

## **Digital Double Project / DANM MFA Thesis Proposal**

### **Mimesis & Mocap v1.0**

by Chris(Topher) Maraffi, 12/07/09,

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### **Introduction:**

My performative thesis project seeks to simulate embodied mimicry by digitally recreating the mirror gag routine, as immortalized in classic cinema by the Marx Brothers in their 1933 film *Duck Soup*. The goal of this research is to create improvisational comedic interaction between a live stage performer and animated 3D double, also known as an avatar or synthespian, so that the performer and audience react to the simulacra as an entertaining agent. This is a gestural approach to the Imitation Game or Turing Test, and it is intended to create an Eliza effect, or the willing suspension of disbelief, in the performer and audience. To this end, I will also seek to extend the anthropomorphism common in traditional puppetry to a digital puppet by integrating the avatar's movement in its native virtual environment into the theatrical set, through the perspectival device of the mirror reflection, to create a shared performance space for collaboration.

Through streaming motion capture (mocap) data into game engine AI software I intend to research a hybrid production technique that blends live pantomime with digital autonomous processes to enable the medium of code to become a creative partner in a movement dialogue. To minimize the technological risk of delivering the thesis performance in April, and to produce a clear roadmap for the desired interaction, I intend to take an iterative approach to this research by first producing a fully choreographed version, or a simulation of the simulation. This approach will allow me to build and test the conceptual framework that will ultimately support the technological approach, by first exploring representation, gesture, and memory between a living and synthetic body in a theatrical performance. Throughout this process, I will also be researching real interactivity using AI software, and will present the results of my research for use in future projects along the same line of enquiry.

### **First Draft of Choreographed Performance Script**

A corner rectangular space in the DANM DARC Theater is delineated as a stage set by theatrical curtains. Viewers stand at the fourth wall looking in on a theatrical dressing room in the style of old Broadway or classic Hollywood. Some glamour photographs of movie stars and painted posters of films from the early 20<sup>th</sup> century are interspersed with furniture, costumes, and stage props such as hats and masks on racks. The central focus

of the room, however, is two opposing vanities with large rectangular mirrors framed by rows of white exposed bulbs. A variety of used makeup bottles and a vase of flowers crowd the top of each black table in front of the mirrors, but only one vanity is obviously still in use. Around this vanity are additional mirrors, such as a small round tabletop mirror with a flexible arm and a tall standing mirror to one side, and both are angled towards the audience to reflect the sitter. Also sitting on the table is a simple white mime mask on a mannequin head, and a pair of white mime gloves, as well as a laptop facing away from the audience. Through the reflections in the mirrors, the audience can see a YouTube clip of the Marx Brothers mirror gag from *Duck Soup* playing repeatedly on the monitor. The other vanity is obviously not in use, as it is almost alter-like in the careful arrangement of older makeup bottles, faded flowers, and just a couple old black and white photos in silver antique frames. One of the photos is a publicity still of the Marx Brothers, only with my own face composited on top of Zeppo's. There is also a vintage print by Gilbert named *Vanity*, which contains a famous optical illusion displaying a woman sitting at a mirror, that can also be viewed as a giant skull. Vintage jazz music is playing on some unseen radio or record player, although occasionally it skips in a manner reminiscent of a contemporary DJ remix.

I enter from the back of the stage space, away from the audience, stepping through the curtains. I am wearing a colorful oriental silk robe, and appear to be an actor relaxing between costume changes. My hair is slicked back in the manner of the 1940's with a hair net, and my beard is neatly trimmed. I sit at the well-used vanity, look at myself in the mirror for a moment, and light a cigar. Just then an upbeat tune begins to play "It's a great big beautiful tomorrow...", prompting me to pull out my cell phone from my robe pocket as it continues to play the *Carousel of Progress* theme song. I answer it, stopping the song. "Hey. Yeah I'm getting my head into the game. Fifteen minutes? OK. See ya." Then after taking one more puff, I walk over to the other vanity and place the cigar in an ashtray on the table next to the Marx Brothers photo. I look into the vanities mirror, but no reflection looks back. That mirror (which is not a mirror at all, but a rear-projected 3D rendering that represents a mirror reflection of the empty stage space) refuses to recognize me, will not retain my reflection in it's memory. After contemplating my absence for a moment, I walk back over to my vanity, and take off the robe to reveal a black unitard that has many small white fluorescent spheres attached to it. Sitting down again, I place on the white gloves, flexing my hands as they come alive gesturing. Then I pick up the mask and carefully place it on, continuing to stare into my vanity's mirror, clearing my mind in the tradition of western corporeal mime and eastern Noh pantomime, allowing the ghost of the mask to possess my body like a mechanical puppet. Abruptly I yell into a microphone on the table "Intent!". At that moment, I dim the vanity lights by manipulating a switch I have on the table, and start a mirror ball rotating above the set with a pin spot to create theatrical light effects in the space. The audience can see me manipulating the technology that is setting the mood of the space. Then a movement becomes apparent in the other vanities mirror. I stand up, still looking into my mirror at the figure materializing in the other virtual reflection behind me.

