

Last Tank Rolling: Exploring Shared Motion-Based Play to Empower Persons Using Wheelchairs

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ABSTRACT

This paper presents *Last Tank Rolling*, a collaborative motion-based military survival game in which players using wheelchairs are invited to apply their assistive device to control a tank. The game offers a strong in-game metaphor for the wheelchair, and invites joint physical interaction that encourages able-bodied players to perceive their peer as a competent collaborator. Ultimately, this project aims to explore the value of shared video game play as a means of empowering people with disabilities, and connecting players of all abilities to foster inclusion.

INTRODUCTION AND BACKGROUND

Connecting people using wheelchairs and able-bodied persons in a positive context is an important step towards fostering inclusion [8]. Research on video games suggests that they can be a tool to promote positive relationships among players by increasing empathy and engagement [2, 3]. Findings on motion-based games demonstrate that players become more engaged not only with the game but with each other if movements are natural [7]. However, developing games with wheelchairs specifically in mind has usually been a single-player process [1, 4]. Recently, projects like *Liberi* [6] have begun to explore the value of collaborative motion-based play for persons with mobility disabilities, and work on player balancing in a competitive context [5] has demonstrated that incorporating wheelchairs in motion-based games provides an opportunity for engaging players of all abilities.

In this project, we explore whether collaborative motion-based games can be leveraged to empower persons using wheelchairs, and connect them with able-bodied peers. We present *Last Tank Rolling*, a collaborative motion-based military survival game in which players are invited to apply their wheelchair to control a tank, and players need to work

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CHI PLAY '14, Oct 19-22 2014, Toronto, ON, Canada
ACM 978-1-4503-3014-5/14/10.
<http://dx.doi.org/10.1145/2658537.2661303>

together to withstand enemy troops. The game aims to empower persons using wheelchairs by offering a strong in-game metaphor for the wheelchair, and through joint physical interaction that encourages players to perceive their peer as a competent collaborator.

LAST TANK ROLLING: SHARED MOTION-BASED PLAY TO EMPOWER PERSONS USING WHEELCHAIRS

To explore the integration of wheelchairs in shared motion-based game interaction, we created *Last Tank Rolling*.

Design Rationale

Last Tank Rolling was developed with a focus on providing an empowering experience for the player using wheelchair input; it is a 2D vertical scrolling military survival game, players need to collaborate to withstand enemy troops. The basic game concept was developed by an interdisciplinary team consisting of researchers in human-computer interaction, sports and exercise science, practitioners, and persons using wheelchairs at an AHRC workshop on performance and games at the University of Lincoln.

Game Concept and Joint Player Actions

In *Last Tank Rolling*, players need to work together to defeat waves of enemy forces and reach their military base. The game implements two player roles: the person using wheelchair input controls a tank, the other player controls a soldier. The game leverages differences between the roles to create a complimentary set of skills and abilities; while the soldier is agile, but vulnerable, the tank has a higher resistance to enemy fire, but depends on the soldier for repairs. To underline this reciprocal relationship, players need to overcome a number of in-game challenges, each associated with a specific combination of player input.

Both players need to *navigate the territory* by avoiding obstacles, e.g., abandoned vehicles, the tank driver needs to ensure that the soldier is safe. If an enemy air strike occurs, the soldier needs to *seek shelter* behind the tank to stay alive. While the soldier's health is replenished automatically, *tank maintenance* after enemy fire has to be performed by the soldier. Both players can individually *fight enemy troops*. The soldier can fire at a higher frequency but deals little damage; the tank has a low firing rate, but enemies take extensive damage. Players can combine strength by entering a *joint firing mode* (Figure 1).



Figure 1. Collaborative input in Last Tank Rolling: Seeking shelter (left), tank maintenance (middle), and joint firing mode (right).

Prototyping Phase

The prototyping phase focused on interaction design to reinforce the idea of empowering players using wheelchair input, and highlighting reciprocity between both players.

Interaction prototyping: Collaborative input. We followed a Wizard-of-Oz approach to identify suitable forms of shared player interaction that would strengthen the role of the player using wheelchair input. Figure 1 gives an overview of collaborative physical player input. The goal of these interactions is to implement the wheelchair in a way that adds value to the game and empowers the player by offering an important and powerful in-game role, and to emphasize reciprocity through synchronous player actions.

Interaction prototyping: Individual input. We created a digital prototype (Figure 2) to assess the feasibility of individual body-based and wheelchair-based game input. The prototype was implemented using Game Maker, the Kinect SDK, and the KINECT^{Wheels} toolkit [4]. Basic wheelchair movements control the tank (moving back and forth, turning to sides), weapons can be fired by extending one arm to the front. Tank speed controls game speed.

NEXT STEPS AND CONCLUSION

Last Tank Rolling is currently being implemented into a fully playable game. It is planned to evaluate the game in terms of player experience as well as its potential to connect players together with St. Francis School for children and young adults with special needs in Lincolnshire. The goal of the next phase of this project is to validate the potential of collaborative motion-based play to empower persons using wheelchairs, and to study whether it is possible to foster inclusion through positive shared experiences. The first study will explore whether persons using wheelchairs can be empowered by experiencing physical competence through motion-based play. In a second study, we will

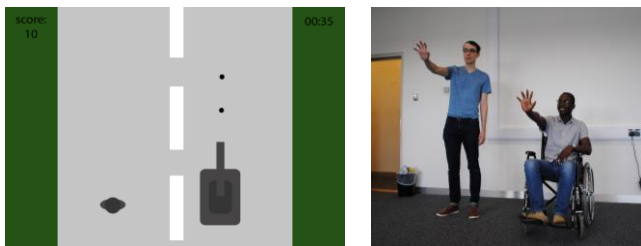


Figure 2. Digital prototype and interaction prototyping.

focus on the able-bodied player, and whether shared motion-based play that puts persons using wheelchairs in a strong in-game role has the potential of positively influencing the way able-bodied persons perceive peers with mobility disabilities. We believe that motion-based games could be a new tool to empower persons using wheelchairs. This project is a first step towards exploring whether shared video game play has the potential of empowering people with disabilities, promoting positive attitudes towards them, and connecting people of all abilities to foster inclusion.

ACKNOWLEDGMENTS

We would like to thank all workshop participants for their contribution to our game concept, and Kieran Hicks for implementation support.

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