

Spatial Considerations: Hybridizing Production Modes for an Immersive Adaptation of Shakespeare's *The Merchant of Venice*

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ABSTRACT

This paper discusses the creation of an immersive adaptation of Shakespeare's *The Merchant of Venice*. We present the approach to narrative, character, and visual style taken during the development of a fulldome film that allows viewers to experience Venice through the eyes of the Jewish character Shylock, and the technical considerations required to facilitate these approaches. Fulldome film refers to a dome-based video projection technique in which audiences are collectively placed within an immersive audial and visual environment, creating a sense of environmental immersion reminiscent of real-world sensory encounters. It is argued that the specific qualities of the source play—including the visually rich nature of Renaissance Venice, and the thematic centrality of issues relating to empathy and alienation—make it particularly appropriate for reinterpretation in a contemporary context through the use of immersive media forms. We posit that while immersive media in a broad sense offers the opportunity to revisit the challenges surrounding the play, there are certain aspects of our adaptation that would benefit from further development to fully immersive VR. Particular emphasis is placed on the potential of VR to expand notions of interactivity, and we present how we plan to approach this shift in production mode in terms of a preliminary discussion of content and technical design.

Keywords: Shakespeare, Virtual Reality, Fulldome, Animation, Adaptation

Index Terms: Computing Methodologies – Computer Graphics – Animation

1 INTRODUCTION

In this paper, we present our ongoing project to develop an adaptation of Shakespeare's play *The Merchant of Venice*, with a particular focus on how we have embraced the potential of immersive media to offer a new insight into this classic text and the debates that surround it. The conceptual exploration of this multi-modal experience is the latest stage in the long-running collaboration between a team at Nanyang Technological University, Singapore led by this paper's first author, and leading Shakespeare scholars from the Shakespeare Institute at the University of Birmingham, UK, in particular the Institute's Director, Professor Michael Dobson. Through cooperation between animators, illustrators, designers and researchers in Singapore and literary scholars in the UK, to date this partnership has offered insights into the theoretical and practical requirements of adapting works of Shakespeare to digital media [1]. Funded by the Ministry

of Education, Singapore, the current stage of this collaboration is focused upon the following research questions:

- What are the narrative elements in Shakespeare texts that suggest a specific choice of medium for adaptation (360 fulldome, VR or AR)?
- How must digital source material be transformed to answer the specific requirements of immersive media forms?
- How does the choice of digital medium inform the perception of the adapted play, or the delivery of non-fictional content?
- What adaptations in approach to narrative and style are required for multi-modal approaches towards delivery (specifically referring to fulldome and VR)?

The bulk of our paper will focus on the production of an adaptation of *The Merchant of Venice* for immersive fulldome film, which is nearing completion. Produced in Unreal Engine, the film offers the opportunity to reflect upon the specific narrative, stylistic and technical adjustments that are required of the source text to suit the demands of the media. Fulldome technology is most commonly found at planetariums and science centers, however the potential of the fulldome cinema form is increasingly being recognized within other sectors, including theatre [2]. Fulldome offers the potential to create immersive, shared, digital storytelling experiences that do not require viewers to wear a headset, avoiding some of the physical risks associated with other forms of immersive media such as Virtual or Augmented Reality [3]. Within the dome, audiences can choose to sit or recline on the floor or are placed on omnidirectional seating which allows them to gain a full view of the curved screen [4]. Animation loops and sound draws their attention to particular aspects within the screen, creating the impression that they are being addressed directly by the characters in the film, and facilitates the delivery of a linear filmic progression. The higher accessibility of this medium in terms of both cost and scale combines well with the visual opulence that a surround screen can offer for a presentation of a visually rich, panoramic view based upon the context of Renaissance Venice to a wide audience.

The term "fulldome" refers to "immersive dome-based video projection environments where the viewer is surrounded by the video projection in a hemispherical angle of view" inside a 180-degree dome [5]. The environment is extended "360 degrees in azimuth and down to the dome horizon" and accompanied by a "multi-speaker, spatial sound system" which allows viewers to "experience an immersive film space surrounding them on all sides" [6]. "Immersive" here therefore is defined in terms of creating an experience which surrounds the viewer, engulfing them with visual and audial elements that replicate real-world sensory encounters. Although the fulldome filmic medium does not offer the opportunity for interactivity or autonomous decision making on the part of individual audience members, sitting within the dome surrounded by the screen creates an immersive sense of space and

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lends itself particularly well to the creation of rich, visual environments far beyond what is possible in traditional cinema.