The figure in the other mirror behind me is not facing away like a normal reflection should although otherwise it is a 3D rendered mirror representation of myself in a black

mocap suit, white gloves, and mime mask. The virtual space in the other mirror mimics the environmental lighting in the room. My digital reflection is staring and gesturing at my back. When I turn by body to confront it, the figure moves inhumanly fast (almost a cinematic cut) to mimic my position, and begins following my every movement. After some tentative pantomime, my digital reflection and I engage in the mirror gag, as I appear to be playfully trying to trick the reflection into exposing itself as having independent agency. I pantomime and dance about, occasionally seeing glimpses of improvised gestures going on when my back is turned, through the mirrors on the other side of the room. Our movements are revisions of the original mirror gag that is still playing on the laptop monitor at the other vanity. As the pantomime progresses, jarring mechanical repetitions of movement occur in both me and my reflection, with more extreme cinematic quick cuts in the synthespian, much like skips in a DJ remix. This slipping should have a trancelike possessed quality to the movement. There are also other supernatural variations that are already built into the tradition of the mirror gag, such as in the hat trick sequence. After we place on our hats, I lift mine as if to tip it, as does my reflection. However, my reflection's head stays with his hat, stretching his neck several inches in an uncanny manner. I quickly drop the hat back on my head, feeling my own neck. When tentatively I try it a second time, it comes off normally. At that point, I gesture several times to drop my hat, as does my reflection, but then when we do drop them his hat bounces back up into his hand (like Harpo's famous trick), while mine falls to the floor. Just then my phone rings again, "It's a great big beautiful tomorrow...", and I walk over to my vanity to get it. My reflection continues to improvise while my back is turned. "Yeah? OK, I'll be right up."

I look up into my vanities mirror at the figure in the other mirror gesturing at me to come back and play. Turning, I quickly walk over to the other mirror as my reflection starts to mimic me again. Moving my masked face very close to the surface, I quickly tap the glass where the edge of the figure's mask is placed, knocking it off, as my mask continues to stay in place. There is no face behind the reflection's mask, only the ghosted impression of a skull and eyeballs. The figure throws up its arms in a slapstick manner, and runs off back into the mirror, fading as it goes. I take off my mask looking after it into the empty reflection again. I grab the cigar off the table, pick up my hat and tip it towards the empty mirror, walk back over to my vanity, turn up the lights again, put on my robe, and start walking towards the curtains as the Carousel of Progress theme song begins to play again for the final time. "It's a great big beautiful tomorrow..."

This performance is meant to create a hybrid performance space that juxtaposes and layers opposites to create the perception of uncanny theatrical magic clearly using technology: the light comedic slapstick of vaudeville in the competitive game-like movements of the mirror gag is remixed with the serious ritualistic movements of mask theatre and corporeal mime; the nostalgic past media of film, whose linear memory passively repeats the ghostly movements of long dead performers like the Marx Brothers, is remixed with nonlinear reflexive new media processes to animate agents or spooks in digital memory; the organic embodied movement of the live performer in real space is remixed with the nonliving body-without-organs movement of the synthespian in virtual space. These metaphors are performatively explored by the actor through old and new

techniques and technologies, from the mask and stage lighting to the virtual mirror and simulacra. It is conceptually important that the performance occur in a theatre and that the performance is recorded into digital memory, and broadcasted on the Internet as a YouTube video.

## **Thesis Project Production Schedule**

- **December:** Conceptual research and pre-production planning (Proposal, bibliography, script, etc.).
- **Winter Break:** Finish pre-production performance visualizations (3D stage design & modeling, storyboards, animatics, character modeling, etc.). Start writing thesis paper.
- **January:** Start motion capture production and post-production processing (cleaning mocap data, character animation, rendering, etc.). Continue writing thesis paper. Start independent study with Kathy Foley.
- **February:** Start building stage set in the DARC theatre. Finish rendering. Finish first draft of thesis paper.
- **March:** Begin rehearsals in DARC for final performance during Open Studios at the end of March. Meet with committee at Open Studios for performance. Videotape the performance as part of the documentation for my final thesis show.
- **April:** Edit the performance video early April. The final thesis show presentation at the end of April will consist of displaying simulated mirror gag performance video, group performance simulated dance battle video, and embodied interactivity research.
- **May:** Finish revising thesis paper for final committee review.

**Ongoing:** Real-time embodied interactivity research using mocap and software.

## **Thesis Production Stage, Technology, and Props & Costume Budget**

### **Stage:**

1. Plexiglass for main mirrors 48x48 in.(clear and mirrored), Prof Plastics: \$200.00
2. Kenroy Home Broadway vanity lights (rack of 8, 4 racks), Amazon: \$100.00
3. Antique black trestle desk (2), Amazon: \$150.00
4. Magic Focus flexible-arm tabletop round mirror, Amazon: \$25.00
5. Draper or De-lite rear projection screen (for virtual mirror), Amazon: \$500.00
6. Mirror ball, motorized turner, and LED spot, Amazon: \$40.00
7. Lutron lighting dimmers for vanity lights (2), Amazon: \$50.00
8. Miscellaneous makeup bottles and antique hair brush for vanity, Thrift: \$25.00
9. I already have theatre posters, frames, silk flowers, masks, desk lamps, etc.

### **Technology:**

1. Maya and Motion Builder 2010 (student edition), Autodesk: \$350.00
2. Ecstasy Motion (indie edition), BrokeAss Games: \$150.00
3. Projector, DANM.

4. Computer for playing rendered video, DANM.
5. Walkie-talkies (used to fake a cell phone), already own.
6. Laptop, already own.

**Props & Costume:**

1. Black unitard, Capezio: \$20.00
2. Mime gloves and top hat, Theatrical Shop: \$20.00
3. Styrofoam balls and luminescent paint: \$20.00
4. Robe and mime mask, already own.

## **Thesis Interactivity Abstract**

### **Synopsis:**

The performance part of my project involves a live performer on stage in a motion capture suit performing improvised movements. A digital 3D character that represents the performer is projected on an adjacent screen. The 3D character will respond to the performer by mimicking their movements, while also regularly responding with unexpected variations. The goal of the piece is to create a call-and-response dynamic between the performer and synthespian's embodied movements, that unfolds as a unique combination of human wetware improvisation and digital software simulation. Because the movement is all based on the performer's movement, they are essentially improvising with a digital representation of themselves.

A specific example of theatrical mimesis in classic film is the Marx Brothers Mirror Gag. In this playful pantomime, one brother is dressed up like the other, and pretends to be a nonliving mirror reflection or copy of the original. The original brother tries to reveal the copy as a living impersonator by tricking them into making an error in their mimicry. The comedy occurs through the light competitive interaction, especially when the original's back is turned from the copy, who then is free to improvise without being caught. The dynamic of this pantomime raises issues of agency with the uncanny movement of the reflection as simulacra, and can be viewed as the original or pre-computer Imitation Game.

