

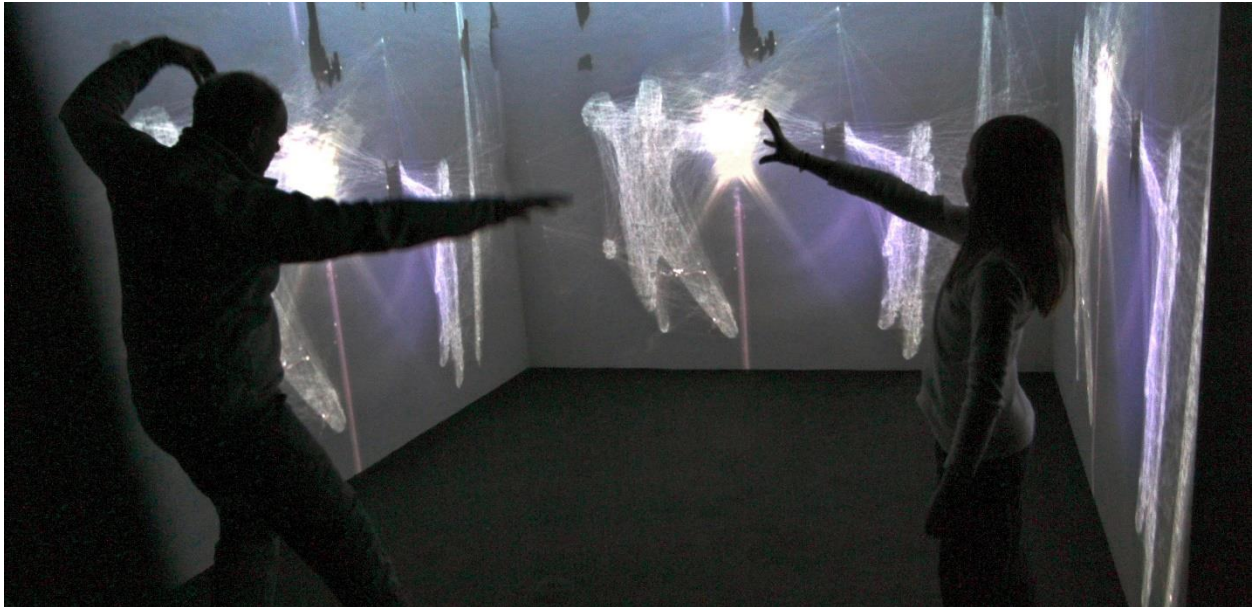
# FLYING, SPINNING, AND BREAKING APART: LIVE VIDEO PROCESSING AND THE ALTERED SELF

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When viewing our own altered image, live video processing has the ability to influence sensation, movement and expression. While artists have explored extending the body via video projection, scientists have made significant progress in understanding how we perceive and locate the body in media environments. Here, scientific research is used to examine the body in interactive video performances and installations.



*Fig 1. Participant with bright reflected light filling the body*



*Fig 2. Two participants attached by webbing*

## 1. Introduction

From the early sixties video synthesizers, to recent iPad2 apps, people have always been fascinated with fantastically altered versions of themselves. As real time video representation of the body becomes more and more common through video chat and teleconferencing, some people will want to exert creative control over their image. And although the video image is wholly constructed with digital data, and therefore capable of infinite manipulation, it is tethered to a live human being. No matter how abstract the image becomes, its gestures are not that of an algorithm, but a spontaneously acting person –the language and expression of a moving, sensing body. However, video processing is not "neutral," it changes our perception, which can be keenly observed when viewing an altered version of our selves.

This paper draws from recent studies in cognitive science, and observations from the past fifteen years of the author's creative work in dance and installation to examine the experience of live video processing and the body. In these artworks, scale is important; the projections are approximately life size to act as a mirror to reflect back the participants' movements. Whole body movements are also important; the participant is fully engaged with freedom of movement, a sense of balance, and kinesthetic response. While these works deal with the translation of the physical to the digital, what is most interesting is the feedback loop back: the digital image alters both human movement and sensation, which, in turn, alters the processed image. Viewers tend to imitate their altered image, finding a limited repertoire of movement that "resonates" with their digital double. They often report a feeling of immersion or presence within the video image.

How do these processed images add new knowledge of our selves? How do we “feel” when observing our bodies extended, warped, colored or delayed in time? How are group dynamics affected when people find themselves interacting with others in the same altered world? Video processing adds new information, changing the meaning and perception of our own image.

In previous work using movement-activated sound for dance and installations, I noticed a strong intuitive tendency for participants to use gestures that match the physical quality of the sound. For example, high impact sounds caused by breaking or hitting, would elicit sharp, quick movements, while quieter ambient sounds would suggest longer sweeps with the limbs. Thus, participants’ efforts are closely aligned with imagined physical forces required to make the sounds.

In a similar way, live video processing suggests forces that influence participants’ movements and feelings in their body. People attune to their altered image, just as they attune to each other. One collaborator, dance artist Cindy Cummings, described her performances with her altered video double as “a contact improvisation with an alien version of my self,” each being mutually influential.

