How Projection Technology is Changing the Performance Art Industry

A Research Paper submitted to the Department of Engineering and Society

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science in Computer Science

Jeffrey Lionel Mouritzen

Spring, 2023

On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

Advisor

Kent Wayland, Department of Engineering and Society

STS Research Paper

Balancing Innovation and Preservation in an Evolving Art Form

From the earliest points in human history, live entertainment and performance arts have existed as a fundamental pillar of society. It allows mankind to share stories, efficiently diffuse information and lessons to the masses, and preserve cultural history from generation to generation. It is without a doubt that theatrical arts, being one of the most traditional forms of performance art, continues to thrive as an authentically human experience, where people can use the space to express and present the experiences and stories that make humanity unique. For many familiar with the industry, ranging from the most committed dramaturg artists to the casual audience member, the theatre might even represent a sacred place, detached from the pressures and stresses of a rapidly changing outside world. However, as is the case with the human experience, theatre continues to also be a place of change and innovation, blending the traditional with new and exciting changes.

One major way one might observe the change that occurs in the theatre space is through the incorporation of technology. Though the theatre space is commonly assumed to be more organic and human-centered when compared to other industries, implementing technical elements into theatre is by no means a new phenomenon. Technology and theatre have traditionally been in a very close relationship, as technologies (such as the introduction of the microphone) would work to solve functional issues that came with making shows more accessible to the mainstream public. What is new, however, would be the noticeable uptick in the development of digital technologies *in the art itself* throughout the past few decades—a byproduct of the digital revolution. These new technologies allow for artistic special effect choices that are aimed at immersing the audience in new and innovative ways. Such technologies

include anything from advanced digital lighting and projection art, to the even "newer" technologies of virtual reality (VR), augmented reality (AR) and mixed reality (MR). It is an exciting period for change, but given that these technologies are driving the theatre industry away from the more traditional technical methods of live entertainment, a new question arises: how is special effect digital technology, such as the use of digital video projection, *changing* the theatre industry, and how are theatre professionals and audiences alike adapting to and molding how such technology is ingrained into the mainstream?

The significance of this question isn't merely a question of artistic taste. There is a genuine concern to be had about where society will draw the line of "this is no longer authentic" when it comes to the live theatre we consume. How we as a society treat incoming technologies and adapt them into the more technologically "restrained" parts of our culture (such as theatre) sets a precedent for the incorporation of future technologies to come. The more technology is incorporated, the more it finds its way in and changes traditional works, potentially detracting from or even tainting the original creative vision of the artists who dedicated their lives to the theatre space and to their work in the theatre. The agency of the human artists behind the art must be preserved, or else society will slowly drive out the essence of theatre, and diminish the potential it can do as a cultural anchor and device for educating the masses through story and mythology.

Understanding the Space: The Historical Relationship Between Theatre and Technology

To clarify once again, the incorporation of technology into theatre isn't anything particularly new. It has been a well-documented phenomenon from the introduction of microphones and speaker systems to the proliferation of advanced rigging and set automation

(Saltz, 2001). Even manipulations of video projections have existed in some primitive form since the turn of the nineteenth to twentieth century, leading to the motion pictures we now call cinema (Waltz, 2006). In the past few decades, however, new *digital* technologies are now being used in innovative, artistically-minded ways by traditional theater companies to take the traditional art form in fresh, previously unexplored directions. As mentioned before, these technologies include (but are not limited to) digital lighting, projection art, virtual reality (VR), augmented reality (AR) and mixed reality (MR) . These technologies are being experimented with by some of the highest-profile companies in the theatre industry, such as National Theatre and Royal Shakespeare Company (Rogers, 2019). These professional production companies are known for their high quality mainstream theatre, so their incorporation of innovative technologies is symbolic of how drastically the traditional theater industry is evolving and constantly being challenged.