Simulating the mirror gag with a live performer and 3D character requires that the synthespian follow the movements of the performer with slight variations in the timing and position of the limbs, so that the mimicry is not entirely mechanical. If the performer turns away, however, the synthespian is triggered to simulate emotional, possibly even rude, gestures towards the performer. It is important for the success of the gag that the performer can see, out of the corner of their eye, the 3D character gesticulating behind their back. A real mirror may be placed on the other side of the performer, opposite from and facing the projected image of the synthespian, to enhance the visual interaction.

### **Method:**

To create the simulation of mimicry on the synthespian, I intend to stream the data into a games engine using machinima style techniques. The performance data recorded by the

motion capture suit and software must be digitally processed to incorporate slight variations in timing and position, before it is mirrored and assigned to the synthespian in realtime. The illusion of improvised movement is done through custom coded software, ideally using AI algorithms, to call and blend pre-recorded motion data from a library of clips by the same performer. The clips need to be blended locally to the character's global position in 3D Cartesian space, which should always be based on the mimicry data. The blending occurs whenever the data of the performer's head rotation registers greater than 70 degrees global Y rotation away from the synthespian, and the blending itself should not be linear, but speeded up to simulate rushed movement.

To emphasize the bodily movement, the performer should wear a generic mask, like a painted mime face, which is also modeled as the static face of the synthespian. The only moving part of the performer and 3D character should be the eyes, which will generally look at the other, but occasionally diverge and vary.

### **Meaning:**

Simulating the mirror gag with digital technology raises the question of agency as a synthespian takes the place of a human pretending to be a non-living reflection of a live performer. The multiple layers of mimesis occurring in such a dynamic may produce an uncanny Eliza Effect for the performer, and through repetitive movements with variations, may possibly achieve the effect for the audience as well. The variations in bodily and eye movement between the masked human and digital performers should increase this uncanny simulacra effect. The fact that the performer does not have complete control over what appears to be their own reflection may cause the perception of agency in the shared movement to become blurred, ideally leading to creative playful engagement with a digital other in a feedback loop of movement.

My thesis also explores the interactive digital puppet as the evolved materialization of several influential and prolific theatrical concepts such as Craig's *Uber Marionette*, Artaud's *Body Without Organs*, and Park's *Rep and Rev*. This research also has practical applications for integrating software mediated synthespians with live performers in a scene to enhance creativity. In addition to leveraging my own experience as a dancer, mime, and animator, this project explores new applications for machinima style productions by exploring animism, anthropomorphism, empathy, and expressive interaction between a synthespian and an embodied performer.

### **Future Improv-Dance Research:**

A further application of this research is as a dance simulation to enhance a performer's creativity through digital memory and processes. A specific example of mimesis and improvisation in contemporary dance is competitive street dancing, such as hip hop, which is based on the classic African American call-and-response dynamic. Movements are reflected back and forth between performers as each takes turns rising to the requirements of the previous movement, while adding improvised variations of their own. By using the same approach and technology as outlined for my thesis, I intend to have a

dancer engage in an improvisational dance with a digital 3D dancer, or digidancer, as part of a live theatrical production. The captured movement of the performer must be blended with a library of compatible stored dance clips pre-recorded by the same dancer, ideally using a games engine, and then assigned to the digidancer when the live dancer stops in a pose. Taking turns in this manner should produce a call-and-response or Rep & Rev dynamic, so that the combined performance will evolve along an improvisational arc.

### **The Digital Double Project:**

Mimesis & Mocap is proof of concept for the first phase of a long-term conceptual project that is intended to produce a technological replication of my self, a digidouble. I am starting by capturing and simulating my full body gestures in a theatrical context, but I ultimately plan to digitally process all my common gestures, facial expressions, and speech patterns into a coded 3D avatar.

### **Compare and Contrast to Contemporary Work in Digital Arts Practice**

My thesis project most closely relates to two areas of contemporary arts research: First, performance and dance studies that use motion capture technology to record the movement of live performers on stage, and then digitally process that movement data in real-time to project back into the performance as interactive animation or sound media; Second, serious games studies that use the AI technology in a game engine to animate 3D syntheians in a machinimatic real-time performance. My project seeks to combine these two areas of performance and games research to explore a third area of study in AI, to trick human observer's of the performance into perceiving autonomous agency in the digital projection, otherwise known as a Turing Test or Imitation Game. In this short essay I intend to examine how my project relates to and differs from previous text or dialogue based imitation game approaches, such as seen in Joseph Weizenbaum's *Chatterbot Eliza* and Michael Mateas' *Façade*. I will also look at how my project compares and contrasts with several contemporary dance performances that use mocap technology, such as Digital Culture Lab's *AltW-Blowup*, Kris Verdonck's *I/II/III/IIII*, and Hiroaki Umeda's *Accumulated Layout*, as well as with machinima puppetry projects that use 3D avatars and game engines, such as Georgia Tech's *PuppetShow*.

YouTube example chatterbots talking to each other:

<http://www.youtube.com/watch?v=Lr7qVQ3UoSk>

### **Embodying the Imitation Game with Contextually Specific Theatrics:**

There are a few key aspects of my project that are designed to address the imitation game problem. The biggest difference between my project and most chatbots since *Eliza*, and which I think is addressed well in *Façade*, is delineating contextual specific interaction. Chatbots may achieve the *Eliza* effect for a short time due to player interest, but they lose the effect quickly when the player is allowed too wide a range of textual input. Typing in slang or nonsensical sentences produces answers that reveal the software does not understand the wordplay going on. In general, Turing Test's are traditionally criticized

for the same reasons that general aptitude tests are criticized; they require too wide a range of diverse knowledge to pass, that may not be in the general experience of the person tested, or in this case the AI program tested. *Facade* creates a very specific social and cultural situation for the player to experience, with responses that are limited by that context. If the player attempts to break those implied rules, which are also in line with well established social etiquette, then the characters in *Facade* take the appropriate response of forcing the player out of their home. Thus there are several implicit and express factors built into the game to prevent a player from breaking the *Eliza* effect. In my project I seek to create a contextually specific comedic situation by simulating the classic film pantomime the Mirror Gag, limiting the interaction to embodied movement.

