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Directing for Cinematic Virtual Reality: how traditional film director's craft applies to immersive environments and notions of presence

Virtual Reality has been an area of research for over 40 years yet only recently has it begun to achieve public acceptance. One key to this has been the development of 'Cinematic Virtual Reality' where media fidelity approaches that found in feature film. Unlike traditional VR, CVR limits the level of control users have within the environment to choosing viewpoints rather than interacting with the world itself. This means that CVR production arguably represents a new type of filmmaking. Grammars for filmmakers have developed significantly resulting in a rich vocabulary available to use to create compelling stories. Relatedly, researchers into Virtual Reality have also begun to understand mechanisms behind compelling engagement within VR. This paper looks to find a bridge between these two previously disparate media. It is argued that the concepts of 'suspension of disbelief' and 'presence' can be linked via 'transportation theory'. The applicability of existing filmmaking directing techniques for the creation of CVR projects is then explored. Existing film production methods are considered in a manner adapted to establishing 'presence' in a CVR space. Finally, areas for future exploration are considered in light of the immaturity of Cinematic Virtual Reality as a medium.

Keywords: directing; cinematic; virtual reality

Introduction

The immersive medium of Virtual Reality (VR), referring to the presentation of first-person experiences through the use of a head-mounted display and headphones that enable users to experience a synthetic environment as if they were physically there, arguably began with Ivan Sutherland's (1968) work nearly fifty years ago. In the early1990's computer technologies had advanced to a point where the commercial

potential of VR was seriously explored. There was significant investment by established manufacturers such as Silicon Graphics, Sun Microsystems and Evans & Sutherland as well as the creation of numerous VR start-up companies such as VPL, Division and Virtuality. However, the technology was ultimately not sufficiently mature nor at a low enough price point to enable viable take-up so commercial exploitation stalled. Schnipper's (2014) article, 'The Rise and Fall and Rise of Virtual Reality' includes an insightful section by Robertson and Zelenko (2014) with interviews with key players of the time. Only recently, with the emergence of inexpensive high-powered computer processing and display systems, has VR begun to become commercially viable and to be adopted by the public. Central to this take-up has been the development of so-called Cinematic Virtual Reality (CVR).

While a formal definition of CVR is still being developed, the emerging consensus is that the term refers to a type of immersive Virtual Reality experience where individual users can look around synthetic worlds in 360°, often with stereoscopic views, and hear spatialised audio specifically designed to reinforce the veracity of the virtual environment (as a note, there are presently no initiating studies or foundational articles that can be seen as seminal at this point). Unlike traditional Virtual Reality in which the virtual world is typically generated through graphics processing and audio triggers in real-time, CVR uses pre-rendered picture and sound elements exclusively. This means that the quality of these assets can approach that found in high-end television or feature film.

CVR programmes began to appear in 2015 propelled in part by major initiatives by Google, Jaunt VR and *The New York Times*. Google (2017) launched a major push into VR including the introduction of Cardboard, which enables many mobile phones to be used as a low cost head-mounted display. Jaunt VR is an online CVR distribution

portal founded in 2013 and backed by major investment from Google, Disney, the Chinese media conglomerate CMC and others (Spangler, 2015). Its stated mission is to, "…put realism back into the virtual reality experience, lending an uncanny sense of presence never before possible" (Jaunt VR, 2017). In late 2016, *The New York Times* launched 'The Daily 360' (2017), a free online site that releases CVR programmes on a perpetual basis, making them arguably the largest producer and distributor of CVR content to date. In all three instances there has been direct engagement with Hollywood. Despite the fact that CVR take-up is still relatively low and projects to date are largely experimental, this has also involved the participation of major actors such as Natalie Portman, Don Cheadle and Ruth Negga (in the series *Great Performers: LA Noir*, 2016) and established film directors (detailed below) to help raise the medium's profile both publicly and within the film industry.