The decision to embrace immersive media in our adaptation was shaped by, and has shaped, our approach to narrative concept. Our experience aims to place subjective experience front and center. Audiences who view our immersive experience will be positioned so that they are able to encounter the play's setting, Renaissance Venice, through the eyes of the play's main character, the Jewish moneylender Shylock, in first-person perspective. Taking this approach demonstrates how modern, immersive media forms can provide a solution to some of the challenges relating to empathy and representation that have been faced by directors and actors when traditionally staging the play in the past.

In the body of this paper, we will outline the stylistic and narrative decisions that have shaped our approach to the creation of our fulldome film, rooted both in the requirements of the medium and in the nature of the source text. We will explain how these decisions were incorporated into our approach to technical development in terms of asset creation and image manipulation. We will then touch upon our intention to further build upon the film to create a fully immersive VR experience, made possible by our decision to construct our fulldome experience within Unreal Engine at the first instance. Our discussion outlines the specific creative and technical requirements of mediating these two immersive media forms, with the aim of showing how fulldome cinema both be an engaging, exciting immersive medium in its own right, but can also function as bridge in which to establish the foundations of a potentially interactive environment that can be built upon at a later date.

Before further elaborating on the production process itself, however, it is necessary to contextualize our adaptation strategy within the brief history of Shakespeare adaptations for fulldome, and the scholarly and performance history of the *Merchant of Venice* in general and its socio-political reception in particular. Understanding this context will set up the specific challenges and possibilities for a contemporary adaptation in immersive digital media.

2 SHAKESPEARE IN FULLDOME: OPPORTUNITIES AND CHALLENGES

The history of Shakespeare adaptations in virtual reality has been discussed by the authors and others elsewhere [7, 8, 9]. However, there has not been a scholarly evaluation of the potential that fulldome holds for revisiting his plays within a 21st century context. Fulldome allows for storytelling within "three-dimensional space...immersive cinematic presentations full of emotional excitement and remarkable spiritual effects" [10]. Projecting a film on a curved surface whilst making use of sound and movement offers a way for a large number of people to simultaneously feel as if they are physically experiencing the encounters depicted in the film. Animated fulldome in particular offers the possibility to place audiences within a setting that is simultaneously recognisable as realistic, yet also fantastical and surreal. These qualities arguably make the medium well suited for approaching some of the most linguistically, visually, and narratively renowned works of English literature.

The only previous example of a work of Shakespeare adapted for fulldome is LivinGlobe's *R+J* (2004), a 20-minute film directed by Harald Singer. This "modern and somewhat surrealistic version of the Shakespeare classic *"Romeo and Juliet"*" focuses on a group of young people who perform a "play in a play" whilst attending a party in the desert [11]. On the one hand, this adaptation – described as "the first Immersive Cinema fulldome movie, shot in the fulldome format with real actors on real sets" – provides an insight into the creative possibilities that the medium offers for providing new approaches to even the most well-known and frequently

adapted of Shakespeare's works [12]. The film expands the bard's work from the stage into "new domains of the imagination with fantastic associations and visual effects" [13]. Audience members take on the role of the director – unlike a traditional film, where cuts are required to transition between sections of dialogue or sets, in the dome the audience can see the full environment at once, and individually decide where they should look and which action sequence they should observe [14]. From a technical perspective, the film's visual language draws on issues of cross-reflection within the dome to keep the environment as dark as possible, making use of a set that was designed to allow action to develop both horizontally and vertically, constructed on multiple levels [15]. The production combined computer animation with live action shots in the form of match-cuts, image montages, and a blue box "love bubble" which engulfed the tragic couple [16].

However, considering its shortcomings highlights the potential of using animation to more deeply engage with the scholarly framework in which Shakespeare's works exist, making use of the technological developments that have emerged in the in years since *R+J* was produced. The live action sequences in the play, being almost two decades old, cannot help but look completely outdated in terms of production technique and aesthetics. In narrative terms, *R+J* deviates considerably from the original play, creating something that is very abstract, and fantastical, almost completely detached from its Shakespearean prototype. Removing the setting completely from its original historical context stresses the universality and timelessness of *Romeo and Juliet* and the modern resonance of its themes of youth and untimely love, at the expense of engaging with the specific Renaissance themes and concerns which can be found in the play [17]. Recently, several scholars have criticised attempts to detach Shakespeare's works from their original contextual specificity, arguing in particular that *Romeo and Juliet* should be considered within its 16th century context to understand the lovers' story, the use of language, and the themes of desire and kinship that structure the narrative [18]. Gail K. Paster has argued, for example, that the play's use of metaphors is closely linked to Petrarchan idealisation, working within a "complex, ambivalent discourse of women" which can only fully be understood within the context of Renaissance power structures and gender relations [19].

