# IMorphia: An Embodied Performance System

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## Abstract
*iMorphia* combines body tracking, games engine technology and projection to create the illusion of an embodied virtual character within a virtual set. The performer wears a white costume onto which a virtual character is projected creating the illusion of a three dimensional figure, which through body tracking, closely follows the movements of the performer. Video glasses connected to a video camera enable the performer to see their transformed self from the same perspective as the audience. This shift in perspective, 'the embodied performative turn', represents a novel performative form of interaction directed at an audience whilst challenging inherent conventions of screen based interaction.

## Author Keywords
Projection; body tracking; performance; Kinect; Unity; illusion; the uncanny; improvisation; immersion.

## ACM Classification Keywords
H.5.1 Multimedia Information Systems (Artificial, augmented, and virtual realities); H.5.2. User Interfaces (body, gesture).

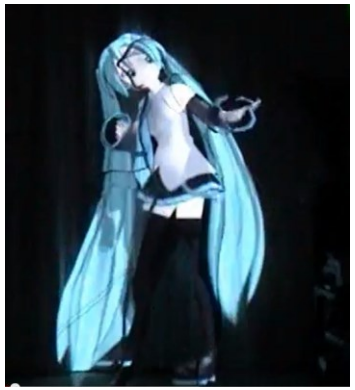

Figure 1: MikuMiku projection on performer wearing a white body suit.

Figure 2: three semi-realistic human characters; female and male from Daz 3D studio and female from Makehuman.

## Statement

Projections have been used to create theatrical illusions dating back to the magic lantern generated phantasmagoria of the eighteenth century 17. With the advent of twentieth century film and video projection, more sophisticated animated illusion became possible as exemplified by the work of Josef Svoboda with Laterna Magika 15 and the recent work of Robert Lepage with Ex Machina 7.

Within dance and video art, projections have also been used to transform the body, a startling example being D.A.V.E (Digital Amplified Video Engine) by Klaus Obermaier 12 which I witnessed in 2002. This particular work significantly inspired my practice based research in the creation of *iMorphia*. D.A.V.E used pre-recorded video and choreographed dance to produce uncanny illusions of body morphing and physically impossible movements. Recent work combining video projection and computer generated imagery, such as the pop promo Sweater by Willow 18, demonstrates the effectiveness in creating a suspension of disbelief when virtual scenery is combined with live action.

The availability of the Microsoft Kinect and accessible games engine technology such as Unity has led to a range of experimental developments enabling the real time control of virtual scenography through body movement and gesture 6. In November 2013 using a combination of MikuMiku Dance, a Japanese dance anime software toolkit and the open source NI plug-in 9, I created my first prototype, *MikuMorphia*, see Figure 1 and website documentation 10.

The marrying of the projected image with the body of the performer creates an illusion of a three dimensional figure; an uncanny digital double. The notion of the uncanny originally formulated by Jentsch 5 then Freud 4 also permeates robotics and CGI in the form of the Uncanny Valley 11; a liminal in-between space causing cognitive discomfort when something cannot be distinguished as either human or non-human. In creating believable robotic or filmic illusions, the Uncanny Valley is to be avoided, whilst within the arts and literature, the uncanny is seen as a creative and provocative space 14.

In order to explore the creative potential of the uncanny, the second prototype utilized semi-realistic human characters imported into Unity from Daz 3D Studio 1 and Makehuman 8, see Figure 2.

A user study involving sixteen participants was carried out to in order to evaluate the effectiveness of the new system 16. An ethnographic study of video and audio recordings produced three key observations;
i) performance is effected by the projected body image;
ii) both audience and performer experienced a sense of the uncanny viewing the transformed body
iii) performers lost a sense of control not knowing whether they were controlling the virtual body or it was controlling them.

The second phase of the research investigated how improvisation might be facilitated by having two performers transformed on stage and whether the use of interactive backdrops and virtual props might encourage play and collaboration.

An exercise comparing *iMorphia* with the performative system PopUpPlay 13 revealed how collaboration and improvisation is better facilitated in PopUpPlay through having an operator control the virtual scenography and manipulate the virtual props. Simply having props able to respond to performers through the physics engine of Unity, such as an interactive ball, only encouraged game like play rather than improvisation.

PopUpPlay differs from the *iMorphia* system in having performers face the screen, with the audience watching the backs of the performers as they perform to the screen. The significance of reversing this effect through the video glasses and camera employed by *iMorphia*, the embodied performative turn, impacts not only on how the performance is perceived by an audience, but on how performers interact with the virtual backdrop.

Dixon 3 describes four categories of performative interaction – navigational, participatory, conversational and collaborative. In the current phase of the research, these categories are being investigated to determine how they operate within *iMorphia* and the potential impact of the embodied performative turn.

Through a series of enactments, it became clear that a performer performing towards an audience changes how they interact with the virtual. Akin to "Alice Through The Looking Glass" 1, everything is reversed.

Interactions are directed outwards away from the screen and towards the audience. Navigation is no longer perceived through the immersive first person perspective or the third person over the character viewpoint prevalent in VR and gaming. Navigation out of a scene is challenging as neither the performer nor the audience can see what lies ahead and it is no longer possible to navigate towards a specific out of view goal. Navigating into a scene, with the performer facing the projected backdrop is technically challenging as the Kinect loses track of a person turning and facing away from the sensor.

A further technical problem with navigation and participation is the difference of location between the real performer, the virtual performer and the virtual scene. Moving in a real three dimensional space and having the virtual character move correspondingly in the virtual scene results in problems of colocation and with the video glasses lacking stereoscopic depth, it is difficult for the performer to accurately locate and interact with a virtual object. These problems may be overcome by the use of stereoscopic visual feedback and more robust and accurate tracking.

In conclusion, the embodied performative turn suggests an alternative form of performative interaction directed towards an audience. Accurate colocation and appropriate visual feedback to the performer are essential in ensuring both audience and performer experience an effective and believable melding of live action and virtual scenography.

## Biography

BSc Computers & Cybernetics 1977, MA Fine Art 1995.

Between 1995 and 2001 I worked as a Research Fellow at the Royal College of Art in the department of Computer Related Design where I created and exhibited the interactive installations Alembic (ISEA 1997), Biotica (SIGGRAPH 2000) and the Neural Net Starfish (Millennium Dome 2000 and Emocao Art.ficial 2012).

In 2002 I was awarded a NESTA fellowship (National Endowment for Science, Technology and the Arts) enabling an ongoing art research practice exploring the concept of mimesis. (http://mimetics.com)

Residencies include: Centre for Electronic Media Art, Monash University, Australia (2001); Centre for Ideas, VCA, Melbourne University, Australia (2002-2003); Edinburgh School of Informatics (2005-2008).

I am currently completing a PhD at Nottingham University investigating intermedial performance and improvisation. (http://kinectic.net)


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