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## Virtual Hamlet: Combining Motion Capture and Real Time Digital Puppetry

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As a theatrical production, Hamlet poses a particular directorial challenge: the Ghost. How should an apparition be presented onstage alongside mortal characters? Traditional Shakespearean theatre presented apparitions using theatrical effects to visually separate these characters from the mortal characters. Modern theatrical productions must address this same issue with every new staging. Solving this question can help lay a clear conceptual footing for the rest of the production's conceptual considerations. A recent production in New York City in 2015 directed by Austin Pendleton opted to make the Ghost invisible to everyone but those guards who first encounter him, and once Hamlet sees him, only Hamlet. This decision rendered Hamlet mentally disturbed in the eyes of the audience (Isherwood 2017). Kenneth Branagh's cinematic Hamlet in 1996 created a ghost that had a "special effects and a horror-film look." (Maslin 1996) This approach favors brutal realism expected in modern cinema. These two approaches represent extremes in production solutions to the ghost; psychological illness, and pale faces in armor.

When Hamlet was first produced, the Elizabethan stage was full of special effects (Brockett, Franklin 2008). Shakespeare was a practitioner of special effects technology such as pyrotechnics, rope and pulley and trap doors. His commitment to authenticity and effect even led to the accidental destruction of a theater by fire in 1613 after the use of a cannon-based special effect. As conceived by faculty in a theatre program and a digital effects design department at the

same university, the challenge of representing the ghost and the Shakespearean spirit of theatrical effect became an opportunity for collaboration. This was our opportunity to create a new type of ghost, one that bridges the traditions of theater and cutting edge interactive media.

Theater has a history of stage projections dating from the 1700's use of magic lantern devices (Figure 1) to the 1920's when innovators like Erwin Piscator began their experiments with the medium (Figure 2).

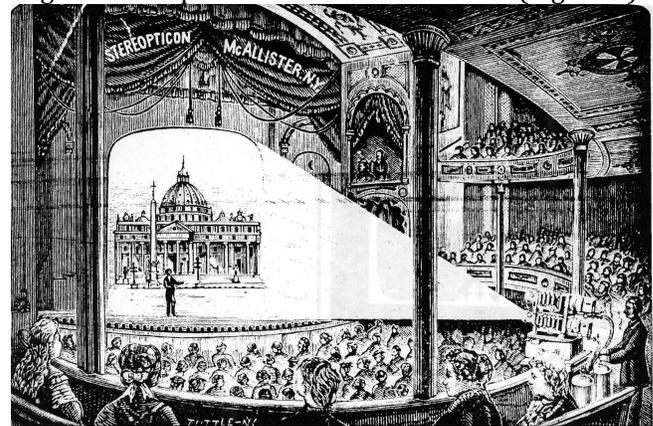


Figure 1. A magic lantern projector device.

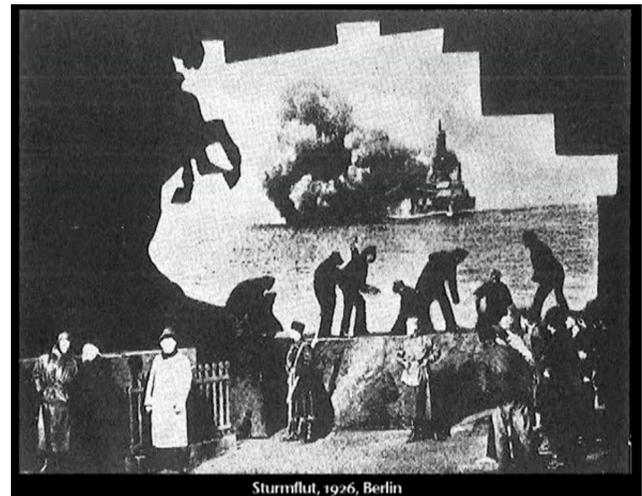


Figure 2. Erwin Piscator staging of *Sturmflut*, 1926 with projected imagery.

Throughout the twentieth century there was an extraordinary growth in the implementation of projections from experimental to mainstream theater (Theatre Communications Group 2011). While the size and complexity of projections has grown over time they have been until recently static or pre-recorded. With emerging technologies such as Microsoft's Kinect Camera and Derivative Software's TouchDesigner

projections can be an interactive, responsive addition to the live theatrical experience. Our collaboration utilized these technologies in creation of our ghost. Theatre has a long tradition of extending the body in performance. Costumes, makeup and prosthetics are the bread-and-butter of the art. Greek theatre used large scale masks and costumes to amplify theatrical expression, while Elizabethan theatre utilized extreme makeup applications and costuming for supernatural characters. Physical puppetry provides a clear mechanism to extend the performative and expressive capabilities of the actor. There are, however, some practical limitations to the physical puppetry approach: the movement and visual effect of the puppet is limited to the physical realities of the performer. Pushing beyond these boundaries, cinema has used digital motion capture to create such characters as Gollum in the Lord of the Rings trilogy and the recent Planet of the Apes films. Andy Serkis, an actor known for his motion captured performances, states, "Performance capture is a tool that allows actors to transform themselves into many different characters. You're not confined by physicality. You can play anything" (Hart 2017). Advances in virtual staging and performance capture, notably used in the production of the film Avatar, have extended motion capture for characters into the real time realm.

Although hybrid physical/digital stagings have been undertaken before (Meador, W. Scott, et al 2009, Bermudez et al 2002), the field has not kept pace with rapidly evolving technology. Our production combined recent advances in inexpensive real-time motion capture with the theoretical underpinnings of theatrical puppetry to perform a spatio-digital character in a live theatrical venue. A Kinect sensor on stage captured the movements of a physical actor performing the ghost. This data was manipulated in Derivative Software TouchDesigner and optically projected as an abstract digital apparition back onto the stage concurrent to the performance (Figures 3, 4). The virtual puppet became at once puppet and avatar, both extending and replacing the physical body of the actor. The dual space of this performance, half body-sized space of the actor and half virtualized space of the projected apparition, plays to the notion of the Cybrid space (Anders 1999).



Figure 3. Technical rehearsal still from the NJIT 2016 Hamlet Performance.



Figure 4. Production still from the NJIT 2016 Hamlet Performance.

This poster contextualizes, describes and presents the Spring 2016 theatrical production of Hamlet at the New Jersey Institute of Technology featuring a digitally created projected parametric Ghost character performed in real time by a motion-captured onstage actor.

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