
Innovation vs Practicality vs Entertainment: Developing and implementing affordable technological solutions for theatre accessibility

By Pierre-Alexis Mével, Jo Robinson, and Paul Tennent (University of Nottingham and Newcastle University, UK)

Abstract & Keywords

English:

This article examines the use of inclusive technological solutions to promote accessibility on stage. Specifically, it concentrates on the way technological solutions are developed and integrated into a show's design both in terms of the immersion and entertainment provided by the end-product, but also in practical ways, to make the technological solutions affordable and practical from the perspective of designing and running a show. The article is based on the empirical findings of a project funded by the Arts and Humanities Research Council (United Kingdom) and the Engineering and Physical Sciences Research Council (EPSRC) that brought together Red Earth Theatre, a small-scale touring theatre company based in the UK with an established track record and commitment to research in inclusive integrated communication for young audiences (with a focus on Deaf audiences) and an interdisciplinary team of researchers across arts and computer sciences at the University of Nottingham. The researchers developed technological solutions that would allow for accessibility to be embedded into the creative process (following principles similar to those of accessible filmmaking). Any such solutions, however, have to strike a balance between affordability, practical integration into workflows and particularly the design possibilities and creative options they present. They also have to successfully embed accessibility into performances in ways that are going to not only enable immersion, but also add to the semiotic richness and entertainment value of a show for all members of the audience, whatever their needs.

Keywords: accessibility, surtitling, inclusion, immersion, creative captions, technology

1. Introduction

Captioning for the theatre[1] can be studied from several academic perspectives: from Music Studies and Drama and Theatre Studies to Audiovisual Translation and Accessibility Studies, via Technology and Computer Sciences. Based on the empirical findings of a project funded by the Arts and Humanities Research Council (AHRC) and the Engineering and Physical Sciences Research Council (EPSRC), both based in the United Kingdom, this article examines the design, creation, and use of inclusive technological solutions to promote accessibility on stage. To reflect the varied approaches possible to captioning for the stage, the project brought together an interdisciplinary team of researchers across arts and computer sciences at the University of Nottingham with Red Earth Theatre, a small-scale touring theatre company based in the East Midlands (United Kingdom) with an established track record and commitment to research in inclusive integrated communication for young audiences (with a focus on Deaf audiences). On their website, Red Earth Theatre (2022) put a deliberate emphasis on "generat[ing] a different voice" and on the work they have carried out with regards to embedding inclusive accessibility practices into their shows: "we are pioneers of integrated theatre and develop new techniques for accessible storytelling that test convention and advance inclusive practice". The approach taken by Red Earth Theatre for their productions combines *two languages*: English (for the dialogue and in captions) as well as Sign Language (in the form of British Sign Language (BSL) or Sign Supported English and what the company term the Visual Vernacular[2], depending on the needs of each show). Red Earth Theatre productions stand out because rather than relying on a stage interpreter, the actors in their shows perform both in English and in sign language, and their productions are designed in such a way as to elicit total communication – that is, to connect with the audience by combining several modes of communication in theatre "including metaphor, symbol, costume, set, lighting, auditory, signed, oral, written".

The last couple of decades have seen the development of a growing interest for captioning for the stage in academia. Oncins (2013) provided an overview of the coverage, which demonstrates that the majority of studies dealt with translation, be it opera translation (Desblache 2007; Dewolfe 2001; Matamala and Orero 2007), the translation of plays (Carlson 2006), or indeed intralingual translation and accessibility, usually in the form of captions (Griesel 2005, 2009; Mateo 2007), before greater interest was taken in other forms of accessibility more recently, particularly audio description (Di Giovanni 2018; Ferziger et al. 2020).

In addition, more and more studies are now emphasizing that a crucial step towards inclusiveness is to involve members from wider communities, particularly people who may face barriers in partaking and enjoying artistic creation. These studies examine stage performances, such as Johnson's article (2018) on the inclusion of community actors from the Down Syndrome Research Foundation in Niall McNeil and Marcus Youssef of Vancouver's Newworld Theatre, *King Arthur's Night*. But similar work is being carried out for screen products, such as Romero-Fresco's work on Accessible Filmmaking in which the author expresses regrets that "with a few exceptions, sensory-impaired [...] spectators are normally not involved in the production or testing of accessible versions" (2019: 5).

While accessibility has in the past been a largely outcome-based notion (the goal of accessibility being for people with disabilities to be able to gain access to products and performances that are otherwise unavailable to them), initiatives of the kind discussed above are indicators of a paradigm shift aiming at making accessibility more inclusive. Accessibility, rather than being a separate outcome, is thus integrated into a wider framework of inclusiveness, whereby solutions that work for people with a disability are likely to also work well for people at large, regardless of their circumstances.

