Reproduction, Mediation, and Experience
Virtual Reality, Motion Capture and Early Modern Theatre

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> Uniqueness and duration are as tightly intertwined as transcience and reiterability. Stripping the object of it's sheath, shattering the aura, bear witness to a kind of perception where a sense of similarity in the world is so highly developed that through reproduction, it even mines similarity from what only happens once. (Walter Benjamin, "The Work of Art in The Age of Mechanical Reproduction," 10)

Given that Walter Benjamin analysed the fleeting place of aura in "The Work of Art in the Age of Mechanical Reproduction" in 1936, in the first half of the twentieth century, one might assume that the exponential effects of digitisation in the twenty-first century would reduce the place and primacy of aura both captured and reproduced in contemporary art and the humanities. [1] We suggest that the reproducability of digitisation is not necessarily irreconcilable with aura and provide two means of engaging with historical performance through digitised (re-)creations. In this paper, we investigate virtual reality representations of performance in a specific, historical venue by exploring the motion capture of an actor on a virtual, late sixteenth-century theatre from London, the Rose Theatre. Technology and the form of what we might term a historically-informed 're-enactment' can mediate the way in which knowledge and experience are transferred, and even what may be considered 'knowledge,' let alone art. Our work provides opportunities to address what such intermedial confrontations might produce for revisiting performance in early modern England, as well as the performance of early modern theatre today. These technological interventions enhance live theatre performance rather than impeding, disrupting or distracting from contemporary performance practice. From this technological capture of historical performance and this virtually reconstructed venue, we have the means to enhance the exploration of, in this case, theatre history and its implications for performance in the twenty-first century. We address a virtual environment and the motion capture of performance for that environment. While the environment is historically accurate, it remains static until the actor enters. While the motion capture technology permits the rethinking of performance in contemporary and historical contexts, a captured performance loses its specificity if it is not embedded into an environment. So our goal here is to combine and integrate these two global frames – one captured in the live and one constructed from history in the virtual.

Why focus on the Rose Theatre when so much more attention is given to the Globe theatre? The answer is partly because the reconstruction of the Globe, near its

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[1] Benjamin's concept of aura is particularly repurposed here as a mode of identifying the capture of performance that this technology facilitates beyond the traditional notion of image captured and reproduced on film.

original location on the south bank of the Thames River in London, has generated considerable controversy and disagreement. Further, when the foundations for the Rose were discovered in 1989, there appeared the promise of understanding exactly what the venue looked like when Christopher Marlowe's plays were performed for the first time.[2] Many of the questions about the nature of this venue appeared to be able to be answered: exactly how big it was, how many galleries there were, what the shape of the stage was, exactly where it was positioned, and what the sightlines were for both actors and audience. Useful though the excavations were, they did not produce the requisite answers, only partly because the excavations were not able to be completed, given the construction deadlines for the building, Rose Court, over top of them. One third of these foundations have not been excavated, because of insufficient funding; they remain covered over with a thin layer of cement and sand to preserve them. With the differences of opinion about the Globe reconstruction and the unavailability of the complete foundations for the Rose, there is certainly a need for other means of understanding long-since demolished theatres when, for instance, 'bricks-and-mortar' answers are unavailable or impossible. A virtual model of the Rose provides a very good sense of how this small, irregularly-shaped theatre would have appeared and, most likely, how it would have operated. We know that when early modern theatre is performed today, it differs from the style of performance when Shakespeare was alive, so attempting to capture that form of performance, and then 'staging' it in an accurate model of the venue could lead to better understanding the nature of such performance and the venues in which it took place, not to mention live performance today.

First, the venue: the Rose venue is created by Ortelia, a Brisbane-based company that creates VR models of real cultural spaces. While one aspect of Ortelia's operations is concerned with creating absolutely accurate models of contemporary cultural heritage venues such as art galleries, museums, and theatres, another avenue investigates the scope for re-creating cultural venues that no longer exist. An Ortelia virtual environment is generated from the geometry and dimensions of the actual site, and in this case, the actual foundations of the Rose.[3] It is then textured with images of the requisite surface textures. The models are highly detailed, down to the position of electrical outlets, and other such essential functional features that are not essential to the Rose Theatre but are essential in contemporary indoor cultural spaces. The models also demonstrate a venue's aesthetic features such as paint, stonework and the like.

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[2] The Rose Theatre is a smaller version of an Elizabethan theatre style which has been made famous by the neighbouring Globe Theatre and its contemporary reconstruction in London. These open-air venues were octagonal or polygonal in shape. There were two or three tiers of seating around the thrust stage, in addition to the pit, the open area in the middle where audience members stood to watch the action. This is not the only shape of theatres in the Elizabethan era, but it is the one that has captured the imagination of patrons today through the building on Southbank and movies such as *Shakespeare in Love*. Also see Eccles for the full history of the Rose and its 1989 excavations.