As exciting as these new technologies and adaptations are to innovative creators and enthusiastic audiences, there are proponents in the industry, particularly professionals in dramaturgy (which is the study of the theory and practice of dramatic composition), that discourage and criticize this transition to a more digitized theatre on the grounds of it's "dehumanization" of the art and diversion from the original artistic intent of traditional theatrical pieces. In this context, "dehumanizing" the art refers to diverging from organic traditional theatre (that is, theatre built around the "human" aspect with minimal technical or spectacle distraction) to the point where there is a subjective loss of authenticity. Dehumanization is especially apparent (or otherwise more likely to be discussed and criticized by professionals) in theatre works considered "classics", in which cases the original artistic intent forwent the use of spectacle and technology, and instead focused on the actors, dialogue, and actions.

The debate over “dehumanization” in this context is rather broad and tends to take many different forms based on the technology being discussed, but a prime case study might refer back to the societal and cultural mini-movements during the 1960s. It was during this period that camera recordings of live performances were first starting to escalate, leading to major backlash and a wide-scale rejection of technology in live stage environments. Artists, particularly those backing the rejection, sought to “rehumanize” the theatre by stripping it from the technical elements that proliferate “dead theater” (a word coined by disapproving artists who saw the inclusion of technologies within the theater as “cold,” “technical,” and “slick,”) (Gray, 2014). This notion of protecting and rehumanizing the theatre persists to this day, and has only become more nuanced as the technologies being used become more advanced and specialized for the theatre. Referring to the technology of projection art in particular, the trend toward incorporating video projection art technology into staged productions has led to the rise of projection-mapping software such as Troikatronix Isadora—digital technology intended specifically to aid with the unique ways mainstream theatre uses video projection in and on their set designs. Such software has facilitated making the set of a play purely video coming from a projector, fundamentally changing plays written to be performed in minimalist set designs.

Relevant Perspectives from Scholars and Industry Practitioners

Matt Gray, an assistant professor of theater at Northeastern University, Boston who has previously also directed, acted, and taught at LAMDA in the UK, Carnegie Mellon University in Pittsburgh and NYU Tisch School of the Arts, once wrote a dissertation regarding what he calls a “Tenuous Relationship Between Theater and Technology”. In his essay, there is a strong prevailing argument that technology in performance arts is by no means anything new, and has

had a very significant role in the development and growth of theater. There is a deep dive into the "conflict" that exists where a technology or a series of technological systems threatens to "dehumanize" the art, using examples from history (particularly the 1960s) in which there were societal and cultural mini-movements to rehumanize theater by stripping it from the technical elements that proliferate "dead theater". The essay also explores the impact of mainstream "commercial" theater on the drive toward technological innovation in the theater, where there is a discussion on the correlation between the two. Another key point Gray makes is how the over-abundance of technology will almost certainly mean a distinct divorce from the realm of stage-based, theatrical performance art, as there is no longer any inherent correlation between attending a theater training program and working in the digital media industry (movies, TV, etc.). Being a professional in the theatre industry and a professor of dramaturgy, Gray represents to a great extent the social actors who are critical of the involvement of technology in theatre, who may also stress the importance of treading carefully as society adapts to the use of such technologies.

To further understand how society has incorporated such technologies into the performance arts, one may consult Sol Rogers' article on the companies who are pushing the technology to the mainstream theatre space. Rogers, who is the CEO and Founder of REWIND (an Emmy nominated immersive content studio), closely details the ways new technologies are being used in innovative ways by traditional theater companies and organizations to take the traditional art form in new, previously never experienced directions. He discusses the emerging use of newer technologies in the theater industry, such as virtual reality (VR), augmented reality (AR) and mixed reality (MR), as well as how audiences and performers alike have embraced the new experimental technologies. Some of the high-profile companies experimenting with these

technologies include National Theatre, Royal Shakespeare Company, SOMNAI, ARShow, Cosmos Within Us, and The Under Presents. As this research paper focuses more on set design/video projection, the case study on the Royal Shakespeare Company is especially important for understanding the context of the technologies impact. Not only does it touch on the use of video projection with their digital avatar of Ariel in *The Tempest*, but it is also a prime example of newer technologies dramatically altering very traditional theatrical works (works written by Shakespeare himself).