See YouTube example of the Marx Brother's Mirror Gag:  
<http://www.youtube.com/watch?v=Gg19Md-tZ6A>

Other similarities that my project has to *Façade*, but differs from chatbots, are embodied theatrics and emotions. *Façade* places the player in a dramatic situation with two embodied characters that behave in a manner that is purposely uncomfortable for a third party guest. The characters of Trip and Grace may be simplified 2D cartoons, but they still look and behave in a naturalistic manner, arguing with emotive action and dialogue that evokes sympathy or empathy in many players. The dramaturgy has the effect of both engaging the players continued attention, while also distracting the player from considering the agency in the characters. By simulating the Mirror Gag, I seek to achieve a similar emotive theatrical dynamic that is based on embodied humor or slapstick, to engage and distract the player. Traditionally, humor has been widely considered the most natural of human emotions, with comedy being a talent that is difficult to teach other humans, much less produce artificially through a machine. Creating a fun and funny AI program would likely have an *Eliza* effect because slapstick humor has the capacity to bypass the intellect through the nearly universal language of comedy.

See YouTube example of Michael Mateas' *Façade* game:  
<http://www.youtube.com/watch?v=GmuLV9eMTkg>

The theatrical and entertaining scene that the player finds themselves in the middle of within *Façade* has another advantage over chatbot programs, and which I hope to create in my project, which is the suspension of disbelief. This is something we are all trained to do when enjoying entertaining drama, in order for it to actually be entertaining. We engage our imagination to enter the virtual world presented to us, whether it is a novel, minimalistic play, movie, anime, or game. The suspension of disbelief, as a double negative, is an algorithm that inherently has a loop in it. It also requires, like other belief algorithms, theatrical or media ritual, such as artificial framing and lighting, or the hyper real of the simulacra. I hope to create this in my project by having the player wear a simple mime mask. The environment will be windowless with stage lighting, and the frame of the monitor will represent the mirror frame, as well as a magical window and a proscenium. The player willingly transforms towards merging with the reflection by donning the mask and approaching the reflection in the mirror, which also wears the

same mask. What will be noticeably different about the reflection if the player looks closely, however, is the movement of the eyes and the fingers.

The mask is practically a universal element of traditional pantomime, for both mimes and clowns, and is highly influenced by shamanism. In the choreographed performance of my project, I envision the performer in the mocap suit entering the stage with their back to the magical mirror, intrigued by a simple white mask hanging in the dark space. Initially there is no reflection in the projected mirror, until the mask is placed on, at which time the visibility of the 3D representation fades up behind them, and facing them unlike a true mirror image. In this version I intend to have the performer reference the early 20<sup>th</sup> century French pantomime and corporeal mime techniques of Jacques Copeau and Etienne Decroux, who used shamanistic meditative ritual when donning a mask, to empty the mind and become possessed by the spirit or character of the mask. Breath techniques are used to clear the mind so the mask can take over the performer's body. Once the mask is in place, the performer will turn to face their reflection in the magical mirror, and the mirroring dynamic will start. In this performance the pantomime movements of the performer, and of the mimetic synthespian, will also incorporate corporeal mime techniques of isolating body parts to simulate the lack of human affectation in an autonomous uber marionette.

See YouTube example of pantomime and mask technique at NYC Puppet Kitchen:  
[http://www.youtube.com/watch?v=jUE5h-8gX\\_E](http://www.youtube.com/watch?v=jUE5h-8gX_E)

In the eastern tradition of Japanese Noh mimes, there is a similar shamanic ritual for placing on the mask that actually uses a mirror. The performer dons the mask in front of the mirror, staying in place until the spirit of the mask takes over through the reflection. In my production, I will employ this technique by placing a real mirror on stage facing the projected virtual mirror, and have the performer place their mask on looking in the real mirror. The advantage of this is they will be able to see the virtual reflection appear behind them, starting the interaction through the technological device.

### **Proprioceptive Movement with a Body *without* Organs**

Although Georgia Tech did develop an interesting embodied version of the *Façade* game, the main difference between my approach to the Turing Test and text based games is that I want to engage the player's entire body strictly through gesture, rather than engage their mind through dialogue. I believe this will create a more basic human interactivity that reaches less cognitive parts of the brain, as does pantomime and slapstick humor. The projected synthespian will appear to be a life sized mirror image of the player as a 3D representation, and although simplified like the *Façade* characters, it will move in a natural manner from the streaming mocap data. The difference to a real mirror, and what should engage the player's attention, is the variations in the reflection's movement. Mirrors engage people's attention anyway, but mirror's that are not passive should immediately increase the player's interest, and may begin the uncanny *Eliza* effect. My project also has another inherent agency loop that may increase this effect, that plays from the Mirror Gag itself; which is that the computer generated body is masquerading as a human who is masquerading as a reflection of the player.

See YouTube example of Georgia Tech's embodied *Façade* game:  
[http://www.youtube.com/watch?v=x\\_I1AbA7w0](http://www.youtube.com/watch?v=x_I1AbA7w0)

To trick the reflection into revealing itself as having agency, the player must move their entire body, just like in the classic Mirror Gag, creating a playfully competitive dynamic between human and digital bodies. Hopefully this experience will become fun, and lead to empathy with the 3D body through proprioception. It will be interesting to see if the players ever unconsciously start mimicking the variations performed by the reflection through AI. To increase the engagement dynamic, whenever the player turns away from the reflection, AI programming will cause the reflection to pantomime prerecorded slapstick movements designed to evoke an emotional response. The player will be able to see this happening behind their back, through real mirror's placed in the stage environment, and then can react to the challenge. This is where the potential comedy may materialize in the simulated gag.