This was also the overarching philosophy for our project, which focused on fostering inclusion: with that inclusion understood not as a tick-box outcome but rather as a methodology. In other words, the project aimed to develop and test an approach to designing theatre in such a way that performances can be enjoyed by *all* audience members, with a

variety of needs, challenging the notion that any one segment of audience members are typical users. The ambition was to create solutions that could be used by the widest range of companies to cater for the widest range of audience members.

Drawing on that experience, this article examines the interrelationship between innovation (understood in the article as the design and implementation of new technologies), practicality (how technology is integrated into workflows and its affordability) and entertainment (the way these new technologies are used to facilitate inclusiveness and immersion). We also consider the issues that arise at the nexuses of these three overarching principles and aims.

The article therefore opens with a discussion of our project's aims and ambitions, before briefly reviewing the different events that were organized to facilitate the creation of inclusive technological tools that can facilitate immersion. We then examine the barriers that are to be overcome and discuss two of the tools developed during the project. The first of these enabled the integration of captions into QLab in order to provide an easy way for companies to generate and alter captions through the rehearsal and production process; the second enabled theatre makers and their technical teams to produce a three-dimensional map of the stage which allows for captions to be projected anywhere on the set, drawing on existing research on augmented reality[3].

2. The project: aims and ambitions

The project involved working in close collaboration with Red Earth Theatre, but it was important to have stakeholders from the D/deaf community[4] embedded from the outset. Consequently, the project saw us developing partnerships with local (Nottinghamshire Deaf Society) and national (National Deaf Children's Society) D/deaf societies, as well as local schools (Royal School for the Deaf Derby; Reigate Park Primary Academy), with a view to involving Deaf members of the public at every stage of the project: from scoping out project aims, developing early design ideas and piloting some of these ideas through to studying reception of the type of integrated captioning developed as part of the project. Not only is this ethically sound, but it also opens up creative possibilities, and highlights the different ways in which *designed-in* accessibility and inclusiveness can impact a performance's affective, theatrical, and narrative aesthetic.

In spite of the growing body of work and projects being carried out on accessibility in the Arts, a report produced by Wilmington (2017) for Red Earth Theatre highlights that D/deaf members of the audience face many barriers before they are able to fully enjoy theatrical performances. A particular obstacle that must be overcome is the "informational" barrier (Wilmington, 2017: iv) – that is, D/deaf members of the audience are often simply not aware of shows of the kind designed by Red Earth Theatre even exist: which contributes to the (reductive) narrative that these audiences can be hard to reach. Part of our project thus also aimed to develop material that showcased the communicational approach used by Red Earth Theatre (and others) in the form of short videos that introduced their inclusive approach and featured integrated captions analogous to the kind used in Red Earth Theatre shows.[5]

Following an early feedback-gathering process with members of the audience, one problem area that was identified was the position of captions projected on a screen on the side of the stage or the presence of a stage interpreter (also on the side of the stage). That positioning requires the audience to constantly swivel their necks (a phenomenon referred to as the Wimbledon effect by Red Earth Theatre's directors), splitting their attention across very different, distinct and discrete spaces. Such engrained and discriminating practices amount to what Bauman (2004: 40) describes as "audism" – that is, "discrimination against individual program hearing ability". Building on Humphreys' (1975) seminal definition of audism, Bauman (2004: 241) claims that institutions "have assumed authority over Deaf persons, claiming to act in their best interests while not allowing them to have a say in the matters that concern them the most"; this also further explains and corroborates the "hard-to-reach" (Mével 2020: 206) label sometimes used to describe D/deaf members of the audience. The presence and location of captions directly impacts on members of the audience's ability to enjoy theatrical performances. Indeed, the notion of entertainment central to this article is perhaps better defined in relation to immersion and the ability to enjoy a show without having to split one's attention between the stage and another space where the stage interpreter is located or where the captions may be displayed.

On the positioning of captions, whilst Oncins (2013: 47) notes that "no standard can therefore be identified for the position of the open screen display in theatre houses", it is often the case that small- to mid-size theatre companies rely on a screen on the side of the stage to project captions, both for convenience and because of the flexibility it offers. This underpins Oncins' (2013) broader point that accessibility for the stage is still more often than not dictated by the tools available and venues' layout, rather than by directors' intentions or audience's needs. The exact position of the screen in relation to the stage and to the audience may vary from venue to venue, depending on the venue layout, set design, and lighting options. For our project, one of the core concepts emerged through discussions with stakeholders from the D/deaf community early in the project was the aim to create a technological tool that would allow for the projection of captions directly onto/into the stage space, rather than on a screen on a side of the stage – and to design and deliver those captions in ways that made them a part of the show's aesthetics rather than the after-thought captions for accessibility so often are. The idea was to promote greater integration of captions into the show's aesthetics – restricting the Wimbledon effect – while also making the creation of captions a process that could be designed-in and implemented from the onset of a show's creative process, rather than added at the end as is still too often the case.