Methods of Gaining Professional Industry Insight

A primary method utilized when researching and analyzing the complex developing relationship between theatre and technology was to conduct interviews with artistic directors and staff members of theatrical productions that have had experience incorporating innovative, digital technologies into their work. The University of Virginia Drama Department, being an educational space brimming with seasoned professionals and professors in the theatre industry, proved to be an ideal space for collecting experiences related to the evolving use of digital technologies in theatre. For this investigation, I had the pleasure of interviewing Associate Professor Marianne Kubik, who, in addition to having an extensive background in acting and teaching at UVA for over 15 years, also directed the mainstage production of *When the Rain Stops Falling* in the fall of 2021, in which use of projection art was a significant element of the show[1]. In addition to WTRSF, Kubik's long list of directing credits includes (but is not limited to) *Sense and Sensibility* (2022), *She Kills Monsters* (2019), *Shipwrecked! An Entertainment - The Amazing Adventures of Louis De Rougemont (As Told By Himself)* (2017), *Rhinoceros*

[1] It is worth noting that I worked on the production of *When the Rain Stops Falling* as a projection operator and assistant designer. I didn't report directly to Kubik, but I was still involved in the design process to some capacity as an undergraduate student. This is further elaborated in the Technical Report portion of this thesis.

(2012), *dark play or stories for boys* (2011), *So Careless* (2008), *Call of the Wild* (2006), and *Scapin* (2006). Kubik's extensive experience in both projection-heavy and projection-less productions makes her an invaluable resource for gaining insights into the technology's impact from the perspective of those actively working with it, as well as understanding the production process from the artistic team's point of view.

When formatting the interview questions to make the best use of her time, I chose to focus in on three main topics: her experience and creative process during WTRSF, her reflections on the production (as well as feedback she got from her creative team and from audience members), and her general preferences and opinions on the use of projection design in theatre. I asked her to explain in detail what challenges and complexities her artistic team faced, how she negotiated and synchronized the different technical elements and artistic visions alongside the action on stage, why she went the direction she did in terms of design, what she would do differently, and what lessons she learned that she would like to share with other aspiring directors using the technology. The goal of the interview was to get an idea of how the technological transition to using projection technology impacted the production and design process (from her experience as a seasoned director), as well as where in the humanity-driven theatre space this technology is able to fit in. By understanding the role the technology played, we will be able to gauge if the incorporation of this newer technology felt abrupt or disruptive to the other social actors within the production space, and determine if the blending of technology and live theatre was generally well received by the production itself and audience members alike.

Additionally, other relevant sources consulted for this report include critic writings and broader theater criticism, to see how non-professionals and non-production involved personnel interpret the use of technology in these shows. The general idea was to get a full image of how

those industry-involved social actors adapted to and molded the integration of modern digital technologies into the theatre world, or alternatively how the integration of such technologies influenced how society perceives and classifies authentic, classic theatrical works. To help with this, I referred to critic reviews of the 2016 production of *The Tempest* put on by the Royal Shakespeare Company. I selected this show in particular for three reasons. First, the production, much like Kubik's WTRSF, made heavy use of projections to the point where it was a major element of the show, utilizing technology to effectively mold the story. Second, the Royal Shakespeare Company, as mentioned before, represents a major player in the mainstream theatre industry, and in many ways represents the general direction the art will go in. Finally, the show itself, *The Tempest*, is a Shakespearean work that clearly had no intention of being transformed into a digital landscape through projection design technologies. By observing how professional theatre critics responded to the bold choice of altering the original artistic vision with incorporate technologies, one may gain a better understanding on how this technology is received within the sacred, traditional theatre space.