[3] The Ortelia modeller who created this version of the Rose, used as his foundation an article by Jon Greenfield and Andrew Gurr on the excavations. Greenfield is an architect who has been associated with the Rose for some time, and Gurr is an Emeritus Professor from Reading University, and one of the principal consultants on the construction of the new Globe Theatre.

They are also easy to use, employing familiar interactive gaming technology tools (a mouse and the W-A-S-D and arrow keys). The modeler faced the usual things in building this version of the Rose: establishing the height of ceilings at the time, the height of stair risers, the average size of citizens in sixteenth-century London, known construction methods, and finding the right kind of oak panels and thatch that was appropriate to the day. In the process, the model raised several new questions for theatre historians, some of which will emerge in the course of this paper.[4] We have deliberately not yet included the columns that appear to have been on the stage following renovations or the canopy that likely protected the actors from the elements. There are differing opinions about these items (See Bowsher, 41 and Eccles, 28), but a model such as this is relatively easy to modify. It is also possible to incorporate later versions that emerge from historical records. While we wished to avoid the controversies that continue to surround the Globe, the construction of our model of the Rose has forced some questioning of the standard sketches that have for decades (and in some cases much longer) illustrated, more or less definitively, what the theatre looked like.

The second facet is motion capture. The dynamic activation of these environments, an activation that necessarily involves the incorporation of the live (or precaptured actor) into a historical space like the Rose model, presents unique challenges for the actor, director and animator to resolve. A significant complexity associated with this is the Benjaminian concern with the capture capacity of the frame, and the impact that framing dimensions (including limitations) can have on the preservation of aura. When the traditional framing mechanisms of performance environments are removed and we work with actors in digital environments that capture performance in an omniscient (or global) scale, the authenticity of performance required to appropriately populate the historical space not only becomes amplified but places a unique performative pressure on both environment and performer.

The Omniscient Frame is a mechanism that can be employed in the capture of live performance for filmic, game and theatrical production. When performance is captured in a motion-capture environment, dependent on the established capture volume, all framing decisions can be made after the capture (in game or film environs) or during the capture real time in live performance. Unlike traditional film-making or the staging of performance where all of these intentions necessarily need to be confirmed by the director in the production or rehearsal stage, in the global capture of performance these decisions can be made after the shoot, in several different permutations or indeed by the end user depending on the user interface. This presents a unique challenge to the maker (the director/animator/actor) in that there are no specified performance frame intentions apart from a direct concentration on the actual scene. This makes "performance capture" (Zemeckis in Forni, 47) entirely theatrical in nature,

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[4] The model reveals several construction problems regarding stairways that eventuated following the various renovations: that is, working with the actual foundations as one would if one were to physically re-construct the theatre demonstrates that most illustrations of the theatre misrepresent where the doors would be.

and lends itself perfectly to the population of the recreated historical environment we have begun to describe.

So the concept of the frame is challenged in this discussion, particularly in its relation to the played intention and movement of the actor. Current incarnations of capture and manipulation devices, in this particular instance optical motion capture systems, can record beyond the conventions of the standardized 180, 270 and 360 degree frame, and indeed the Rose Theatre environment occupies a similarly global space. As we move beyond the capture, relay and storage of the visual and the aural in traditional framing terms and move into territory that now also captures the plotted movement of performance within omniscient framing environments, we enter a landscape now populated with a third layer of Benjamin's captured aura. This third element, captured frameless movement, is an addition to the layers of performance to be stored and is central to a key notion of this work.

A primary connection exists between the integrated perception of environment as an end user (based on the visual map developed through movement and associated constructed memory about our virtual landscape), and the concept that an actor's movement that can now be captured outside of any formal frame. The Omniscient real time capture of performance, while allowing for an unlimited amount of framing potential, demands a unique and uncompromisingly disciplined style of direction and performance that has thus far remained relatively unstudied. Little has been discovered about the challenges of communicating the unlimited potential of framing and focus to the actors who work within these systems. The Ortelia environments provide an optic that can allow these sorts of questions to be posed.

Once the actor enters the environment, we are able to explore several other significant features of the theatre and aspects of theatre historiography. Among some of the issues that have come up are three we discuss here: the actor in relation to small space; the actor actually being seen; and the actor knowing 'how to act.'