When it came to our project, therefore, we were keen to combat some of these limitations, embracing the potential of animation to go beyond the aesthetic shortcomings of the live-action approach of *R+J*. In addition, rather than removing Shakespeare's narrative from its original context, we were instead keen to see how fulldome could help us to further engage with the original setting of a play. With this in mind, we seized upon the suggestion by the Shakespeare scholars that we should use *The Merchant of Venice* as our source text. Further discussion of why *Merchant* was selected with reference to inherent qualities in the text and scholarship surrounding the play will take place in the next section.

3 THE MERCHANT OF VENICE: A CONTEXTUAL REVIEW

Shakespeare's *The Merchant of Venice* is one of his most well-known and most performed plays [20]. The play is structured around two, central intersecting storylines, based upon the characters of noblewoman Portia and Jewish moneylender Shylock. At the start of the play, Shylock loans a sum to Antonio, the play's eponymous merchant [21]. Ultimately, Antonio is unable to repay his debt, but punishment falls upon Shylock, and he finds himself humiliated and broken at the hands of the Venetian court, forced to forfeit his goods and convert to Christianity.

When selecting a source text on which to base our adaptation for immersive media, there were several qualities that made *Merchant* a suitable choice. The play takes place in Italy, broadly within the period contemporary to Shakespeare's own. When recalling the

European Renaissance, what first comes to mind is visual opulence – a desire to revive the achievements of classical antiquity, an influx of gold as a result of exploration and colonisation, and the ornate costumes and architecture of church and state. Renaissance Venice encapsulates many of these ideas, and more – the city was “a multicultural metropolis...its position at the crossroads of trade routes linking Europe to the Islamic World brought a continuous flow of commodities...[which] complemented locally-made products” [22]. The opulence of historical Venice is also found in art – reaching a pinnacle in the 18th century with the works of Giovanni Antonio Canal, known as Canaletto, which depict the city’s buildings, waterways and civic pomp in precise detail [23]. 300 years later, observers continue to be charmed by the beauty of the city – in 2019, Venice saw more than 1.5 billion international arrivals, many disembarking from the cruise ships that at times dominate the historic skyline [24]. The central position of the city within global cultural life is further reflected by the annual La Biennale di Venezia, which brings together the best of the world’s art, architecture, performance, and cinema in the city. As a result of this enduring cultural legacy, and its association with opulence, luxury and history, there seemed no better setting than Venice to explore through the medium of fulldome, which allows for the creation of visually rich environments which engulf the audiences through the use of a large, curved screen.

In addition, our project looked to explore the extent to which modern, immersive mediums can offer solutions to issues inherent in the source text that have presented challenges to both scholars and directors in the centuries since the play was first performed. Particular debates have surrounded Shakespeare’s depiction of the moneylender Shylock, who has been described as arguably “Shakespeare’s most controversial character,” yet is also seen by some critics as a reflection of the bard’s tragic and sympathetic depiction of the outsider, offering a reflection on the flawed nature of humanity in the broadest sense [25, 26].

Poet and curator Aviva Dautch encapsulates this divide when she acknowledges that we should consider how Shakespeare’s “nuanced writing...allows such contrasting interpretations to co-exist as valued readings” [27]. Similarly, Dobson, Sharp and Davies have stated that whilst it is possible to view the play’s treatment of Shylock as representative of the anti-Semitic views held by both Shakespeare and his audience, he can also be read as a construction used by the playwright to expose his Christians’ hypocrisy rather reflecting Shakespeare launching an attack on Judaism itself [28]. *Merchant* is thus perhaps best described in the words of director Karin Coonrod, who has stated that the play is not “really anti-Semitic...it’s a provocation. It is about anti-Semitism, it is about the stranger and the outsider...” [29]. This approach, and any rejection of the idea that our decision to take *Merchant* as our source text could be read as an endorsement of anti-Jewish sentiments, was central to how we approached designing our experience in terms not only of setting and character design, but also with regards to narrative approach and perspective.

