figure 4**
"*The Woods*" being played in The Urban Arts Space, Columbus, Ohio.



**Figure 5**
"*The Woods*" being played in The Urban Arts Space, Columbus, Ohio.

## Conclusion

The strength of cooperative games is that they promote social interaction, build empathy, and improve personal relationships by encouraging players to work together to achieve a common objective. "The Woods" further expands this by promoting real-world, physical space interactions over screen-based interactions, made possible through our unique design of AR and audio spatialization. Expressive, playful, collaborative, and physical, "The Woods" illuminates our connections to one another and communicates the importance of fostering positive social interaction through face-to-face engagement while prompting our players to coordinate their efforts, discover what connects them, and work together in pursuit of shared goals.

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