The difficulty of embedding captioning into creative processes cannot be downplayed: live performances on stage have specific requirements and constraints that will be discussed below. It was also crucial to develop rational and implementable technical solutions from a technical and operational perspective that Red Earth Theatre could immediately take into their stride and integrate into their own workflows as a devising theatre company. Blue sky tools may sound good in a vacuum but may be either technically impossible to integrate into workflows; so technologically advanced that the start-up cost of learning familiarity for stage technicians is too high, or the system can simply be too costly. It was thus a key requirement that any tools developed were affordable, so that such tools can be taken up with companies operating with limited resources – an aim that now seems even more important following a pandemic that has imposed severe and sometimes terminal effects on theatre companies' budgets.

In short, our project's aim was to create accessible, innovative technological solutions that that can be integrated into theatre production in two key ways: *practically*, into stage tech workflows alongside lighting, sound etc, and *aesthetically* into the show's design and dramaturgy. The solutions we designed and that are discussed below thus support inclusive entertainment in ways that theatre companies can take up easily and affordably, with a view to stimulating debate around issues of integrated access, fostering the development of further technological solutions for the stage and beyond, and making inclusive accessibility the norm rather than a (perceived) undesirable side effect for both stage directors and for all members of the audience. The triple focus on innovation, entertainment and practicality also demonstrates that seemingly competing interests can be combined to design tools that are neither *crutches* (i.e., tools that cater for a perceived *disability*) nor so difficult to use or so unaffordable that they cannot be taken up by the industry at large.

Before venturing further, it is worth noting that questions of accessibility and inclusivity as well as the terminology surrounding them, are undergoing something of a revolution. Di Giovanni's (2021) look at instances of inclusive theatre-making provides vital insights into the current state of affairs. Building on the notion of accessible filmmaking (Romero-Fresco 2019), and more generally on the philosophy of access, Di Giovanni proposes a shift from the somewhat privative notion of accessibility to the more comprehensive and equalitarian concept of inclusion. Whilst theatre-making should ideally be mindful of questions of access, and embed accessibility into design processes, we also agree with Di Giovanni that theatre-making that claims to be truly inclusive should also involve members of the audience throughout the various creative stages. It is also one of the aims of this article to provide some evidence of the ways in which members of the audience were involved throughout the course of our project to help shape, design and implement inclusive technological tools for accessible theatre-making.

3. Accessible technology: affordable technology

The practicalities of theatre-making can superficially appear difficult to reconcile with mass entertainment, especially as far as small- to mid-size theatre companies are concerned. And from an audience perspective, there are also barriers that may prevent the so-called hard-to-reach members of the audience going to venues and enjoying stage performances. On the one hand, theatre makers face very practical barriers to making theatre that is inclusive, or better yet that integrates accessibility as part of the creative process. Through conversations and collaboration with various theatre makers and theatre companies during our project it became evident that this burden is normally not artistic: most artistic directors want to retain control of the way their creation is going to be enjoyed by the audience and can recognize the creative possibilities fostered by new technologies, in contrast to working with a deficit model of access that sees captions as either a hindrance or as something that just has to be done. Rather, the challenge for these companies is a material one: they operate on very tight budgets which do not usually stretch to include the purchase of new and potentially expensive equipment, never mind research and development as well as training costs. It was therefore important that our project was structured in such a way as to make possible the synergistic collaboration between the researchers at the University of Nottingham, Red Earth Theatre (including its artistic directors, actors, set designers and technical staff) and the audience (including in particular D/deaf stakeholders).

The project opened with a one-day scoping network meeting, bringing together key stakeholders in the project from local and national Deaf charities including the Nottinghamshire Deaf Society and the National Deaf Children's Society, [6] the Red Earth Theatre production team, and researchers from the University of Nottingham. The day was supported by two BSL interpreters who also took part in the discussion where possible. The day centred around a showing of Red Earth Theatre's *Mirror Mirror*, which enabled all participants to understand the current state of discussions during the day: it was here that we fixed on the core priority of finding a way to embed captions aesthetically – and potentially dramatically – into the stage space of the show.

This event was followed by a hackfest hosted in the Mixed Reality Lab, University of Nottingham. This open, exploratory meeting was designed to take place over two days: the first day enabled the sharing and scoping of available technologies as well as an exploration of potential technologies to support inclusive integrated immersiveness for D/deaf theatre audiences, while the second day allowed participants to trial and test potential technologies with short extracts from the Red Earth Theatre production of *Mirror Mirror* and the company's performers. Across the two days, our aim was shortlist one or two promising technologies for development and further testing.

