

Beyond Cooperation: Three-Way Body Transfer Illusions For Physical Play

Jakub Sypniewski¹ & Robb Mitchell²

¹University of Salzburg, ²University of Southern Denmark

jakub.sypniewski@sbg.ac.at, robb@sdu.dk

Abstract. Video is often used to give people sensations or insights into another person's perspective via providing real-time feeds of first-person viewpoints. Less explored is rapid and dynamic perspective changing that can make it uncertain for users whether or not they are viewing a direct feed, and if they are viewing themselves or another. We present a 3-person wireless headset system developed as part of an investigation into new forms of collaborative physical play. Each headset incorporates an external video camera and an internal screen that provides its wearers with visual information. Camera transmissions are rapidly and automatically switched to be received by different headsets, thus providing wearers with continuous cycling through 2nd and 3rd person perspectives. By asking participants to join a simple collaborative task in a shared physical space but dislocating their sense of sight, the system explores the interdependencies of users' actions and their communication in an unusual configuration.

Introduction

In “Beyond Being There”, Hollan and Stornetta (1992) questioned whether the goal of computer-mediated communication should be to merely replicate the qualities of face-to-face conversation. They concluded that technology was likely to abolish understandings of what it means to be collocated. We are also interested in how small groups can go “beyond being there”. We have been experimenting with developing wearable systems to challenge perceptions of the boundaries between self and other and thus explore new forms of triadic cooperation. We are curious how being highly interdependent, unsure of one's exact location and experiencing

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ambiguity as to whether one is seeing oneself or another might affect collaborative physical activities. We are intrigued by the possibility that cycling through receiving visual streams from different directions might confuse participants not only about which camera they were looking “through”, but also whether they were looking at themselves or another.

Through extending aspects of dyadic body transfer illusions (Petkova and Ehrsson 2008) into three-way interactions, our work offers a new form of interdependent play (Mitchell et al. 2015, Isbister et al. 2017) experience. However, our combination of video-mediated and collocated encounters may also provoke discussion on designing for cooperative work and social interaction more generally. For instance, facilitating a radically alternative set of relationships between accountability, visibility, and awareness vivifies aspects of social translucence (Erickson & Kellog 2000).



Figure 1. Three headset wearers attempt to explore the world together. A screen inside each helmet is receiving a visual stream from a camera mounted on the front of another wearer’s helmet. An Arduino rapidly and automatically switches the camera transmissions between different headsets.

The Channel Surfers Platform

In this demo we will deliver an abridged version of intense, immersive experiences we trialled with over 80 participants at cultural festivals in Finland and The Netherlands. Our intention was to create and understand new forms of teamwork and social play. We have been fascinated by the great variety of ways users feel and act in response to the following set up:

Three participants will be asked to stack cardboard boxes into a tower while dressed in white full body suits and experiencing the world from a constantly switching 2nd and 3rd person video camera perspective. The participants will form a triangle by standing approximately 3-5 meters from each other, facing the centre of the formed triangle. A cardboard box will be placed in front of each participant. Participants are instructed to pick up one box each and to form a tower in the middle of the area (marked on the floor using sticky tape). The participants are allowed to talk and touch each other. There is no time limit.

White Suits and Silver Boxes

Participants are asked to wear white, full-body suits, and lightweight box helmets (figure 1). The suits are used to conceal users' normal clothing and thus making them less recognisable to self and others. The helmets have three purposes. First of all, they act as a housing for the system's hardware. Secondly, as the suits, the large box helmets disguise the users' visual identities and facial expressions. Lastly, building upon earlier experimentation (Sypniewski et al. 2018) placing the large helmets on users' shoulders instead of on their heads, slows down participants' movements, thus stabilising the transmitted video image seen by the others, and reducing the chances of motion sickness.

Perspective Cycling Hardware

The system is based upon modified radio transmitted, first-person view equipment, commonly used for piloting radio-controlled hobby vehicles, such as model airplanes. Inside each helmet, the wearer faces a 4.3-inch head-mounted colour video display. On the external front of each oblong helmet, a small factor camera is mounted. Also attached to each helmet, but more discretely, are a transmitter and radio receiver wired up to an *Arduino Uno*¹ microcontroller, and a lithium polymer battery. The Uno is programmed to switch frequencies of radio receivers. Using radio transmission allows for low image latency, increased distance between users, and independence of the locally available network infrastructure. This solution is

¹ <https://www.arduino.cc/>

inexpensive, but results in rather low fidelity of the displayed image (480p) and occasional video noise and artefacts.

Feed Switching Behaviour

The Channel Surfers system removes the users' own perspective on the world. Instead the feeds cycle between the points of view of the other two users. The switching of perspectives happens every 15 seconds and is synchronised across the headsets. The interval is long enough for users to understand their position in the physical space and progress in a task, but not long enough to complete it. It is the relation between the short switching intervals and longer time needed to complete a task that forces the users to shift their attention and actions towards a different collaborator. The three-way split further complicates the interdependency. That is, no participant will receive and give video signal from and to the same user at any given time. A user will receive a video feed from the perspective of one participant and at the same time transmit their perspective to another, different participant.

Acknowledgments

We wish to thank Jakub Rybar and Steven Klingberg for the collaborative development of this project, and Leif Bitsch for generous advice on technical aspects.

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