4 APPROACH TO VISUAL DEVELOPMENT AND DESIGN

4.1 Mediating fact and fiction through narrative style

One significant challenge that faced us was how to interpret the presentation of Venice and the character of Shylock within the context of the play, yet also acknowledge that we are dealing with a real historical minority in the form of Renaissance Venice’s Jewish community. It was thus important to consider the extent to which the full dome medium can inform both the perception of the play, and the delivery of non-fictional content. A thread running throughout the development of our project was how we might use

the immersive filmic medium to balance fidelity to the play itself, with historical accuracy in terms of the real physical spaces of Renaissance Venice, and the experiences of the city’s Jewish community.

Negotiating the divide between fact and fiction was particularly important because Shakespeare’s play completely overlooks the existence of the Venetian ghetto, a setting that is vital for understanding the actual lived experiences of Jews in the city. We were thus faced with the challenge of mediating historical accuracy and a desire to stay faithful to Shakespeare’s text. The Venetian ghetto was established in March 1516, marking one of the first locations in which people were segregated and subject to surveillance as a result of religious difference [30]. Jews were required by law to live within this walled and gated area, and were limited to carrying out certain, restricted trades within the city proper – including moneylending, the occupation of Shylock. However, Christians were able to enter the space of the ghetto during the day, which led to engagement, interaction, and an awareness of each other’s cultures [31]. Reasons for Shakespeare’s failure to reference the ghetto in his play are unknown – whilst he never visited Italy himself, the society in which he lived and worked presented him with ample opportunities to engage with information about the city and its inhabitants [32]. Whilst therefore the reason for excluding any reference to the ghetto is unclear, what is apparent is that any attempt to address the historical reality of life for Venice’s 16th century Jewish population required an engagement with the ghetto as a locale.

To facilitate this, our overall approach to setting became one that hybridises fictional characters and sequences taken from Shakespeare’s play, with information gleaned from factual accounts of historical environments. To suit the demands of the immersive fulldome media (such as the risk of discomfort if required to spend a long period watching a domed screen within an immersive environment), and to demonstrate the potential that the medium offers for doing something innovative with a classic source text, rather than simply producing an abridged version of the original play, we instead chose to produce a 10 minute film that would focus upon short interactions within a visually rich environment. These interactions are based around quotes from the Shakespearean source text. The narrative structure of the film is focused around four scenes, set in the square of San Giacomo di Rialto, on the Rialto bridge, in the Ghetto, and outside the Doge’s palace in Piazza San Marco. Whilst the Rialto and the Venetian court located at the Doge’s palace are explicitly mentioned in the play, information surrounding the other two locations was gleaned from research using primary historical and secondary sources to understand the places and experiences that shaped life for Venice’s real Jewish community in the Renaissance. Located within the main commercial centre of the Renaissance city, the square at San Giacomo reflects the occupations open to Jews at this time; the Rialto bridge reflects the iconic intersection between land and water that defines Venetian space; the ghetto represents the restrictions on movement and the residential spaces of the community; whilst San Marco represents the legal restrictions placed upon the Jewish community by the Venetian authorities.

From the earliest stages of the project, the scholars from The Shakespeare Institute with deep knowledge of the play expressed a desire not to overlook both these historical realities faced by minorities, and the complex legacies of tourism pressures and migration which exist in the city of Venice today. It was agreed that presenting a two dimensional, “picture perfect” view of the city that portrayed it as no more than simply a set of beautiful visuals would be somewhat disingenuous to not only the themes of alienation and prejudice at the heart of Shakespeare’s play, and to the historical

reality of life for certain segments of Venice's population, but would also overlook the issues that continue to face Venice in the 21st century and which must be placed at the heart of understanding what impression we wanted to give of the relationship between past and present in our film. With this in mind, we were keen to adopt an approach to style and visual design that acknowledged that there is not, and has never been, a picturesque ideal of Venice as it is sometimes projected to tourists, and that the reality faced by minorities, migrants, and the city itself from an environmental perspective challenge some of the assumptions that traditional artistic depictions provide [33].