Findings and Analysis

Kubik first went into great detail about what the collaborative creative process behind the development of *When The Rain Stops Falling* looked like, and how it contrasted to other shows she has been a part of. Typically, mainstage productions follow a timeline that starts with a collective meeting with all the designers, which would then develop into more separate design conversations. With this show, however, Kubik started with the projection designer Mona Kasra during the middle of the summer, 6 months before they started and 9 months before the opening. They did this primarily because of the very visual characteristic of projection design, which

required many physical prototypes to be developed throughout the process (even if it meant most were eventually scrapped): “We couldn’t just talk about the ideas, we needed to see them.” The skewed timeline meant that it would often prove to be a challenge to get the entire design team on the same page. Bringing in Lee Kennedy, who was the scenic and lighting designer, at a later point the process led to even more design revisions from the perspective of the projection designer, as it was common for there to be creative conflicts between the different technical elements and designers resulting from their separate design processes and conversations. According to Kubik, it was especially challenging to merge together scenic, lighting, stage action, and the added projection art because of the complexity that came with adding each new design element. It was a necessary struggle, however, as Kubik explains that “If you don’t set that up in the beginning, then you have designs that you are trying to follow through that don’t mesh and match up or play off each other, and it’s too late to change them then.” The solution was a long series of difficult conversations, particularly when designs that were not working had to be cut. All technical elements inevitably had to come together and agree both on a technical and artistic basis. Several meetings and rereads of the script were necessary to come to a consensus on what the true “heart of the story” was during any given scene—all of which had to be done in a relatively short time frame.

In addition to the creative design complexities brought upon the artistic team with the inclusion of projection art, Kubik also notes a variety of unique technical challenges introduced by the implementation of projection technology into the show, first and foremost being limitations regarding the placement of the actual screen. In the Culbreth Theatre where this play was produced, the projector screen had to be in a specific spot that was far enough downstage from the rear projector. There are numerous reasons for this, primarily related to the technical

limitation of rear projection when trying to achieve a bright and clear quality picture (Turnock, 2022). This specific location conflicted with the blocking of some of the scenes, and limited the space that the actors could use when performing. This complication was especially apparent for the opening sequence of the show, which Kubik had originally designed and blocked out to be "outdoors in a vast space, with everybody walking around with open umbrellas'". There wasn't enough space between the performing platform and the scrim screen because of the umbrellas, which could damage the screen if they came into contact with it. This meant that everything had to be restaged, with the actors taking the additional burden of being extremely careful and space conscious while performing: "They literally had to walk and move their umbrellas constantly, while watching that they don't trip on the platform." She continued on to say that the projection setup was likely something she'd wish she could have gone back and done differently for the sake of the actors, comparing the difficulty with WTRSF to her previous production difficulties:

> "It was a learning process for sure. In my last production that used projections, *She Kills Monsters*, we also had a lot of spacing issues with the set, actor blocking, and the projections that we simply did not have the time to fix. We were still having to re-block scenes up to a week before opening. If I were to do *that* again, I would've certainly reassessed the set." (M. Kubik, personal communication, April 19, 2023)

Kubik, being first and foremost a director that works closely with the actors, also had a number of additional considerations to share regarding their involvement in the technical design process. She regrets that she hadn't had the actors work and interact with the designs until very late in the rehearsal process (the first time actors were introduced to the projections was mere days before opening night). Part of it was well out of her control, however, as technical elements (particularly complex ones like projection), are never truly ready until late in the production

cycle, which will always impact how actors can prepare for and act out scenes: “You can’t change the projections too, they are always going to be what they are going to be. The actor must adjust, and we didn’t give them enough of a chance to play.” (M. Kubik, personal communication, April 19, 2023) The actors, to their credit, were able to adjust very quickly to the technical changes they worked around, but Kubik notes that this was only because they would ignore them entirely. They knew the projections were there, of course, but they didn’t pay attention to them or add them into their performance in any real capacity. To Kubik, this was a missed opportunity: “it would be valuable if they knew what was happening; they could choose to alter an action or delay a cross in order to give the projections the room to have a more meaningful impact on the story.” The takeaway here is that the “human” part of the art needs to work with the technical part just as much as the technical elements need work with the story and characters. Otherwise, the overall vision is tainted.