Looking next at a theatrical performance that uses digital media, entitled *AltW-Blowout* by Simon Biggs and Sue Hawksley at Digital Culture Lab, you can see some interesting similarities and differences to my project. Video of a dancer's moving bodies are captured and projected, achieving a mirroring effect, while the software manipulates pieces of the video to deconstruct and reconstruct the bodies. This piece does produce a degree of uncanny *Eliza* effect in the animated collage, mainly in the reconstructed movement as a kind of video cyborg representation of the dancers. It is also successful in engaging the performer's creativity and audience interest.

See YouTube example of Digital Culture Lab's *AltW-Blowout* dance performance:  
<http://www.youtube.com/watch?v=I9oiOE29HA0>

But the main difference *AltW-Blowout* has to my project is the lack of dimensionality and predictable familiarity of the captured video, where we recognize the unaltered moving images of the live dancers. No matter how you slice them, these images are not native to the digital medium, but are flat echoes of our multi-dimensional organic world. A digital 3D avatar is a complete simulacra, a virtual body without organs in Cartesian perspectival space, formed from digital code, electrical impulses in silicon, and projected as living light like an apparition. Like puppets and animatronics, computer generated characters have an inherent otherness that recorded video can never achieve, no matter how much you process or manipulate it. By using processed motion capture data and AI to animate this type of character in a naturalistic manner, and then blend in subtle supernatural movements (which are actually inherent in the dynamics of the Mirror Gag), I anticipate that the uncanny effect can be enhanced and extended.

### **Cutting the Umbilical Chord of the Uber Marionette or Pinocchio Becomes a Real Boy**

The next two experimental dance videos I want to consider, by Kris Verdonck and Hiroaki Umeda, show how the human body can achieve an uncanny effect by moving like a marionette or a machine. In *I/II/III/IIII* by Kris Verdonck, the dancers are

suspended by invisible wires, making them essentially into living marionettes. The uncanny effect is achieved by combining the naturalistic movement of the human bodies with the magical effect of a puppet defying gravity. The supernatural effect only works because the dancers surrender some of their agency to the marionette technology, creating a hybrid technique, and because the technology is hidden.

See YouTube example of Kris Verdonck's *I/II/III/IIII* dance performance:

<http://www.youtube.com/watch?v=fNo4xeizMf0>

A similar marionette technique was used in a Woody Allen movie I worked on, *Everyone Says I Love You*, in which a magical partner dance is done by the side of a river in Paris by using wires, and then we rotoscoped out the wires in postproduction.

See YouTube example of Woody Allen's partner dance in *Everyone Says I Love You*:

<http://www.youtube.com/watch?v=pYpcEF1hBHs>

One more experimental dance example I want to examine is Hiroaki Umeda's *Accumulated Layout*. Corporeal mime technique used movement isolations as a method for transforming the body into a vehicle or performative tool. An extension of this mime technique in dance is the robot in breakdancing, and popping-locking in hip hop. Both techniques use the machine metaphor to create the appearance of uncanny movement throughout the body. Body parts seem to have their own agency, as the dancer's attention quickly and fluidly moves through each part. Fast pauses in between movements isolates moments in time as poses, very much like separating the movement into animation frames. Sometimes the dancer appears to defy gravity and glide across the floor, as in moon walking. *Accumulated Layout* has some of this technique combined with mechanically controlled lighting and sound, creating a synthesis of machine movement with a human body.

See YouTube example of Hiroaki Umeda's *Accumulated Layout* dance performance:

<http://www.youtube.com/watch?v=pT1awoyy3ro>

All these dance examples use technology to enhance an inherent uncanny quality of the body as a mechanical device. My project will be designed to create similar effects through the pantomime of the live performer, and then will technologically enhance the uncanny human movements to a supernatural level in the body of the synthespian. Defying gravity and isolating body parts can be taken to new levels in the virtual Cartesian space of the computer program, which is one of the main reasons why computer generated characters can be compared to Craig's Uber Marionette. Again, this supernatural quality was already a part of the *Mirror Gag*, as can be seen in the Marx Brothers and the *I Love Lucy* versions on the YouTube example. In the first example, it occurs when Groucho breaks the plane of the mirror to circle his reflection. While in the second clip, supernatural movement occurs when Harpo uses a trick hat to defy gravity and expose the reflection as a real person. The difference between the classic gag and my simulated version is that the synthespian cannot be exposed as a real person, but can be exposed as having real agency through the AI software. My last analysis is of other

machinima style 3D puppetry research projects. For instance, Georgia Tech's *Puppet Show* project has some similar real-time puppet and machinima qualities, but the motion capture technology is 2D optical blob detection using the Processing software to stream the motion data into the Unreal game engine, rather than 3D mocap.

See YouTube example of Georgia Tech's *Puppet Show* project:

<http://www.youtube.com/watch?v=7PmQJH6Tf5c>

There are other projects by the Georgia Tech Machinima and Synlab groups that contain some aspects of my project, but are different in that they use 2D computer vision techniques for the mocap. The Henson Creature Shop's *Digital Puppetry Studio* is a better example of using live streaming 3D mocap to control a synthespian's body, but even this technique has a crucial difference to my approach. All of these techniques and technologies are using the digital medium as tools for creating motion, while I want to use the medium as a fundamental partner in the creative process of the performance. If the body with organs is the medium of organic pantomime and dance, then the body without organs, or code, is the medium of virtual pantomime and dance. My project seeks to be a first baby step towards implementing digital intelligence into the embodied arts of acting and dance, as a machinima technique, that can lead to true synthespians with improvisational agency that shapes the performed movement. This is my proposed solution to the Imitation Game that has the potential to realize the Uber Marionette in a virtual 3D puppet, by releasing some of the traditional strings between the puppeteer and puppet to the coded medium itself, and eventually mutate Pinocchio a little further towards becoming a real boy.