The final event of this first phase of the project was a stakeholder showcase that took place at Reigate Primary School, Derby. Along with invited theatre makers with interests in making accessible theatre from across the UK, pupils from the Deaf Enhanced Resource Facility Unit at Reigate Primary (years 5 and 6) and their teachers attended a sharing of extracts from the *Mirror Mirror* show that incorporated the different prototype technologies developed in the wake of the Hackfest, and which are described in the next section. Following the sharing, the team gathered feedback in order to draw out the different audience groups' responses to the mixed-method total communication approach: we aimed to understand and evaluate the effects of the immersiveness achieved by the deployment of our prototyped approaches to evidence the potentials and challenges of our research.

It should be noted here that the project's tight timeframe – and its focus on research, development and testing of accessible immersive technologies – meant that for the purposes of this showcase we had to retro-fit immersive captions into short extracts of an already existing devised performance. However, one of the key underpinning ideas of our conception of integrated immersive inclusiveness – reinforced by the findings of our discussions with theatre makers and audiences across the three project events – was to promote the idea that the captions should function as a fully-fledged component of the theatrical narrative, combining with the other theatrical semiotics to generate meaning, rather than as merely “additive” (Pedersen 2007: 13), added to a product that is already considered complete in order to make it accessible, like an “afterthought” (Romero-Fresco 2019: 2).

With the help of follow-on funding from the UK's Arts and Humanities Research Council, the next phase of the project thus saw the research team collaborating with Red Earth Theatre on their production of Russell Hoban's *Soonchild*. Here our aim was to enhance and stabilise the technologies developed at the above events, working in the context of a full touring production to ensure the usability and robustness of our prototype system as part of the everyday setup of an inclusive touring show. As well as supporting the creation of a theatrically engaging and inclusive production, this process was used to capture and record opportunities and challenges as well as to gather feedback from audience members and from the production team. We used the feedback to formalize a suite of tools and guidance that other companies would be able to use in their own productions. The project was capped by a final sharing event with local and national theatre companies to present our development package and make it available (via a free borrowing scheme) and accessible to them (via training).

4. Breaking informational barriers: initiatives and limitations

While the project's structure allowed for a well-rounded approach that was inclusive and fostered productive discussions between all the parties involved, the project team were very aware in the wake of Wilmington's report (2017) that there is a certain reluctance from members of the D/deaf community to attend theatre performances, based on the perception that these are “not for them/not in their language” (Wilmington 2017: iv). This particular barrier to access is both psychological and informational: D/deaf members of the audience believe that the programme offered in theatres is not suitable for them, and this belief is not contradicted by any information, correspondence or advertisement from theatres showcasing the kind of work they do, highlighting how inclusive it is and showing how it might appeal to these *hard-to-reach* audience members.

In an attempt to bridge this communication gap, Esteban and Mével (RedEarthTheatre 2019a) created a short promotional film to showcase and advertise the kind of artistic and aesthetic decisions the team had developed with Red Earth Theatre and the other stakeholders. The video was produced in collaboration with Red Earth Theatre's artistic directors, and involved two of the actors from Red Earth's adaptation of *Soonchild*, which began its UK tour

shortly after the video was released. The video was eventually shared online, with and through stakeholders, and disseminated widely within – and well beyond – the D/deaf community.

The video features the two actors – Matilda Bott and Craig Painting – in a two-shot, filmed from the hips up, with a piece of the set used for Red Earth’s *Soonchild* in the background (see Figure 1 below). One of the actors (Bott, on the left-hand side) provides a spoken commentary, while the other (Painting, right-hand side) simultaneously provides BSL interpretation. The video also features integrated captions,[7] which start relatively conventionally (being displayed at the bottom of the screen in white letters with black contours) before gradually springing to life to support the message and emotional content of the video (Figure 2); the captions can also be seen interacting directly with the actors on the screen (Figure 3). The relatively simple visual organization of the shot means that the hand movements of the actors (particularly Painting, who provides the sign interpretation) can be seen clearly at all times over their plain black clothes. This short video is a case in point for the integration of captions from the start of the creative process. Indeed, Esteban and Mével included the captions at the storyboard stage to make sure that they would interact well with the actors’ words and movements[8].

In contrast to the integration of captions into the live theatre experience which we discuss in the next section, it should be noted here that while the captions were envisioned and scripted from the beginning of the creative process, their implementation into the video was actually done after shooting was completed, using video effects software. Making these captions in post-production was by far the most time-consuming activity of the video-making production process: the tools currently available to perform this task are inadequate at best, and also require high levels of technical expertise. It can be argued that theatre makers face similar challenges for their productions: the existing tools for captioning stage performances are unwieldy or ill-adapted to the creative needs of theatre makers and can make the integration of captions a difficult and time-consuming endeavour. As a result, the provision of captions is often treated as a task to be carried out late in the creative process (when the script has been finalized). This in turn challenges by its very nature the notion of integrated inclusion: a challenge which the main activity of our project sought to address.