While CVR programmes in various genres have begun to be created, including advertisements for fashion (Gaultier, 2016) and travel (Lufthansa, 2016) as well as sports-based promotions typified by Mountain Dew (2016) and GoPro (2016), the majority of projects are either non-fiction, e.g., *Fighting 'Cholitas' Wrestlers* by Bracken, Shastri, and Mullin (2016) and Starr-Dewar's *Rapid Fire: a brief history of flight* (2016), or action-based narrative, e.g., Lewis' *Escape The Living Dead* (2016) and Lin's *HELP* (2015), which claims to be the first live-action CVR movie. Programme durations vary widely from short clips of under a minute, such as Koppel and Mullin's documentary short *Rebuilding a Church Crushed on 9/11* (2016), to medium form projects of approximately twenty minutes, such as the BBC's *Click 360* episode (2016), to multi-part dramatic series, such as Liman's *Invisible* (2016), which consists of five episodes of roughly six minutes each. Standard lengths have yet to be established but the majority of programmes are currently no more than seven minutes.

The user's ability to move autonomously within the virtual world, a core attribute of traditional Virtual Reality, is restricted in Cinematic Virtual Reality to an ability to choose an angle within the environment from which to view the scene – the inability of users to actually interact with elements contained within the virtual world is the primary difference between the two media. While both are immersive, CVR experiences are effectively linear presentations with the duration of each experience dictated by the length of the media assets employed. As a result, the methods associated with experience creation (i.e., production) for CVR arguably represent a new type of filmmaking. Considering CVR in this way suggests that some long-established filmmaking techniques could be adapted to this new medium. Indeed, it is interesting to note the involvement of established filmmakers in several of these projects – Doug Liman is best known as the director of *The Bourne Identity* (2002) and *Mr. & Mrs. Smith* (2005), Justin Lin directed *Fast & Furious 6* (2013) and *Star Trek Beyond* (2016), and Eric Darnell (*Antz* [1998], *Madagascar* [2005]) directed *Invasion!* (2016), which is the first Pixar-style CVR project to be released. The ability to experiment and explore new techniques in their primary feature film genres – Liman and Lin predominantly direct action films; Darnell high-end animation features – motivated each to work in the new medium (see interviews by Robertson [2016], Roettgers [2015] and VR Film Pro [2016] respectively). Each has cited his interest in CVR as a new storytelling vehicle but also recognises that there are fundamental differences between directing for film and for CVR. Liman's comments (in Robertson [2016]) are indicative:

> …we had to rethink the way we were telling stories, because when you just take a traditional scripted scene out of any TV script or movie script and shoot it in VR, it's going to be less compelling than what was shot in 2D. You'll feel like you're watching a video of a play. VR should be more emotionally involving, but that doesn't happen automatically by just taking a VR camera and sticking it onto what would be a traditionally blocked scene for 2D

Research into the application of filmmaking techniques to Virtual Reality has been undertaken since the 1990s but on a rather limited basis. The work of Bates (1991) is notable and relevant to this paper in that he discusses the need for a ' "deep structure" for the virtual world' to enable users to fully engage with the experience as well as the importance of 'suspension of disbelief'. He argues that the development of VR production techniques and grammars is analogous to that of technical filmmaking methods used in areas such as lighting, camera positioning and sound. Bates' effectively proposes a way for Virtual Reality grammars to be considered by drawing on existing constructs but does not look more specifically at the grammars themselves. As a note, the use of 'grammars' in this paper refers to the use of certain production methods to create an identifiable style (e.g., deep-focus and realism; continuity editing and 'Hollywood' filmmaking, etc.) as often discussed in traditional film theory.