At the same time, it appeared crucial to our research group to avoid any notions of absolute authenticity – as such could not be provided even by the most meticulous research into archival documents and scholarly reports on the history of the city. To address this, the decision was made early on to choose an artistic style that deliberately reveals itself as artificial – instead of relying on a photorealistic reconstruction of the period. Our stylistic approach took inspiration from the works of Canaletto and his “precise and evocative” views of the city [34]. However, we looked not to his more well-known oil paintings but from his ink and wash works, which reflect a more monochromatic, darker mood (Fig 1). As Rall and Weber have stated in their exploration of visual strategies for constructing authenticity in comics journalism, avoidance of a suspension of disbelief through stylization enables the user to critically interrogate the presented narrative as autonomous thinkers, leading viewers to gain an awareness of the artificiality of the content they are viewing [35]. By literally providing the perspective of a painted “reality” in our approach to design, transparency is offered in the sense of laying bare the project's approach as a merely fictional interpretation of the experiences of a Jew in Renaissance Venice.



Figure 1: Screenshot showing 3D texturing of environment in Maya. Produced by Sulaiman Abdul Rahman.

We also chose to link the message that runs through the earlier scenes in the film – that life within the beautiful city was far from beautiful for Shylock and his historical Jewish counterparts – to the context of the present day. At the suggestion of collaborator Aneta Mancewicz, a scholar with an interest in staging Shakespeare using digital media, we decided to do this by incorporating a shift in the final scene, from the Renaissance to the present day. This would be signified by a major stylistic transition, from the artistic illustrations outlined above, to (limited) cut-out animation of photographs, and by the appearance of tourists and a cruise ship in place of Renaissance figures (Fig 2).

This stylistic change not only signals the arrival in a contemporary setting but also stays in line with our overall intention to avoid false pretences of veracity: while captured images of real people suggest the actuality, the graphic processing and the highly stylized mode of movement deliberately reveal this mediation as artifacts, a socio-political commentary on the wider implications of a play, not a claim to factual reporting.



Figure 2: Panoramas showing design for St Mark's Square, with photographs of tourists and cruise ship inserted into stylized background. Design by Rachel Chan.

In the final stages of the film, Venice as a whole will be submerged underwater – reflecting contemporary issues the city is confronted with including climate change, rising sea levels and the ecological challenges posed by mass tourism. This brings our experience full circle, reminding the viewer that the idealized pictorial of Venice has always been a fictional construct that failed to represent historic realities. It serves as a vital reminder that societal issues like the plight of ostracized minorities belong to a chain of suppressed reality that Shakespeare merely brings to the light in his play - possibly resulting in an empathetic response towards the Jewish community. This is exactly the impact we are hoping for with our immersive experience. With this in mind, it was all the more important to totally match such intent with adequate choices for narrative and design style.

4.2 Venice through Shylock's eyes

In our designs for the characters who are placed within the previously discussed settings, we aimed to avoid an approach that would suggest a view of the Renaissance that would imply a very traditional cartoon look in the sense of caricatured realism, which is the prevalent approach found in the majority of mainstream animation. Instead, we combined stylistic influences drawn from paintings, woodcuts, and historic costume handbooks as well as independent Eastern European animation to create character designs that reflect our serious tone through a slightly rougher and grittier look. These character designs incorporate scruffy textures and extremer contrasts in figure proportions that suggests a more mature and serious overall tone (Fig 3). At the same time, we were looking towards keeping our designs accessible and relatable enough to enable empathetic responses from audiences of varying ages and experiences.



Figure 3: Example of character designs. Design by Lye Hui En.

To insert these characters within the dome, our technical designer Sulaiman Abdul Rahman used the DomeXF plugin for Adobe After Effects to insert and align 2D assets and characters around a 1:1 square resolution layout, placing a circle in the middle. The background environment was first drawn in a panorama equirectangular form, then brought into photoshop where the polar coordinates filter is used to resize it in order to turn it into the circle required for projection onto the curved screen (Fig 4). This background drawing was then inserted into the circle in the middle of the 1:1 square resolution format. When it is projected on to the actual fulldome surface, the warping of the image will show the panorama version (Fig 5).

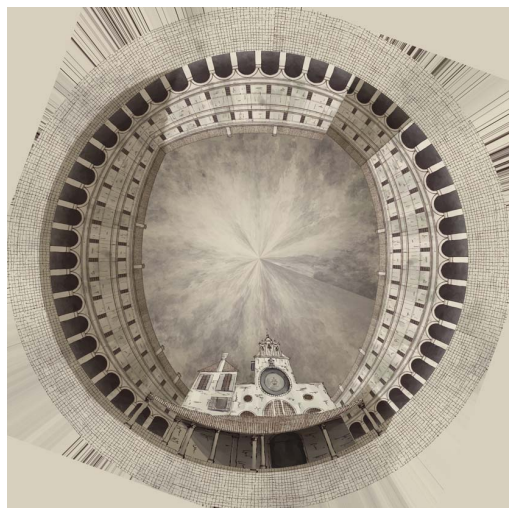


Figure 4: Environment for first scene for projection on curved screen within dome. Rachel Chan/Sulaiman Abdul Rahman.