Figure 1: Screenshot from promotional video featuring BSL and creative captions (RedEarthTheatre 2019a)



Figure 2: Screenshot from promotional video featuring example of creative caption supporting the script (RedEarthTheatre 2019a)



Figure 3: Screenshot from promotional video featuring one of the actors brushing away the caption with her hand (RedEarthTheatre 2019a)

4. Integrating captions: workflows and aesthetics

With these premises in mind, we set out to create a suite of more dynamic tools that could allow for greater integration of captions for the stage on two levels. First, we wanted to enable the ability to create and integrate captions into workflows on the fly to reflect changes to scripts. This would allow theatre makers to think about and implement captioning at earlier stages of the creative process (instead of leaving it until the very end, as is currently often the case); it would also enable devising companies such as Red Earth to keep devising later into the production process, rather than having to *lock down* their script to enable the captioning process to be completed. Secondly, we wanted to address the problems of the Wimbledon effect through a process that would manage the aesthetic integration of captions onto the stage itself and into the action, instead of being relegated to its periphery. The ongoing dialogue described above – with the artistic directors of Red Earth Theatre, Wendy Rouse and Amanda Wilde, with other key people involved in production and delivery (actors, set designers, technicians) and with the stakeholders from the D/deaf community – enabled three closely related tools to be developed.

Our first tool is concerned with process: specifically, how to get from a script to a series of captions. Scripts are often written in Microsoft Word or similar and certainly in the case of Red Earth Theatre, these scripts are living documents

that evolve during the design process and are often subject to changes. Thus, we needed to be able to quickly regenerate a set of captions in response to script changes. **To support this, we developed a tool which reads a Word document and separates each script line into a table, stored as TAB separated values (TSV) which, in each row lists speaker, caption and some additional variables including typeface, size, colour and target location.** The tool makes some assumptions about how the script is formatted: the speaker's name, followed by a colon, then what is to be said, and that each utterance will end with a new line. It also assumes that stage directions and other non-script text will be in square brackets. The tool is configurable to a maximum character limit per caption, so larger speeches are broken up into manageable chunks in an intelligent way – preserving sentences as well as possible and trying to avoid leaving short final captions. This TSV can then be edited in e.g., Microsoft Excel, and serves as the basis for our next two tools.

The second tool developed as a result of this project is based on projection mapping – that is, a technique which uses one or more projectors to display images on a three-dimensional space (which can be a stage in the loosest possible sense). These images are projected on to parts of the set – and potentially on to the actors themselves or indeed on any suitable projection area – and are warped to make the projections appear correct on the physical objects.

Whilst 3D-projection mapping has existed for some time, our approach is particularly innovative as the focus was on simplicity and portability. For small scale productions, only one front projector is necessary. The key principle of our approach begins with a virtual model of the set in 3D, then projects that 3D model of the set back onto the actual physical set. By using game-engine technology (Unity3D) to do this, we are able to rotate the camera angle of the 3D render to match the projector position, thus allowing us to project the set from almost any angle. Since the model (and subsequently the projection) is in 3D, this makes the projection respect occlusion, so objects can be placed in front of each other without leakage. Once the 3D set is projected onto the physical one, this provides a set of virtual surfaces on which content can be overlaid: these surfaces are assigned as targets on which captions or other media can be placed. The final step is to hide the 3D model, leaving only the content displayed on the targets. Figure 4 (below) shows how different projector positions with respect to the set result in a different image to be displayed on the projector. In this example case, we wish to project a red background and a white caption on the back set piece, just a caption on the centre set piece, and a blue background and a white caption on the front set piece. As the angle of the projector becomes steeper, fewer pixels are available for the text, so striking a practical balance for the position of the projector is necessary.