In addition to discussing the production process behind WTRSF, Kubik also elaborated on her own opinions and motivations behind utilizing projection art within live theatre productions. She emphasizes how projection design in theatre is best used sparingly and with purpose, or else it can detract from the essence on stage. For WTRSF in particular, Kubik explains that her goal was to “create an ambiance and an emotional flow to the scenes, instead of just showing them something to read.” She didn’t want the projections to be watched separately from the action, like a slideshow background that gives narrative information in the form of text. The audience had to be able to “feel” what was going on, without needing to watch the projections:

> “It was not as important to us that the projections taught the audience what they were seeing, or explained what was going on. Let us trust that the audience will figure it out.

> What was more important, because it was a GIANT screen back there, was what the audience connected to. Experiencing the emotion, and experiencing the movement of the screen, the movement of the action on stage, and what they were hearing." (M. Kubik, personal communication, April 19, 2023)

To Kubik, the play had a certain "epicness" to it, and that projections (if done correctly) could offer an opportunity to help the audience fill some of what feels like an "emotional vastness" in the play. The existential and cross-generational themes of the play, combined with the wide open space Culbreth theatre afforded, provided a role within the theatre space that projection technology could fill. Kubik used technology not because it achieved spectacle, but because it gave her an opportunity to "tell part of the story of the play in a different or more supportive way", visually supporting what the characters were going through emotionally. According to Kubik, projections needed purpose: "If it's not going to support the story, or it's not going to elevate the story into a different way of communicating where the audience gets a whole different feel, then I don't want to use it." (M. Kubik, personal communication, April 19, 2023)

Kubik's cautious and purposeful approach to implementing projection technologies continued into her more recent projects, in which she recognized when the script and the story did not call for such a technology. She isn't opposed to experimenting with projections in the future (in fact she looks forward to it), but it is clear to her that such applications have a deserved time and place. She is currently producing a play on the Orpheus and Eurydice myth, and recognizes that the "simpler play" that is Orpheus and Eurydice is "not technically-based" enough to justify projections, adding that "it just doesn't feel like it is a projection place—its a puppet place". She further admits that she would likely not use projections on older plays or

plays set in periods earlier than the 1800's, unless the setting is some non-realistic, fantasy setting like *She Kills Monsters*:

> "I think it has to do with 'do I think this story could really, really be told on its own without any lights and costumes'. So more of what we would call *poor theatre*, where you don't have anything. Where it is just an actor and the space, and some light to see them. That kind of a style or feel of a play I wouldn't add projection to." (M. Kubik, personal communication, April 19, 2023)

This general attitude against implementing projection technology in places that it doesn't quite belong (both artistically and historically) was also found to be reflected within professional theatre critic circles. One very poignant example of this would be the reviews for the 2016 production of *The Tempest*, produced by the Royal Shakespeare Company based in Stratford-upon-Avon. As is the case with RSC, which primarily produces traditional, timeless works written by Shakespeare, *The Tempest* is a captivating Shakespearean play involving a sorcerer named Prospero who conjures a storm to seek revenge on his enemies, only to eventually find redemption and choose forgiveness over vengeance on a remote, mystical island. The RSC's production of *The Tempest* diverged from usual adaptations and exhibitions of the classic play by incorporating projection technology as a significant part of the show, further "pushing boundaries" by being the first use of live motion capture in a major classical stage production through their entirely digital avatar of the character Ariel (Alberge, 2016). It was an impressive undertaking, but it was not necessarily received well by theatre critics due to the "gimmicky" nature of this use of technology. Mark Shenton, a theatre critic, columnist, and associate editor of The Stage 2019, was especially critical of the attempt to "break new

boundaries in theatre-making" through the use of the projected Ariel avatar (played by Mark Quartley):