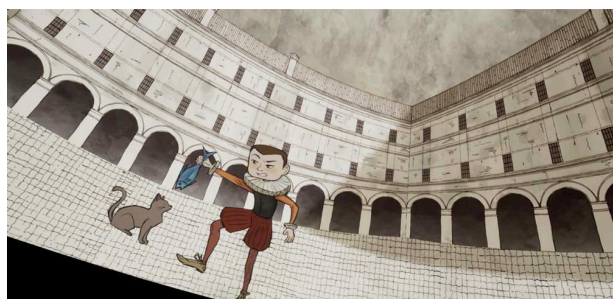


Figure 5: Screengrab from test mockup showing characters inserted into background within curved dome environment.

However, we were faced with an additional challenge when considering how to depict and approach the character of Shylock himself. We were very clear in our desire to avoid creating anything that might resemble a caricature of a Jewish character, nor suggest that we are making any sort of moral comment on his character and behaviour through our visual approach. In their survey of filmmaking for fulldome, Yu and Wyatt explain how the curvilinear perspective adopted to suit the demands of the curved screen in the dome results in “an attempt to represent the undistorted view that we get when we turn our heads and eyes to examine our environment in all directions...creating a visual experience that mimics the visual experience that we have as we inhabit our real-world environment” [36]. Adopting this approach in our film provided us with the opportunity to offer a new perspective – a first person view, through Shylock’s eyes – which offers an innovative way to attempt to engage with the character of Shylock and face the challenges discussed in the first section of this paper. Within the film, we have made use of animation sequences and accompanying sound to draw the attention of the viewers to particular elements within the dome, creating the impression that they – as Shylock – are being addressed directly. By making use of the immersive potential of fulldome to place audiences in a position that allows them to see the world of Renaissance Venice as Shylock, or a historical Jewish figure, might have seen it, the film gives them the opportunity to empathise with his position, rather than observe him as a stylised animated caricature. Audiences do not see Shylock, yet over the course of the film become aware that they are encountering the environment and character dialogue sequences from his perspective based upon the way that these sequences unfold. Shylock’s Jewish identity is reflected through the way that other characters talk about him, and the spaces in which he operates, rather than through any form of iconography or symbolism that has the potential to stereotype or offend.

4.3 Approaches to storytelling

When it came to developing the narrative, the nature of the fulldome medium, with its potential for immersive sound and image, allows us to clearly guide the vision of the audience through the four scenes, shaping how they interact with the environment and the information being presented. Assets were dispersed throughout the background panorama to make use of the large, curved screen required for fulldome film. Inserts which present short, animated sequences using lines taken from Shakespeare’s play appear in sequence within the space, giving the impression that you, as Shylock, are observing and interacting with a range of characters in conversation. As well as using text from the play, interactions with Shylock are also presented in a more physical way. Movement within the inserts and a combination of close ups and longer shots allows for the creation of a sense of depth on the 2D screen. In one insert, a character moves very close to the front of the field of vision and spits; in another, we see a Christian servant emerge from inside a building, only to lunge forward then recoil in shock when he realises that Shylock has been observing his previous conversation. These inserts are placed within the dome in the same way as the process described above in relation to the positioning of background characters within the environment. Whilst these inserts are being shown, short animation loops play elsewhere in the dome, supporting the creation of an immersive environment that reflects the activity that one would experience in the bustling streets, squares, and waterways of Venice in reality.

5 EXPANDING TOWARDS A FULLY IMMERSIVE VR EXPERIENCE: CONCEPTUAL, ARTISTIC, AND TECHNICAL CONSIDERATIONS

5.1 Content

As we reach the final production stages of our fulldome experience, we are now shifting towards a conceptual exploration of how we might adapt our film into a VR experience. Both pedagogical explorations and practical case studies have demonstrated the potential offered by fully immersive VR to allow a range of audiences to engage with Shakespeare's plays in new ways [37]. However, to date, *Merchant* has been overlooked within this emerging field of VR Shakespeare, perhaps as a result of the challenging themes and approach to character as outlined above.