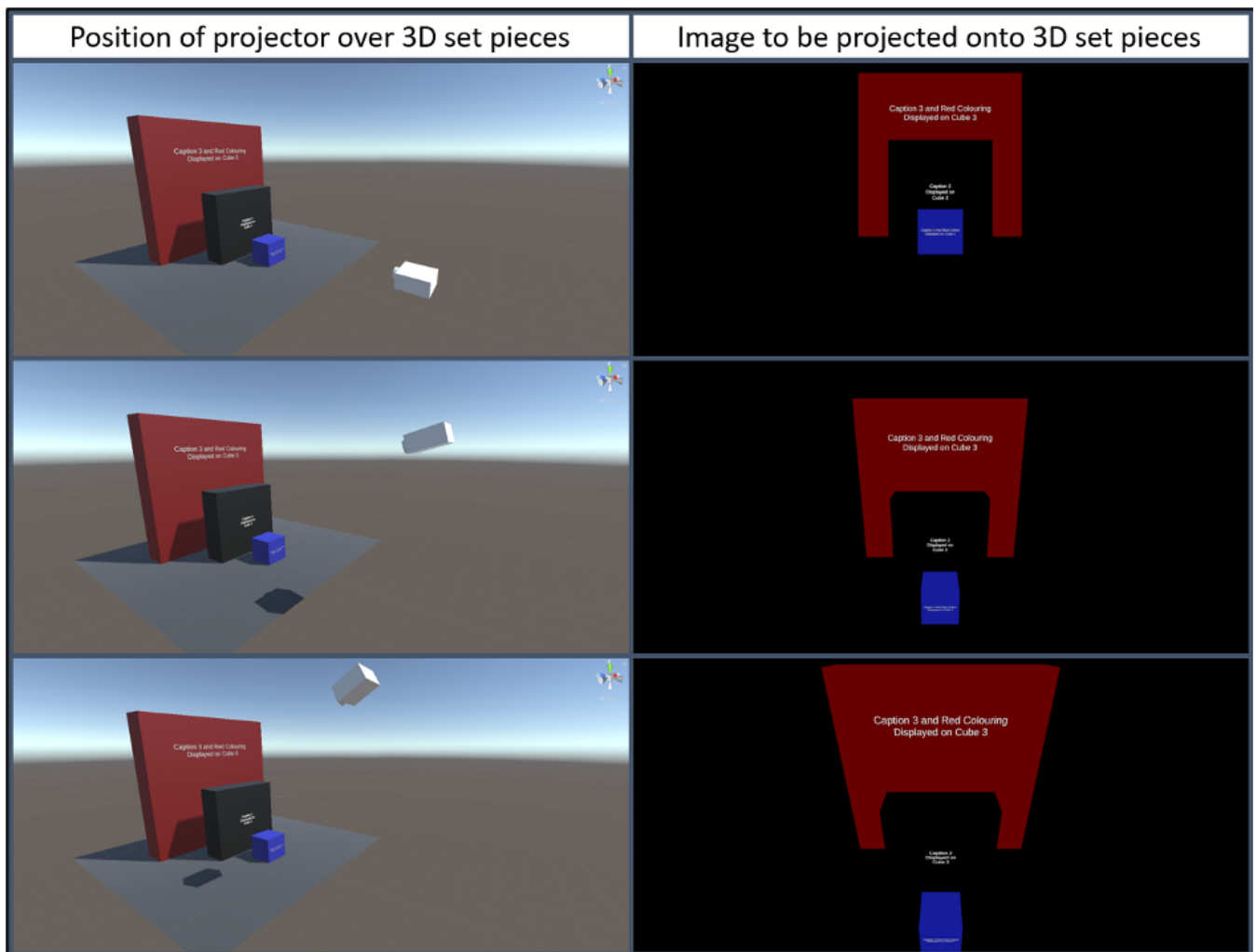


Figure 4: illustration of the different projections that have to be applied to be correctly displayed on stage depending on the position of the physical projector

As highlighted above, one key challenge to developing an accessible system for companies who want to embed captions into their theatre is portability, particularly for a touring company such as Red Earth Theatre who will visit several venues during the course of a show. To position the projector for a new venue we simply re-project the 3D model, then project a virtual mouse that allows us to click known locations on the physical stage, as seen in figure 5 below. The system uses the offset between the place clicked and the known position of that point in the 3D model to rotate and translate as necessary to correctly overlay the set. This means that preparation in a new site takes only around 5 minutes.

To make such a system work, it is necessary to start with a 3D model of the set. Modern sets are often digitally modelled now as part of the production process, but if this is not the case, physical models (e.g., white card models) can easily be scanned and converted into 3D meshes with existing open-source tools such as Blender.