Regarding the first point – the actor in the venue – the intimacy of the venue was apparent before the figure was added, but once we can see the actor on stage, the experiment suggests the need for a different style of acting than even the Globe Theatre, which is significantly larger. This fact was always recognised by theatre historians, but the ability to navigate through the venue reinforces its small scale and the acting that would have been required on such a stage. More important than the cramped space is the basic functionality of the stage: one of the factors we have identified is the extremely small backstage area. If this area were also used as a discovery space, which it would certainly have been in the Globe, there is even less room to hold the objects that would be needed (but kept out of sight) for the plays that are known to have been performed there.

Seeing the actor in the space makes more urgent the need to provide other objects in space, namely known props for the plays that are known to have been performed in this venue. We have worked with *Dr Faustus* in our investigations, primarily because of the power of the final monologue before Dr. Faustus is carried away to hell. The props required for *Dr Faustus* include a banqueting table, a desk, "an empty

throne" (qtd in Bowsher 68), and the facilities to make hell-mouth, plus the rock and mossy bank that are included in Henslowe's diary for this play (Bowsher 67).[5] Bowsher acknowledges that "the Rose would have been too small for elaborate staging devices" (67), but this model suggests that it is in fact too small to even accommodate the necessary props for the production of the day, without the shed that Eccles argues Henslowe built in 1592 at the back of the theatre (28). The stage management of this area would have been very difficult. Our plans include modeling these props to test both the storage of props and costumes in such a confined space, as well as the opportunity to evaluate the effects of the avatar's interaction with them, hell mouth in particular. The next phase of development will also include generating more figures, both actors and audience, to fully populate the venue with, eventually, the several thousand audience members that the Rose would have been able to hold. This will assist in further explorations of actor-audience relationships.

The second major point is that of sightlines and visibility: how well would the audience have seen the actors and vice versa? The model demonstrates that the theatre was quite dark. Without additional lighting (torches, lamps, candles), patrons who paid to sit in the galleries would practically have to feel their way through very cramped passages to available bench seating. Tiffany Stern suggests that patrons arriving early to reserve a seat would have brought with them copies of the play, purchased on the way; they would have filled the time by reading these books (in addition to being required to read the equivalent of scene names/locations).[6] The model suggests, however, that unless patrons were in the front row of the galleries, they would have been hard-pressed to see without artificial lighting. How the theatre was illuminated to permit that reading is yet to be established. There were obvious fire hazards from any of the options (torches, lamps, candles), and each would have also produced considerable smoke, further obscuring view. We hope to incorporate samples of each lighting format to test the effects.

The weather in London also contributes to lighting, or, in the case of London, lack thereof. The model already incorporates two different weather experiences: a sunny July day in London at 2 pm, and an overcast version at the same time. The stage was positioned so that the actors did not have the sun in their eyes, provided the sun was out. The sun played a small part in illuminating the venue though: the angle of the sun hitting the inside of the theatre through the open roof provides only so much light even on the brightest days. The relative height of the theatre – compared to its diameter – restricts lighting to just one small portion of the theatre. The darkness of such daytime theatre makes the possibility of actually seeing the actors – or of the

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[5] Other plays by Marlowe are no less reliant on large props: *Dido, Queen of Carthage* requires a chariot and statue; *The Massacre at Paris* a desk and bed; a hearse in *Edward II*; treasure, a throne, a cage large enough to hold a man, and a banquet table in *Tamburlaine Part 1*; a bed of state, a hearse, and a chariot that can hold three men in *Tamburlaine Part 2*. The plays also relied upon a sizeable number of actors. It is difficult to determine where they would have remained when they were not required on stage.

[6] Stern explored this in her paper at the *Shakespeare's Spaces* symposium in Hobart, Tasmania in August 2010.

actors seeing the audience very well – surprisingly difficult. Even allowing for the eyes of both actors and audience to grow accustomed to the relative darkness, the lighting levels of this theatre – during a sunny day or an overcast day – must have affected the ways in which actors performed their parts.

The third point concerns how the actor 'acts' in such a venue. The inclusion of the actor-driven avatar in the theatre model facilitates an overall activation of space that then allows the virtual visitor the opportunity to still be within the environment but, at the same time, to view how others interact within the prerecorded and modeled system. In the capture of performance the 'mocap' performers are able to locate themselves within the Ortelia environment in real-time and actively participate in the modeled space, with the assistance of a 24-camera Motion Analysis optical motion capture system feeding into a live viewing window that reads the 40-108 marker set template through a live stream.