Our motivation to further expand our project towards an additional medium which allows for the creation of a fully immersive environment has developed based on the approach to narrative and setting identified in the previous section of this paper. Whilst working on our fulldome film, we realised that it would be interesting and theoretically valuable to see how the idea of viewing Venice through Shylock's eyes to challenge idealised perceptions of the city could be extended and expanded within a fully immersive environment, and how the relationship between fulldome and VR could be more closely integrated from both a creative and technical perspective. We are particularly focused on considering the conceptual implications relating the deepening of levels of interactivity represented by this shift in medium.

For one, by shifting our adaptation of *Merchant* to VR we can substantially increase the impact level of our project by making it accessible through additional channels beyond digital dome theatres. Although the number of fulldome theatres found around the world has dramatically increased in recent decades, they are largely limited to science centres and educational institutions [38]. Adapting our immersive experience to fully immersive VR would allow for it to be accessed through a headset and desktop version without the need for the full fulldome set up. By doing so, our adaptation can be made easily accessible for students in secondary education in Singapore and beyond, whilst more dedicated audiences can enjoy the visually popular and targeted fulldome performances.

Secondly, by encountering the experience in fully immersive, first-person VR as an individual, the user will literally be able step into the shoes of Shylock and explore the virtual space of 16th century Venice through autonomous world discovery from his perspective. Rather than sitting or lying within the dome, they will be able to walk around within the virtual environment and experience it independently. This will enhance the sense of empathy and sympathy which the user feels towards Shylock as they will share the sense of alienation which his character experiences [39]. From a technical standpoint, provisionally this will require an adjustment of our approach to narrative and storytelling within the experience - the billboard-like inserts that are used in the fulldome-version to draw the attention towards certain portions of a gigantic screen are not needed in the VR variant. Instead, users will be able to shape their own experience, moving through the virtual space freely and interacting with characters within the environment on their own terms. A fully immersive setting in VR will allow for more interaction and replace the previously linear segments with a situation in which the player can decide who to walk up to and meet and will experience reactions and comments that are determined by how they move through the space, whilst maintaining our fidelity to Shakespeare's original language. Anybody who has experienced VR before will be familiar with the physical immediacy that it gives to virtual encounters. This phenomenon will doubtlessly heighten the impact

of the hidden or openly hostile comments that Shylock encounters as he goes about his business in Shakespeare's play.

We will intentionally maintain the overall aesthetic of the experience entirely unchanged to maintain our intention to avoid false pretences of factual accuracy. By reminding the user of the artificiality of people and places through a use of an animated, artistically stylised approach, we are counteracting the suggested hyperrealism by the full immersion into a virtual world and thus mediating the gap between fact and fiction in terms of our presentation of Renaissance Venice.

5.2 Technical affordances for VR

As mentioned earlier in the paper, the ability to consider further developing our fulldome film to VR was facilitated by the decision to construct the initial production environment in Unreal Engine. However, if we are to proceed with adjusting our existing film for fully immersive media, then several technical adjustments will be required.

The 2.5D assets that have been produced for the film in its current form are ready to be imported straight away and used as billboard assets within a VR environment. The experience gained by the first author from his previous project, *ShakesVR*, has shown that such a design solution, which creates an innovative angle that juxtaposes the usual convention of characters rendered in full 3D, can work well [40]. However, sets and characters placed within inserts in the fulldome film will need to be revised and drawn in full scale, as the current versions have parts cut off due to the framing of the inserts.

Our current fulldome production presents a linear narrative in which the various inserts and animated loops play in a pre-determined sequence. However, VR will allow for us to move beyond this and offer the opportunity for self-guided exploration and world discovery, in which participants can interact with characters and settings in whatever order they choose. In terms of programming therefore, animation events can happen with either gazed based or threshold-based triggers, or even some kind of interactivity in VR which allows users to discover the city and encounter the characters and their views on their own without following a pre-determined path.

When adopting first person within fully immersive VR, decisions will need to be made regarding how to conceptualise the VR player character, which will be Shylock. The possibility exists to represent him as floating hands, floating hands with arms, or a full body without a head, which again requires an engagement with the question of how best to depict a Jewish character in our adaptation, or whether this is something we want to continue to avoid (perhaps at the expense of realism in terms of visualization of body parts when the user is moving around). Regarding locomotion, the decision will need to be made as to whether we select an approach to movement based around teleporting, arm swinging free roam movement, or controller thumbstick free roam movement. These techniques are linked to different levels of motion sickness risk, and thus our decision must be made in relation to how long we envisage our fully immersive experience to be, and how important walking through spaces is to the overall experience that we construct. Perhaps we could allow the players themselves to choose which one they use, in adherence with the idea that we want them to feel as comfortable and as close to their own real-life experiences as possible so as to fully empathise with the character that they are embodying.