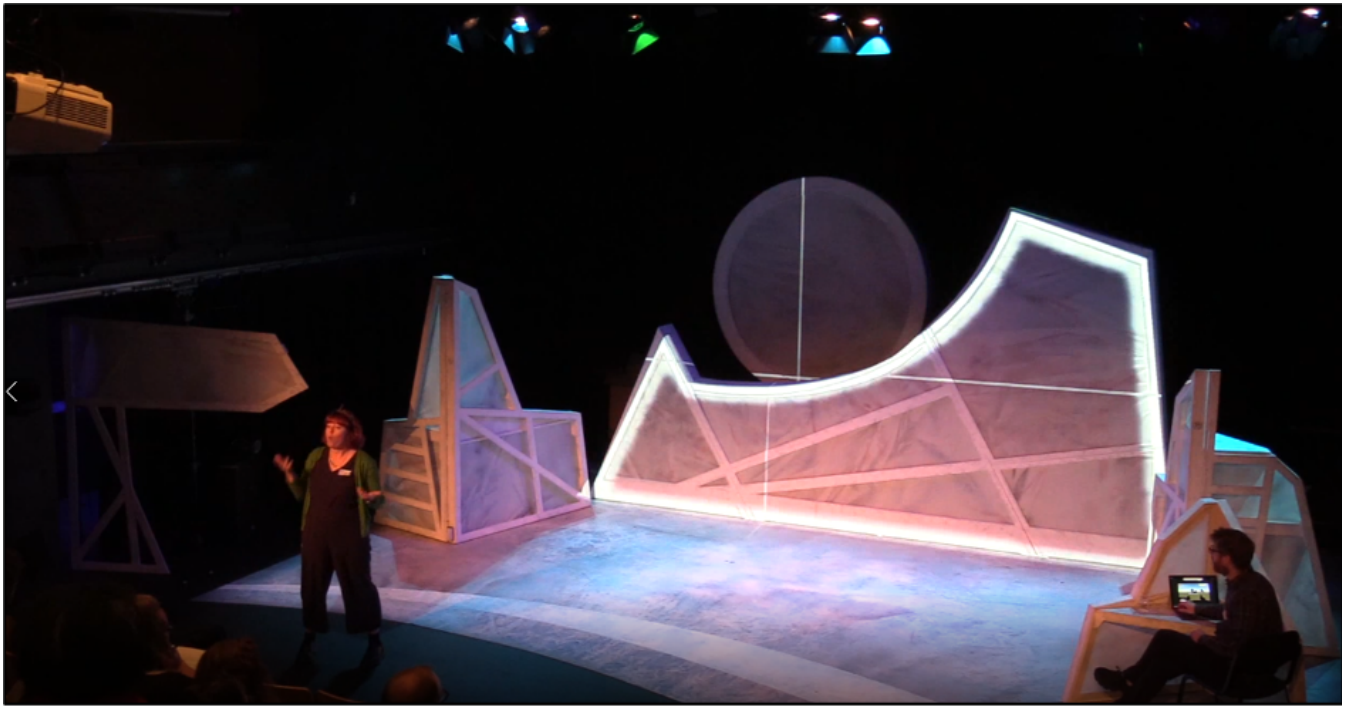


Figure 5: example of a projected crosshairs used as a mouse to select the real world positions of the set pieces, subsequently used to work out the virtual positions in the 3D model

The content for the virtual surfaces is delivered to the system by Open Sound Control (OSC) messages. This was an important consideration for us as OSC is a common messaging framework for audio control and sometimes lighting control in theatre-tech ecologies. A message must contain a target location (one of the virtual surfaces described above), and either a media name or some text. If text, it should also contain typeface, colour, size and alignment: the system then responds to those messages in real-time by displaying the content, with smooth fades where necessary.



Figure 6: screenshot from trailer (RedEarthTheatre 2019b) featuring integrated captions projected on different parts of the set

An example of this system in use can be seen in figure 6 above, where captions are projected on different parts of the set. Captions may be purely textual, but as seen in figure 6, they can also be supported by other design features such as images or video.

The final tool we developed was concerned with integration. It is important when developing new theatre technology to consider how it might fit into an existing ecology. By using OSC as our input system, we were able to integrate with various existing systems, such as MaxMSP, PureData and QLAB. Our tool created cue-lists from the TSV caption file

described above and converted these to QLAB format, meaning the projection of captions and other media onto the selected virtual screens was able to be cued from standard theatrical cuing software (QLAB) alongside sound and lighting.

In summary then, we created a simple – and affordable – pipeline for embedding accessible captions. It starts with a script in Microsoft Word and a white card model of the set; converts the white card model into a 3D model; converts the script into a series of captions and the captions to a series of cues; then uses the cues to drive virtual surfaces on a 3D model of the set, which is finally projected onto the physical set and seen by the audience.

This technology enabled Red Earth Theatre to integrate captioning into their creative processes on different levels. First, with the greater integration of captions into QLab, creative directors are now able to adapt the content of captions with a lot more agility to respond to changing scripts and dialogue right up to the end of the rehearsal process. Secondly, the 3D-mapping tool allows for captions to be displayed much closer to the action and directly onto the performance area, preventing the Wimbledon effect that splits attention between action and caption. The captions can be displayed in a greater variety of places, with a variety of effects, and can synergize more actively with the narrative and with the actors. Our solution also allows for greater artistic and aesthetic integration of the captions, opening up exciting creative possibilities where access can be included in the dramaturgical development of a show.