There are several benefits to the use of Motion Captured animation in Ortelia environments as opposed to scratch animated characters or avatars. The first is obviously the economic factor: for an animator to create individualized movement and action for several avatars would take several weeks, whereas in a mocap shoot all of that data can be captured in a day, cleaned within a week and solved onto the avatar for a fraction of the cost. The second advantage is concerned with the ultimate realistic nature of the movement, individuality and gravity (or weight) that is present in the data captured from a real human in a mocap session. It is also possible under the right conditions for several individuals to be captured at once in a session, and of particular importance to the potential of the system already described, for this group of individuals to be streamed in real-time into a live workspace so that the captured individuals can then respond to the 3D Ortelia environment as part of the capture. The third point about using mocap data within the Ortelia system is the limitless potential to exploit the relational possibilities between individual markers and/or objects within software applications. The motion-captured data (subsequently turned into 3D objects and avatars) can allow for a series of relationships to be created in 3D space that can in turn be allocated behaviors that will react (as per programming) when the relationship is triggered. Put simply, these relationships are spatial and can be used to trigger audio and visual responses when activated or to elicit a physical and/or aural response from other avatars who have populated the environment.[7]

So, the actor walks into a motion captured space to work, though now this is not a *space* as they have formerly understood it, it is a volume. A volume marked out physically on the floor and virtually on a screen located within a motion capture studio that will model a replication of the space available for performance in the 3D venue. This replication of the real into the virtual is not an environment that actors naturally understand or are able to necessarily be prepared for in their training until

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[7] For examples of this type work in performance see: Vincs and Delbridge "The Silk Road Project" (2008), Trisha Brown "How Long does the subject linger at the edge of the volume" (2005). Writing in the area can be found in various forms in both Steve Dixon's *Digital Performance* (2007) and Johannes Birringer's *Performance, Technology and Science* (2008) amongst others.

they encounter the studio – a similar problem to devising a performance style for a venue that no longer exists. The environmental volume that they must populate is visually imperceptible in many ways.

Unlike the playwright who has committed to a character an evolved background, history, established set relationships, and a place in story; the character that this actor will drive (before we introduce a text) exists as a fully rigged digital puppet, an avatar, with one specific function particularly in mind; movement. Movement that is to be captured, unframed in an omniscient virtual landscape only perceptible to the actor through historically constructed memories and the representation of these on a screen. For our actors it has been an animator, a gaming engine, and a few academics that have all determined the design of the character the actor will play and the space that this character will occupy (in this case the Rose theatre). This actor, entering an environment unlike anything encountered before, is encased in substances that create unique surface potentials to be tracked in the volume. The actor is wearing a lycra suit, shoes made out of velcro and a skullcap, like a swimmer. In addition to this, covering the actor are up to 108 reflective markers, 108 individual surface potentials particularly designed to reflect light in a specific arc back to an array of recording devices. This array of devices, the performance volume, the encasement in surfaces, as well as the actor have all become recognizably invariant. As the actor has become an integral part of the motion capture environment, the integrity of the landscape now relies on the actor (specifically their scale and established relationship between markers), as an object. Set as object, completely invariant to the volume, the actor is templated like a factory dye to fit an already existent model.

This idea of the real actor in the virtual is of particular interest with relation to the early modern theatre models to simulate and examine the performance experience for actors on such an early modern stage. Presuming that the same activated (but prerecorded) avatars would populate the audience, the real-time performer (in the future) will be able to interact and elicit responses from the audience based on preprogrammed relational settings, while also allowing the 'actor' to experience the stage in all of its permutations. The allocation of a virtual camera to a certain marker on the real-time streamed performer, will enable the performer to see the view from the stage and literally (and virtually) perform to the peopled audience.

The first two layers of the actor's aura as traditionally captured can be classified as the actor's image (the first layer) and the actor's voice (the second layer). As we move beyond the capture, relay and storage of the visual and the aural in traditional framing terms, and into territory that now also captures the plotted movement of performance within omniscient framing environments, we enter a landscape populated with a third layer of captured aura. This third element, captured frameless movement, is an addition to the layers of performance aura to be stored in the model and is central to this discussion. A primary connection exists between the integrated perception of environment that this paper discusses (based on the visual map developed through movement about an historical landscape), and the concept of an actor's movement that can now be captured outside of any formal frame.