See YouTube example of Disney's Pinocchio:

<http://www.youtube.com/watch?v=Ij9ui2VPes8>

## General Questions & Answers

**Question #1:** You mention many influences from Theatrical theory in your thesis proposal, such as from Halliwell, Craig, Kleist, Turner, Parks, etc...; how are these influences related conceptually to digitally simulating the Mirror Gag, and what is the dominant influence that will require detailed analysis, and become the main theme of your thesis?

Initial Answer: I think the dominant theme that runs through all of my theatrical influences is agency and memory through embodied performance, and in relation to simulating the Mirror Gag in particular, how representations of human movement in media can generate the uncanny illusion of agency through digital memory. Performative techniques since the Renaissance show continuous externalizing of memory and movement using mechanical devices. From chess playing automatons to movie special effects to intelligent online avatars, entertainment and spectacle has been used as a reflexive development technique for extending human agency into autonomous machines. My goal is to take this historical trajectory further through embodied movement, by using

motion capture and machinima technology to explore and blur the boundaries of human and non-human agency. I seek to do this through the real-time mimesis of a live performer in embodied space interacting with a 3D synthespian, or projected body without organs, in virtual Cartesian space.

**Question #2:** How do the theatrical concepts detailed in your thesis proposal relate to the broader conceptual theories of technological memes and cyborgs, and what new interdisciplinary connections does your thesis seek to make?

Initial Answer: The broader connection can be made through mechanical replication and communication technologies, which allow organic memes to propagate from human memory into computer memory, creating technological memes that can autonomously replicate and evolve through computer processes. Memes are an informational representation of our image and movement, which are now captured and processed by both brains and machines through senses and sensors. These representations of us do have the capacity to take on a life of their own in media, and can live long after our physical bodies cease to exist, as a new kind of animated memory that takes on a life of its own.

**Question #3:** What new hybrid forms of technology do you hope to explore by using mocap, synthespians, and machinima techniques to simulate the Mirror Gag, and how specifically will this contribute to technique in the field of Digital Media?

Initial Answer: Theatrical mimesis in the form of embodied mimicry has not yet been thoroughly explored through the medium of code. The classic film medium exploration of mimesis as seen in the pantomime of the Mirror Gag is a great starting point for me to begin my research. Using mocap allows me to create a motion feedback loop that represents the mirror, while the synthespian becomes the reflection, and machinima techniques allow the mirror to become magical by bringing the reflection to life with independent agency. The fusion of this cutting edge digital technology with traditional pantomime techniques has the potential to generate a truly creative new form of performative art.

**Question #4:** Since the interactive technology in this proposal is not yet fully developed, such as streaming mocap data into a game engine and using AI to blend pre-recorded motion; what is the iterative process that you will use to research and produce this thesis project, so that production risks are minimized for the public show, while still making progress towards ultimately developing the full interactivity?

Initial Answer: The iterative approach I intend to take for the initial version of my project is to first fake the interactivity by having the live performer improvise to a choreographed motion captured performance that I process in Motion Builder and apply to a non-interactive 3D avatar modeled in Autodesk Maya. Staging the Mirror Gag as a choreographed theatrical performance before a live audience will allow me to get performer and viewer reaction to the aesthetics and dynamics of the perceived interaction, to see if it achieves anthropomorphic effects of non-human agency. I believe

the theatrical environment and techniques used to frame the performance, such as dramaturgy and lighting, are just as important as the technology for creating an uncanny effect. By first performing a choreographed prototype, I can get viewer feedback to better research and design the human and non-human interactive parameters in the fully improvisational piece.

In addition, by producing and documenting the staged performance, I will have concrete media examples to show the interactive goals of the project to prospective technical collaborators and funders. I am a staunch believer in the performative algorithm “fake it till you make it”, to reflexively drive collective behavior towards innovation and transformation. Later versions will be designed to stream the performer’s motion directly into the virtual environment of a game engine, where digital processes can facilitate the illusion of improvisation, creating a truly interactive synthespian. Then the live performer can freely improvise with a digital magic mirror that appears to have a reflection with independent agency, hopefully creating an uncanny Eliza Effect for the performer and audience, and through shared agency a unique performance each time the simulation is run.

**Question #5:** Where specifically do you want to go conceptually and technologically with this research after completing this thesis project?

Initial Answer: After simulating the pantomime of the Mirror Gag, I would like to continue this research into the area of improvisational dance. A subsequent project would be to simulate the call-and-response interactivity that occurs between dance partners, such as in a hip hop competitive performance. Dancing adds a level of complexity to the embodied movement dynamic, because in addition to visual mimesis, you must also simulate auditory mimesis. Dancers must reflect, react, and improvise to both their partner and to the rhythms in the music simultaneously. Creating this level of interaction between a live dancer and a virtual digidancer would be an interesting challenge, would facilitate a new hybrid dance form, and could model how we creatively improvise while dancing. As a dancer and animator, this research is autobiographical, and is drawing a trajectory towards producing an embodied self portrait in the medium of code. Ultimately, I would like to take the mimesis concept further into facial animation and speech, so that I create a digital double of myself, which I call the Topher 2.0 Project.

## **Artist Statement**

My motivation for this project is to explore what goes on in a performers mind, and by extension human consciousness, when we create. As a fusion dancer for many years, I am always dancing with myself and others, creating new forms of movement through improvisation. When I examine my mental process while dancing, I seem to imagine a virtual representation of my self moving, either alone or with a virtual partner. This visualization technique can be viewed as a wetware simulation that not only makes me a better dancer, but creates new movements through play, by intentionally allowing mistakes or by actively breaking stylistic rules to create new movement combinations and

fusions. Such creative play requires some type of processes similar to pattern recognition and random algorithms running in my brain, which are then materialized in embodied movement. I also practice this technique “offline”, without actually dancing, but still “feeling the flow” of movement, and I have invented new movements this way. In addition, studies have shown that physical performance can be improved by such visualization techniques. Adding another dancer into the improvisational dynamic, that can reflect and modify my movements as a partner or collaborator, adds another unpredictable dimension to the creative evolution of the combined movement in social dance.