In our current fulldome adaptation, we use transitions to move from one scene to another. However, in fully immersive VR the locomotion methods described previously will instead be used to get the user to the next location. More time can be spent developing designs for the fully rendered 3D environments that will connect

these spaces - streets, bridges and even waterways which allow for users to move from one open space to the next (fig 7). These can include design elements such as graffiti, posters, or signs as well as additional characters to encounter that allow for further interaction on the part of the user. This will allow users to move between spaces at their own pace, spending more time in particular locations that they find visually appealing or interesting, much as if they were truly exploring the streets and squares of Renaissance Venice. Stylistically, these differing 2D and 3D elements will be held together by texture mapping the graphic structures used for the flat 2D surroundings also onto the 3D structure, creating a cohesion between techniques.

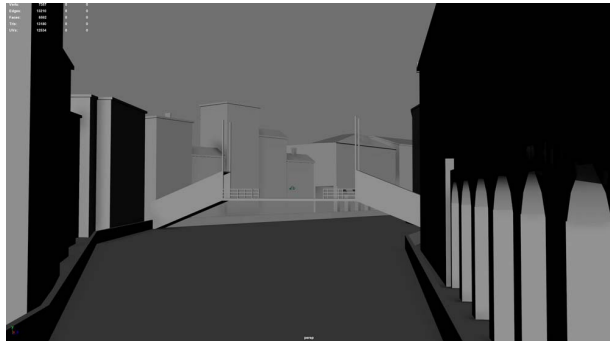


Figure 6: Screenshot from Maya illustrating initial model for transition to Rialto bridge within VR environment. Produced by Sulaiman Abdul Rahman.

6 CONCLUSION

It is hoped that our project highlights the potential that immersive digital media offers to provide a new approach to one of Shakespeare's most well-known, yet controversial, plays. By asking audiences to place themselves in the first-person perspective of the character of Shylock within a visually rich environment that draws upon the historical and literary realities of Renaissance Venice, we are able to revisit some of the challenges that have faced directors and actors producing the play for the traditional stage. In our overall approach, we have aimed to construct a sense of empathy and representation, as well as a new way of considering the issue of the play's antisemitism – by avoiding cartoon-style depictions of Jewish characters, yet also allowing the audiences to place themselves in the position of the main character and consider the potential impact of these interactions on a minority. In this way, the themes and challenges inherent in the text and its narrative lend themselves to the opportunities for engagement offered by immersive media, as well as underscoring our visual approach to the design of setting and characters.

In addition, our project has interesting implications for how fictional and non-fictional elements, and linear and non-linear storytelling, can be incorporated into an immersive experience. By combining fidelity to Shakespeare's play through the integration of original dialogue with historical research about the situation of the Jewish community in historical Venice, a new adaptation-mode emerges that transcends a simple retelling of the play to enable a sympathetic empathetic response towards its Jewish characters – an interpretation that might align with Shakespeare's own intentions and the idea that Shylock represents the bard's "first great tragic figure" [41]. Similarly, by deciding to step away from the original narrative of the play towards a series of encounters in the spatial environments, we are focusing on our intention engage with the character of Shylock on a level that closely ties his identity and

experiences as a Jew in Renaissance Venice to the interactions that real, historical Jews undertook within the multiple spheres of their daily lives. This highlights the adaptations to narrative that can be accommodated based on the requirements and possibilities of the immersive media form.

Our two-pronged approach to realizing the project first as a fulldome film and later as a fully immersive VR experience allows us to maximize the empathetic engagement of the viewer in different ways. The aesthetic opulence of the fulldome presentation creates a visually impressive framework that will attract viewers towards the serious socio-political topics, whilst the options for interaction and immediacy within a fully immersive VR environment can create a heightened sense of physical embodiment and increase empathetic reaction through autonomous world discovery. In summary, we hope that our work has gone some way to proposing new methods for digital adaptations for classical Shakespeare plays and offering insight into potential approaches for developing an integrated fulldome/VR experience.

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