Where frames set the optical terms of cinema, in relation to the more contemporary technology of motion-capture, we should now consider the concept of the 'capture volume,' which in motion capture is the amount of 3D space that the system can 'see.' A translation of physical space to screen based 3D space; this is determined by the placement and settings of the capture devices (cameras) and their distinct relationship with each other as separate units. Depending on the capture that is being undertaken, the size of the volume will be adjusted. The variables involved could include: the amount of objects to be captured, the nature of the performance that is to be captured or the physical properties that are required in the space for performers to interact with. On this point it is worth noting that if a particular character needs to be captured sitting at a desk writing, climbing a rope or performing any other task that will involve interactions with static 3D objects, then the best way to achieve this is to physically have the actor sit at a desk or indeed climb a rope placed in the volume, remembering that it is only their movement in space that is recorded and not a visual image of the physical object. The establishment of the volume is a vital early step in the profilmic[8] setup as any character or object performing outside of this volume (in whole or in part) will either not be captured at all or their individual template will turn into an unmarked data stream or cloud of ghost markers.[9]

This question of reproduction and mediation that Benjamin identifies above is central to the dilemma of the place, space and function of the performer in the captured. There is an inherent lack of respect afforded to the work of the performer from the apparatus. The primacy of what is perceived to be the central character in the scenario, the actor, is under question if we assume a more scenographic approach and consider all parts of the environment of equal weight (or significance). The device could well be viewed as the central component of the experience for the audience, and the relationship of the viewer with the actor is in many ways comparable to a mere functionary role that exists only to showcase the work of the device. In many ways a more accurate way of describing Motion Capture and current digitally mediated capture scenarios is related to a deployment of the impassive. This notion of the impassive provides a means of describing the allowance of the interface to create an open space (within set and widely defined parameters) that is able to capture unframed motion within a set environment that in its raw state remains unbiased. Motion Capture fundamentally employs a particular version of Laura Mulvey's footprint in that the deployment of a completely omniscient frame remains (in the initial capture) completely open and absolutely precise (Mulvey 24).[10] The neutrality of a chosen pictorial frame (as manipulated by early manual camera focus), or a particular capture frame

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[8] This term refers to anything that is set up in front of the camera to be filmed, such as actors, scenic properties, etc. It is normally referred to as the profilmic event, that is, the act of setting the scene for the camera, or in this case the motion capture camera array and system.

[9] A marker cloud or ghost markers are typically groups of markers that are not part of a template; that is markers that have either broken away from the template (for instance, come off the actor) or are inconsistencies in the capture volume.

[10] See Mulvey 2006, where the documentary footprint recording relates to notions of the unbiased.

rate (as manipulated by early manual camera handles) or even particular capture time available (as dictated by the physical footage of film able to be carried in the camera) is only brought into question in Motion Capture after the movement has been captured. The truly impassive document assumes a frame, focus and length of record that remains impartial.

To move towards a conclusion, we note that our work together has also demonstrated that such investigations of the nature of performance in a digital age will require a rethinking on the part of audiences: that is, whether or not to understand the actor's motion-captured performance in this environment in the same way that one would interpret a performance of an actor on a 'real' stage. We gave an earlier version of this paper at a conference on Shakespeare's spaces in Tasmania in August, 2010. We had just succeeded in loading the motion capture files in the venue and were very pleased with the effect from the standpoint of each of our principal research interests. The response was fascinating: rather than caring about the technology, the audience immediately began to critique the 'performance' of the avatar, just as they would a live performance in a 'real' theatre. In other words, just as motion capture presents challenges for actors, it also presents challenges for audiences that we will also have to face.

A second major challenge for such work is, of course, economic. Yet despite the research costs of such technology, the creation of such activated models is substantially cheaper than the 'real life' recreation of venues such as the Rose. The recreation of the Globe took decades and there is still disagreement about whether or not the model is 'right.' More significantly, multiple possibilities can be tested in VR environments to establish which answers are most likely, rather than actually rebuilding with real building materials. The introduction of human figures onto the Rose's stage via motion capture allows us to explore the relationships between space, actor and environment. Current technology invests in this venue the opportunity to once again challenge perceptions of space, performance, and memory.

This collaboration and its effective combination of venue and actors facilitate a new way of thinking about how the work of early modern playwrights can be stored and recalled, thus intersecting productively with contemporary studies in performance, as much as historical studies. It provides a twenty-first-century contribution to Benjamin's notion of 'performance as test' (Benjamin 14) by placing the work and contribution of the actor (or the transformation of the actor) into the historically recreated virtual model outside of traditional descriptions of *the divine*, often associated with the concept of aura. The performance undertaken within these parameters, under the potentials of omniscient framing, allows for an interrogation into what an authentic approach to performance for these spaces could be and begins to address core functions associated with concerns around the place and function of the actor in the mediated. The relationship discussed between movement, early modern performance and visual navigation of particular environments is key to establishing the pathway for the actor to insert themselves into the digitally mediated performance habitat of the

early modern theatre. This work provides a perspective on and embodiment of the relation between technology, memory and experience.

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