> "Truth to tell, the video imagery of the avatar looks frequently blurry and out-of-focus; it seldom seems to summon any really magical qualities. It feels more like a mere gimmick than I assume was hoped for, and Quartley is more effective when he is able to act, unfiltered by technology, as the character and not as an avatar." (Shenton, 2016, November 17)

To Shenton, RSC's production brought back memories of the first time video replaced sets in a large way in Andrew Lloyd Webber's 2004 show *The Woman in White*, which had notoriously left many audience members (including Shenton) with motion sickness (Shenton, 2016, November 30). He goes on to explain that the unnecessary "trickery" of the RSC's projections detracted more from the actor performances than it should've, as support actors frequently had to "compete with Cirque du Soleil-like theatrics" that overwhelmed the space. Michael Billington, a reviewer for The Guardian, further supported the view that the projections weren't achieving much, critiquing that while the effects were undoubtedly innovative, the "kaleidoscopic" visual spectacle "pales besides the show's human values." (Billington, 2016, November 18) He further claims that while the show offers a "bonanza night for ardent techies", the technology being utilized seemed more like a "a one-off experiment" rather than a "signpost" to the future, as at the end of the day audience members will look to the theatre for emotional engagement over technological spectacle.

The most comprehensive review came from an independent theatre critic named Kirk McElhearn, who broke down exactly why the projected elements seemed just a bit off. He explains that, in order to make it more apparent that exciting live motion capture technology was

being utilized, Quarterly's digital avatar was made to slightly "lag behind his actual movements", which was incredibly distracting to the audience and detrimental to the overall ethereal aesthetic. Additionally, McElhearn critiqued distracting moments where the projection did not follow the column of mosquito netting it was meant to be mapped to: "If this can't be perfect, it's not worth doing." (McElhearn, 2016, November 24)

The critical reception to RSC's *The Tempest* demonstrates that there are applications of projection technology that are not necessarily wanted or appreciated by the general theatre society that receives it. Professional theatre critics still prefer that the human element (that being the performances of the actors telling the story) continue to be at the forefront of each theatrical endeavor. The general consensus asserts that the organic, human element should always be prioritized over whatever benefit projection technology would seem to offer, even if that means cutting the technology out altogether. As mentioned before, this is a similar stance that Kubik took when designing WTRSF, and her cautious and purposeful approach to implementing this technology ultimately allowed her to succeed in creating a memorable experience for the audience without overly detracting from the story and live performance. According to Kubik, the feedback received from audience members and colleges within the theatre space was overwhelmingly positive, anywhere from how much it supported the scene, to how beautiful the projections were:

> "Almost everybody who has talked to me about it has talked about those [projected] portraits at the end, the moving portraits with every family member in that family. To see them so lifesize, it was so emotionally overwhelming, in a good way. That is one part of the staging and the scenic design that I wouldn't change. It was just a beautiful ending." (M. Kubik, personal communication, April 19, 2023)

Even with the presence of complex challenges regarding balancing and negotiating all the separate technical and artistic elements, Kubik admits that they did a far better job than other applications of projection technology that she has personally seen, or even implemented herself in the past. She brought up one scene in particular that she found to be very popular among reviewers:

> "If someone was going to comment on it, they were bringing up the ocean scene. They also liked the sound that was going with the ocean, they liked the mellowness of it and the soft lighting, and the use of the table… I think it shifted things for the audience." (M. Kubik, personal communication, April 19, 2023)

Overall, it is apparent from professionals within the theatre industry, both involved and non-involved within the productions, that projection and media technology definitely has a strong role to play upon the stage, as long as it is done with purpose and with great respect to the other human social actors that share the stage with it.