As a child, like many people, I played with imaginary characters in elaborate dramas involving puppets (dolls or action figures) and toy machines (cars, spaceships, etc.). As an adult, I embody more conservative roles as a 3D animator, teacher and a student, but I am still playing with characters. On a more esoteric level, as someone who has practiced Eastern and Western meditation, I witness my self as a character in the Theatre of the World; creating a mimesis in my mind to view myself acting as others view me in the spectacle of social drama. All the world’s a stage, after all, as reality shows prove. But the spectacle or simulacra produced by my behavior is not entirely me. It is a reflection of me so it contains information that represents part of me, but the information has separated from my body so that others can perceive my image. This projection is uploaded to social networking sites, and is continuously reflected back towards me by the people and technology in my environment; by the messages communicated from their faces-screens, behavior-animation, and speech-hypertext.

Media of all kinds communicate information that has separated from our bodies, that represent a part of us, but like a chameleon they are not really us. This was never a pipe, after all. But it is the memory of a pipe, and of the painter’s movement, in the medium of paint. The medium affects the information, mutates the representation. But human memory is also a medium, and so is digital memory. We use internal and external memory to perceive ourselves, and change ourselves. We paint and later try to understand the meaning in the message. We channel the information like a medium to a medium, and then back into the medium of our mind, in continuous feedback loops. From these loops associations are created in memory that represent meaning for us, and modify our behavior. I want to create such a loop between myself and a digital reflection, using the pantomime of the mirror gag as a context, and allow the computer medium to change my memory through its memory. By projecting a part of myself into virtual Cartesian space, my movement, I can experience how it evolves in that environment; how the processes in the new medium change my behavior, and possibly evolve a new perception of my self.

The techniques developed for this performance piece are not primarily targeted at the audience, for instance to wow them with the AI, but mainly for the performer to experience in the moment of creation. It is designed to be a new way to improvise a performance, although I believe the audience will receive a unique and entertaining experience through the performer’s interactivity with the computer. It is intended as a method for allowing active digital processes or agents to be part of the performance, creating a meaningful dialogue between machine and organism. The medium of code

undeniably does become part of the message. I see this project as a movement towards fusing embodied human consciousness with a virtual being or a body without organs, using mimesis as the conceptual catalyst.

Beyond the mirror gag with a synthespian, the next step in this research would be to use similar techniques to create an improvised call-and-response style dance between live and digital dancers or digidancers. Dance uses similar embodied creative techniques to pantomime, but adds another dimension of complexity by requiring interaction with both a performer and the music. Technically this would require pattern recognitions in multiple data streams for movement and sound by the AI software, to make the digidancer respond to both. Ultimately, these virtual mimesis techniques could possibly be extended to a physically embodied character, such as an android performing an improvisational dance with a human dancer in a mocap suit, using virtual 3D representations as a control mechanism for the android's movement. Essentially the android could be dancing with a 3D representation of itself and another, which could be real or virtual (simulating "offline" visualization techniques), or in pantomime of the original mirror gag, the android itself becomes an embodied mirror. This would approach the kind of representational loops occurring in my own consciousness when I creatively play and improvise in social dance with a partner.

## **Keywords, Terms, and Phrases**

**AI:** Artificial Intelligence is a branch of computer science that evolved out of cybernetics that seeks to develop intelligent machines through autonomous software agents. A key part of game engines to simulate intelligent behavior in an avatar for a game.

**"Body without organs":** Playwright Antonin Artaud's surrealist statement presented in the 1947 radio play *To Have Done with the Judgments of God*. In the script he equates God to microbes, and states that man is badly constructed and must be remade as a body without organs so that he can be free from the judgment of God and dance wrong side out again. Statement could be interpreted as a reflexive description of a future digital mimesis of a person uploaded to cyber space as an autonomous 3D avatar, an intelligently designed machinic body made from code, without organs, and free from the contradictions of mind-body dualisms.

**Cartesian Space:** Mathematical representation of perspectival space in a 3D computer program, based on Descartes coordinate system, with X, Y, and Z directions that intersect at a world origin.

**Cyborg:** originally a term from cybernetics, the posthuman concept of fusing machines with organisms has been more fully explored as a metaphor in the humanities by critical theorists such as Donna Haraway and N. Katherine Hayles. The metaphor can be conceptually extended to encompass the fusion of human behavior and perception with technological devices and processes. For instance, the mind can be reliant on both

organic and digital memory for successful functioning in a technological environment. The cyborg concept can be related to technological memes and digital avatars.

**Double, Body Double, Stunt Double, Doppelganger:** Double is used by Artaud as a comparison between culture and theatre, and by Deleuze and Guattari related to simulacrum or copies, and the shamanism influence of Carlos Castaneda. In Castaneda shamanism, double is the term used for the shaman's energy body, a kind of virtual projection that is not subject to normal physical laws, and which usually acts as a trickster, termed stalking. The abstract goal of cultivating the double is to achieve "ultimate freedom" by taking a "somersault into infinity" to have your awareness "cheat death" by becoming disembodied. Body double and stunt double are used in film to replace the principle actor with a better or more appropriate version of the same fictional character. Lately this role has increasingly been given to virtual 3D characters, such as for unusually dangerous stunts, rather than live human performers. Doppelganger is a double perceived as "other", usually in a reflection on a reflective surface that is an omen of mortality or future death. Shaman's in the Castaneda tradition use perceiving their doppelganger as a way to "stop the world" by being in the moment and stopping their mind.