Each video process suggests to the viewer a new kinesthetic vocabulary as they view their own body in real time, flying, spinning, or breaking apart. When disruptions are reflected back to the participant, it creates a dynamic interaction that fuses the physical body with its electronic extension. As we will see, these boundaries are often quite blurred.

In an attempt to further understand the experience of being digitally transformed, I have been pulled into some inspiring research in cognitive science dealing with presence and movement. Although I am not a scientist, I have found support and insight for my artistic hunches, gained from personal experience and from conversations with others. I hope it will be helpful to summarize some of the relevant research here, in a very condensed form, while taking some license to speculate on its potential for understanding the experience of participants immersed in a reflective, digitally altered experience.

## 2. Presence and Perception in the Mirror

Although much has been written about embodiment in virtual reality and telematic systems, a special case can be made for artwork dealing with “video mirrors,” where there is a deliberate relationship created with a participant and their video double. Unlike telepresence, which can be tricky to connect with another individual or correctly locate the body, we immediately and intuitively know and believe that our reflected image IS our body. We are real in two places.

To fully examine our embodied experience in these situations, along with the physical (objective) body and the virtual body, we must consider the body image and the body schema. While the body image deals with perceptions, beliefs and attitudes about the body (a huge subject beyond the scope of this paper), the body schema deals with the, mostly unconscious, internal representation of the body that controls posture, movement and location in space.

How do we reconcile the discrepancy between the location of our physical and virtual body? Research shows that our body schema does not always correspond with our physical body.

### 3. Body Ownership – Where is the Self?

*“Our bodies seem to be infinitely mutable, while they never ceased to be our bodies.” - Susan Kozel [1]*

Botvnick and Cohen’s discovery of the “Rubber Hand Illusion” in 1998 opened up a rich vein of ongoing scientific research on body schema. [2] In the original experiment, a fake hand was placed on a table in front of a participant, while the real hand was hidden from view. When the index fingers of the real and fake hands were touched simultaneously, the participants attributed the location of touch to the rubber hand, identifying it as their own. The key finding is that the physical body is falsely located – *the self is located where touch is seen*.

A slew of experiments have repeated this effect, with infinite variation. Several researchers have shown that virtual limbs and whole bodies in virtual reality systems can be “owned;” when simultaneous touch is introduced, participants (falsely) locate their bodies in the virtual environment. One study showed the promise of producing unusual sensations in the body by addressing physical orientation and visual perspective. Participants felt sensations of floating by seeing a video of their prone bodies above where they were actually lying. [3] Visual realism of the hand or body did not seem to play an important role, and anything recognized as a body or a hand seemed to be an acceptable substitute. [4] This identification with body morphology suggests why people identify highly altered video images as themselves.

In these experiments, vision locates the body, and touch proves it. What is especially relevant to artists, however, are findings that free movement, or action can have a similar effect, with more unified results. One study concludes, “Sensory mechanisms generate a sense of body ownership based on fragmented local representation of individual body parts, but action provides a coherent sense of bodily self.” [5]

Even though much of this research deals with a first-person perspective, I believe it helps to explain some of the powerful effects of unencumbered whole-body movement within reflective video installations. These works combine action with sensation: feeling the pressure on the feet, a sense of balance, proprioception, kinesthetic response, or the touch of a friend’s hand – all of this would go towards making participants feel that their body was both in physical space, and believably in the projected space. The physical exertions, effort, pain, balance, and other sensations one experiences from the physical body, also seem to emanate from the projected body.

Participants most often confirm their on-screen existence by waving their hand and seeing an immediate result. If they have come with a companion, they often try to touch each other in the virtual world. Synchronization is key to the mislocation of the body. Even small time delays may disrupt the effect, although video delay can offer a different kind of uncanny feeling, being in both the present and the past.

In my own experience viewing my altered double, I locate myself simultaneously in both my physical body and in the projection. It is not an either/or situation, but rather, a continuum from being fully in my own body and simply observing patterns of projected light, to feeling fully immersed, present and engulfed by the projected space. Most of this has to do with attention. In virtual reality environments, for example, very little attention is on the physical space, as we can’t see our physical body or the room. On the other hand, “mixed reality” installations, such as those referenced here, usually attempt to minimize outside sounds and maintain visual focus by clearing the room of objects, and having the projection(s) as the sole visual material. The continuum of body location would be more balanced in these situations, and may change with the participant’s focus.



#### 4. Identifying Movement and Self-Recognition

Video processing can color, bend, warp and distort images to the point of abstraction and unrecognizability. However, we have a great ability for recognizing human movement, even from the most minimal of detail. Numerous perception experiments that abstract the moving body image to just a few “point lights” (illuminated dots representing the joints of the body) reveal that the distinctive timing, articulation and pathways of human movement are easily recognizable. Even when further distorted by masking, timing or viewing angle, the human form in motion is still visible. Point-light experiments have also shown the inherent “readability” of the expressive body, with our ability to recognize such things as gender, intent and emotions solely from abstracted movement information. [6] I would speculate that with more information, such as that provided by a silhouette, the reading of emotion and meaning is further enhanced.