Reflection and Concluding Remarks

The research provided by this investigation is intended to allow for a better understanding of the complex relationship between technology and the humanity-centered theatre community. Though engaging in case studies such as UVA's *When The Rain Stops Falling* and RSC's *The Tempest*, we can gain more insight into how projection technology changes the artistic design and production process of theatre productions, and how the technology impacts and is received by all the social actors involved, from the artist and performers to the critics consuming the art. At the end of the day, *art*, particularly live performance, is extremely subjective. It may be impossible to gain a full understanding of the impact projection technology has on the general

public through general theatre success stories alone, but narrowing it down to the individual experience reveals the agency that social actors have in molding how and where the technology is used. The concern of technology in theatre tainting the authenticity of the art may be founded in truth for some instances (like with *The Tempest*), but clearly is nowhere near the point of overtaking the art form. Seeing the complex design process that Kubik describes, it is clear that artists still very much have agency on how this technology is used. If the technology is *overused*, critics tend to make it clear that the implementation is simply not working the way it should. Whether production studios continue to listen to the artists and dramaturgs is a whole other discussion, but it is ultimately the artists who retain control over how their stories are told.

References:

Alberge, D. (2016, September 12). Royal Shakespeare Company plans hi-tech staging of The Tempest. *The Guardian*. https://www.theguardian.com/stage/2016/sep/12/royal-shakespeare-company--rsc-live-motion-capture-intel-imaginarium-studios-tempest

Billington, M. (2016, November 18). The Tempest review – Beale's superb Prospero haunts hi-tech spectacle. *The Guardian*. https://www.theguardian.com/stage/2016/nov/18/the-tempest-review-simon-russell-beale-rsc

Coley, David Edward. (2012) Projected performances: the phenomenology of hybrid theater. *LSU Doctoral Dissertations*. 4051. https://digitalcommons.lsu.edu/gradschool_dissertations/4051

Gray, Matt. (2014, April 14), Building a Better Response: On the Tenuous Relationship between Theater and Technology. *Los Angeles Review of Books*. https://lareviewofbooks.org/article/matthew-gray-explores-historically-distrustful-relationship-theater-technology/.

McElhearn, K. (2016, November 24). Theater Review: The Tempest, by the Royal Shakespeare Company. *Kirkville*. https://kirkville.com/theater-review-the-tempest-by-the-royal-shakespeare-company/

Miwa, Y., Itai, S., Watanabe, T., & Nishi, H. (2011). Shadow Awareness: Enhancing Theater Space Through the Mutual Projection of Images on a Connective Slit Screen. *Leonardo 44*(4), 325-333. https://www.muse.jhu.edu/article/444612.

Rogers, Sol. (2019, December 6). How Technology Is Augmenting Traditional Theater. *Forbes*. https://www.forbes.com/sites/solrogers/2019/12/06/how-technology-is-augmenting-traditional-theatre/?sh=280cf6fe50c0.

Saltz, D.Z. (2001). Live Media: Interactive Technology and Theatre. *Theatre Topics 11*(2), 107-130. doi:10.1353/tt.2001.0017.

Shenton, M. (2016, November 17). Review: The Tempest. *The Stage*. https://www.thestage.co.uk/reviews/the-tempest-review-at-the-royal-shakespeare-theatre-stratford-upon-avon--gimmicky-but-simon-russell-beale-soars

Shenton, M. (2016, November 30). From new tech to casting, theatre is changing fast. *The Stage*. https://www.thestage.co.uk/opinion/mark-shenton-from-new-tech-to-casting-theatre-is-changing-fast

Turnock, J. (2012). The Screen on the Set: The Problem of Classical-Studio Rear Projection. *Cinema Journal*, 51(2), 157–162. http://www.jstor.org/stable/41341044

Wagner, A., & Cluff, P. (2023). From Landscapes to Projection Drama. *PAJ: A Journal of Performance and Art 45*(1), 76-80. https://www.muse.jhu.edu/article/877190.

Walley, J. (2012). Materiality and Meaning in Recent Projection Performance. *The Velvet Light Trap 70*, 18-34. doi:10.1353/vlt.2012.0017.

Waltz, G. (2006). Filmed Scenery on the Live Stage. *Theatre Journal 58*(4), 547–573. http://www.jstor.org/stable/25069915