5. Conclusion

We noted above that there are many different (types of) barriers that prevent members of the audience – but particularly members of the D/deaf community – attending and enjoying theatrical performances. We identified the issue of access as one of those deterrents, with the modes of accessibility usually provided (captions or a stage interpreter on the side of the stage) being anti-immersive – as well as potentially perpetuating audism by discriminating against some members of the audience by forcing to split their attention between the show and the show's mode of access (the Wimbledon effect). Such experiences have ultimately led to these members of the audience feeling excluded from theatre and theatres. These concerns motivated our development of technologies that could foster a new way of thinking about inclusion, by designing solutions that benefit everyone and offer something new artistically.

Red Earth Theatre's production of *Soonchild* took place in the autumn of 2019. The global pandemic that has unfolded since the start of 2020 has only served to magnify the work that is still to be accomplished with regards to access and inclusivity – in theatres and beyond. After being forced to close for prolonged periods of time during the various lockdowns that have swept over the globe, and in the face of the looming threat of indefinite or permanent closure, theatres were initially able to reopen albeit with social distancing measures in place. But the wearing of masks further deepens the communication gap: indeed, D/deaf members of the audience, reliant as they are on lip-reading and/or facial expressions to communicate, are now facing an extra barrier to communication, on top of the many traditional barriers that they have to overcome in order to be able to enjoy live stage performances.

It is urgent that more projects are funded and more accessibility solutions developed in order for inclusiveness to be more than a pipe-dream, and for accessibility to be more than the afterthought it still so often is. Such solutions could include dedicated captioning software or plug-ins aiming to further increase the integration and immersiveness of captions. In order to assess levels of immersion and perhaps more generally the emotional response of audiences, more research on attention-splitting in the context of stage performances using eye-tracking technology is also urgently needed. The recent and significant shift from reception studies to audience experience studies (Jankowska *et al.* 2022: 3) seems to demonstrate an appetite for a more systematic assessment of psychophysiological responses[9] but more work is necessary the spectrum of emotions as well as across different media and modes of accessibility. For the stage, balancing out the audience's immersion, the practicability of the tools available to theatre makers, and the affordability of these tools (both in terms of their actual cost, but also in terms of their learning curve and their ease of integration into existing workflows) appears key to successfully piloting and developing solutions that truly embed access into shows: the work described here with Red Earth Theatre provides one instance of such an attempt. In the future, it is also hoped that similar conversations and projects can be developed with audience and third sector groups that represent other spectra of disability and can facilitate the development of stage practices that can truly be called inclusive.

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Notes

[1] The term caption will here be preferred to the term surtitle, as has become the norm since being ushered in 2015 by StageText and the University of Roehampton. Whereas surtitle suggests that the titles may be displayed at the top of the stage, the term caption does away with any suggestion that titles have a pre-defined space at the periphery of the performance space and opens the possibility of further integration into the stage space itself.

[2] Red Earth Theatre (2022) define these terms as follows: British Sign Language (BSL) is "a visual language that uses hand shapes, facial expression, gestures and body language. BSL is a complete language with a unique vocabulary, construction and grammar". Sign Supported English (SSE) "uses signs from BSL but follows the word order of English", whilst Visual Vernacular (VV) is "a theatrical and physical form of storytelling with strong body movements, signs, gestures and facial expressions. VV draws on cinematic ideas like close-ups, images dissolving into new images etc."

[3] The tools developed during the project as well as draft guidelines for theatre makers looking to use captions can be found on the Integrated Immersive Inclusiveness website (2022).

[4] Whilst the word *community* has recently been overused in some circles, we use it in this article to designate the people who feel a sense of belonging to Deaf culture, with Deafness defined not in medical terms but rather as a cultural, social and linguistic group, as is also emphasized by the capital D.

[5] See for instance RedEarthTheatre (2019a), also discussed below.

[6] The participants were all adults, male and female in equal proportion, with a range of hearing impairments and all proficient users of BSL.

[7] On creative captions/integrated titles, see McClarty (2012, 2013) and Fox (2016, 2018).

[8] For a full account of the creative process of this video and of its importance and meaning as a gateway to access Red Earth Theatre's performances, but also more generally showcasing the particular polysemiotic mode form of communication encouraged by the project, see Mével (2020).

[9] See for instance Matamala et al. (2020), Ramos Caro (2016), and Rojo et al. (2014).

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"Innovation vs Practicality vs Entertainment: Developing and implementing affordable technological solutions for theatre accessibility", *inTRAlinea* Special Issue: Inclusive Theatre: Translation, Accessibility and Beyond.

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