**Eliza Effect:** The willing suspension of disbelief when people engage with intelligent and entertaining software agents. The term comes from Joseph Weizenbaum's 1966 comic doctor computer simulation, called Chatterbox Eliza, that used repetition to imitate a Rogerian psychologist, and which was named after the female character in the stage play Pygmalion because Weizenbaum intended to teach the program proper language. The effect seems to be an extension of the same suspension of disbelief common in theatre and movies, where animism and anthropomorphism is attributed to puppets and other non-living animated characters. Such an effect was documented on the sets of Jim Henson productions, such as Sesame Street and The Muppet Show, where children and guests would frequently forget about the living performer, and interact directly with the puppet as if it was alive.

**Imitation Game or Turing Test:** Mathematician Alan Turing's criteria for evaluating whether a digital computer has the capacity to mimic human intelligence. From his famous 1955 paper Computing Machinery and Intelligence, he expected computers to pass this test in about fifty years. The intelligence criterion has been criticized as being overly biased towards human intelligence.

**Improv:** Improvisation technique in theatre and dance that encourages free-association by the performer to create a unique experience each time performing live. Especially associated with comedy in theater, this technique may be compared to running a computer simulation with changing variables and random functions.

**Machinima:** Coined by Hugh Hancock in 2000, a hybrid gaming term that combines machine with cinema and anime, and uses a game engine to produce independent film style dramatic content that incorporates animated 3D games characters in a virtual environment. In Machinima, dramatic narratives or performances by synthesians are

normally limited to the AI movements and asset contents of the game, but independent artists are starting to customize and experiment with the techniques. Machinima is starting to also be used by film directors in pre-production to quickly visualize scene action as a 3D animatic. By being a hybrid of film and animation, Machinima techniques are arguably the next evolution of dramatic media production. My application adds a live embodied performer element through mocap technology.

**Magic Mirror:** Anthropologist Victor Turner's concept of theatre as a reflexive and dialectic between stage drama and social drama in culture.

**Memes and Memetics:** Biologist Richard Dawkins theory that applies the principles of Universal Darwinism to culture around the concept of the selfish meme, a discreet unit of symbolic information analogous to the gene, that replicates from human brain to brain through communication and imitation. Cultural information replicating and processing autonomously in digital computers is considered a new mutation of memes, and named technological memes or memes by Susan Blackmore, and can also be related to the cyborg concept as a fusion of the human mind with machines.

**Mimesis:** Key concept in the history of western art based on philosophy from Plato and Aristotle, and then subsequently developed as a theory of human nature by other philosophers. Translated by Stephen Halliwell in Aristotle's poetics as representation, this concept also relates to mimicry, memory, and memes. In theatre history also related to the spectacle, and Theatrum Mundi or theatre of the world characterized by Shakespeare as "All the world's a stage...".

**Mirror Stage:** Psychoanalyst Jacques Lacan's concept of the development of the ego and identity in psychiatry. As per Wikipedia: "The Mirror Stage as formative of the function of the I as revealed in psychoanalytic experience...as representing a permanent structure of subjectivity, the paradigm of the imaginary order: it is a phase in which the subject is permanently caught and captivated by his own image".

**Motion Capture or Mocap:** Animation industry term for real-time motion capture or performance capture technology that produces 3D position data for a live performer's body parts over a period of time. Generally done by having the performer wear a suit with passive or active optical markers that are tracked by cameras, or by non-optical sensors, this process is preferred for creating realistic humanoid animation quickly. The captured data can then be processed to rotate the skeleton rig joints of a 3D character in a film or game.

**Perspectival:** Painting technique developed in the Renaissance for creating the illusion of 3D space in a flat 2D painting, based on framing an ideal viewing position so that architectural lines recede to converge on a single horizon point. Subsequently adopted by European theatre as a proscenium stage with painted backdrop, and continued to be used in the film frame as matte paintings, and the computer screen as 3D digital renderings of virtual reality. Considered by art theorists like Panofsky to be more than just a technical

illusion, but a reflexive symbolic process that changed our way of perceiving the world as a mathematical simulation.

**Rep & Rev:** Playwright Suzan Lori Parks' theatrical application of repetition and revision, based on the traditional African American call and response dynamic in blues-jazz music and dance, to transform collective memories and therefore re-imagine history.

**Simulacra or Simulacrum:** Like mimesis, first associated with Plato, and often translated as similarity or representation. Generally used to describe a distorted copy of reality, French cultural theorist Baudrillard developed the concept into a replacement or simulation of reality through media.

**Spook:** In William Gibson's 2007 novel *Spook Country*, the terms spook, specter, ghost, and revenant are slang for intelligent agents. The term country is used for reality in physical, mental and virtual spaces. This view can be compared the metaphor of ghosts in haunted theatre and cinema, from Suzan Lori Park's use of ghosts and possession for memorializing ancestors and re-membering history, to contemporary films with ghosts in media and mirrors.

**Synthespian:** Term for a digital or computer generated actor, usually a 3D character, coined by computer animation pioneers Kleiser-Walczac in 1988.

**“The medium is the message”:** Media theorist Marshall McLuhan's phrase that indicates that the medium, especially communication technology as mass media, changes cognitive orientation of society by creating a new environment.

**“This is not a pipe”:** Surrealist Henri Magritte's famous title that uses language to play with, and break the illusion of, representation in perspectival painting.

**Uber Marionette:** Edward Gordon Craig's theatrical concept of a new performance medium that would allow for the creation of an autonomous puppet without limitations that can replace human actors, and fulfill the director's vision without affectation. I am proposing that the concept is being realized in the digital medium with 3D characters programmed with AI to be self animated synthetic actors or avatars. There is also a rich literary and film history in the arts and humanities related to self animated puppets that references the Jewish Golem, Egyptian mummies, Frankenstein, Pinocchio, automatons, cyborgs, robots, and androids.

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