We have a heightened sensitivity to self-identification in point-light images. Despite the fact that we rarely see ourselves moving, except the occasional look in the mirror, we are able to identify ourselves in a highly reduced point-source image, much more readily than even the abstracted image of a good friend (with whom we have much more experience viewing). We show the highest ability to recognize our own free and expressive movements, such as dance, rather than pedestrian movement. This suggests that our own kinesthetic experience contributes to the visual analysis and perception of movement. [7]

This helps us understand why, even in live video projects where the body is highly distorted, the viewers will recognize and “feel” the familiar rhythm of their own bodies, which will lead them to identify the new image as “me.” Even a literal faint glimmer of the body’s movement can result in self-recognition, as in a scene from the author’s installation “Entanglement Witness,” where the audience’s body appears only as a subtle play of light filtered through autumn leaves.

#### 5. Social Interaction and the Loss of Self

*“Synchronous multisensory stimulation blurred self-other conceptual boundaries even when the perceived other was a total stranger.” - Maria-Paola Paladino [8]*

Once a second person enters an installation, everything changes. We are highly social creatures – there is nothing more interesting to one human being than another! A participant’s experience of the artwork immediately undergoes a highly complex and rich transformation with the inclusion of other people. Live video processing can foster empathy while breaking down the barriers between the self and others. In abstraction, the face is often obscured, or not readable at all in the case of silhouettes, and the details of the body and clothing are missing, allowing many people to experience a liberating loss of self-consciousness. Various problems with eye contact, camera angle and gaze are eliminated. Everyone is in the same “boat” and appears to be made of similar material. As was previously mentioned, the morphology of the body seems to be most significant and this may lead to multiple participants having a feeling of embodiment with their altered image or possibly with others. The focus then turns to the expressive movement of the body, in social interaction with real and “virtual” people, all responsive in real time. The abstract body is still highly expressive, and people will read these images as having emotions, intentions, and personality traits.

I have frequently seen a playful connection and merging with others in my video installations. Some multisensory researchers come to similar conclusions, noting that many interactive social situations present all of the elements for a loss of the real body and loss of self. [9] Others show how sharing embodied experiences enhances social cohesion, and heightens our awareness of similarities between individuals, rather than superficial differences. [10] From a purely sensory experience, subjects felt closer and more positive towards strangers, with a high degree of “self-other overlap,” which is typically experienced with close friends and family. [8]

## 6. *Glint*: Movement and Meaning in the Abstract Body

*“The human visual system appears to be well tuned for the detection of both physical and social characteristics of the human body in motion.”* - Maggie Shiffrar [6]

*Glint* is the title of my recent audio/video installation where viewers see their projected life-size silhouettes filled with various video images and video processes. The specially built room has large projections filling three walls, with an infrared camera used to capture participants’ silhouettes. A hypnotic soundtrack assists in pulling viewers in to a more complete and immersive world. In one section, viewers reported feelings of movement and unsteadiness when seeing their bodies filled with moving water. The discrepancy between their real body on solid ground, and their flowing virtual body, often made them loosen their limbs and sway in sympathetic movements with their video double. If the “Chameleon Effect” has shown that people unconsciously imitate each others behaviors, and if mirror neurons are known to fire in a similar pattern when someone acts or simply watches another act, then isn’t it possible, and perhaps likely, to have a similar unconscious imitative response seeing a highly modified version of ourselves?

In another section of *Glint*, bodies are filled with sunlight reflected off water, which resulted in several people reporting a feeling of warmth over their entire body, or specifically where the brightest light touched their body (Figure 1). In these examples, proprioception and sensation were both influenced by the video image, with reports of people feeling simultaneously within and outside of their physical body.

The installation is often experienced as quite meditative and calming with a single participant, although some did report feeling uneasy being isolated in a darkened room with only a strange version of themselves for company. (An artist of a different ilk might choose more disturbing images playing inside the body, which could illicit deep fear or revulsion.)

To enhance and literally represent social cohesion, a special effect is activated when there is more than one participant; a fine webbing attaches to the extremities of two or more silhouettes when they get close (within 3 feet), shooting out from one body to connect with and touch another (Figure 2). Sometimes traces of the body are left visible on screen, like a living painting that pulls the viewers more deeply into the virtual world.

With the loss of physical detail that might create a feeling of separation or body self-consciousness, participants notice their similarity and connection with other freely moving, and sensing, virtual bodies. The relationships are complex: people isolated with friends or strangers in a darkened room, a feeling of being in two bodies at once, the location or mislocation of sensation, the intense images of flowing water or light, and the overlap and interaction with real and virtual bodies.

## 7. Conclusion

Although I make no claims of the scientific accuracy of my musings, it is inspiring to find scientific discoveries that corroborate and shed light on artistic speculation. An expanded definition of the self, physical and emotional transformation, and merging with others – these are timeless themes in art that technology and science promise to extend; from the audience’s imagination to an immersive, multisensory experience.

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