Formal exploration of Cinematic Virtual Reality, from both technological and experiential perspectives, is beginning to emerge taking into account the specific differences between CVR and VR. Chang (2016) considers the similarities and differences between traditional filmmaking and those for 'VR Film' (his term for CVR) but his exploration is quite brief and draws little on established research on film theory or production. Cho et al. (2016) explore different approaches to user engagement with CVR-based stories through manipulation of first person (i.e., the user being directly addressed by a story character and thus present within the narrative) and third person (i.e., the user purely observes the action) perspectives; however they do not directly relate this to filmmaking methods nor describe their techniques for eliciting specific user reactions in detail. Syrett, Calvi, and van Gisbergen (2016) report a formal study into how 'narrative comprehension', essentially the understanding of story and character, is affected by the use of CVR as a storytelling medium. They note that, while

some elements of a CVR environment can be distracting, participants generally could follow plot and empathize with characters. While they did not consider specific filmmaking techniques, their results nevertheless indicate that '…it is a challenge for the director to guide the viewer's attention' (ibid, 206). Nilsson et al. (2016) address this issue directly, considering means to guide the user's attention within a 360° space to ensure that they are looking in appropriate directions at appropriate times to receive key information during CVR narratives. While their work draws to some degree on basic filmmaking theory, particularly the role of diegetic and non-diegetic cues as discussed by Bordwell and Thompson (2012), it is quite narrow in scope and does not consider film directors' methods nor how they might be applied.

Existing research into Virtual Reality lacks sufficient consideration or understanding of the role of the film director and the formal strategies utilised by them in cinematic storytelling. Therefore, this paper seeks to provide a bridge between virtual reality and filmmaking research in consideration of production methods. It is hoped to provide new insight into how existing techniques can be adapted to create effective Cinematic Virtual Reality experiences and begin to develop directing techniques specifically for this new medium.

'Transportation' Theory

'Transportation' is defined by Green and Brock (2000, 701) as 'absorption into a story (entailing) imagery […] and attentional focus' and an 'integrative melding of attention, imagery and feelings.' They suggest that someone who is transported 'may be less aware of real-world facts that contradict assertions made in the narrative' and may 'experience strong emotions […] even when they know the events in the story are not real' (ibid, 702). Although transportation theory was originally developed for analysis

of engagement with written stories, it is designed to be platform agnostic – '… the term "reader" may be construed to include listeners, viewers or any recipient of narrative information [irrespective of whether it is] fictional or nonfictional' (ibid, 702); 'The key psychological ingredients of the transportation experience are assumed to take place regardless of modality of communication' Green and Brock (2004, 312). Transportation is not unique to medium or genre and requires that the recipient be able to develop a compelling mental model of the narrative world and circumstance, including knowledge of character or subject; full transportation equals full concentration equals full engagement.

It is argued here that, since transportation theory can be used as a means of considering and measuring engagement across media, it is well suited to exploring the applicability of techniques to achieve transportation between film and Virtual Reality – classically defined as 'suspension of disbelief' in film and 'presence' in VR. In both media, transportation is the primary responsibility of the director. By employing transportation theory as a bridging construct, it should be possible to more directly assess the effectiveness of and adapt difference techniques for promoting engagement across these media.

Transportation in Film and 'Suspension of Disbelief'

'Suspension of disbelief' has long been used as the primary term to denote viewer engagement with film and cinematic storytelling. Ferri (2007) presents a usefully detailed exploration of the concept from its evolution (noting its origins as a literary term by Coleridge) through to how audiences presently view (and become immersed) in film. Much has been written about the evolution of film theory and grammars, and the subsequent emergence of modern film 'vocabulary' through which filmmakers can

communicate story in rich and increasingly sophisticated ways and thus transport viewers (see Bordwell and Thompson [2012] and Braudy and Cohen [2009] for seminal overviews). Directorial choices are central to imparting distinct styles that can directly affect how viewers engage with narrative and interpret story, and thus increase transportation. As discussed by Richards (1992), Weston (2003), Proferes (2013) and others, this starts with the director undertaking a detailed analysis of the script to:

- Formulate a specific interpretation of the story
- Define the overall theme and message based on the interpretation
- Define how information will be revealed – does audience learn as the characters (or subjects, if documentary) do? does the audience know more than the characters/subjects? less? etc.
- Define the overall objectives of core characters/subjects and the dynamics between them – whose story is it? what do they want? what do they need? who are the allies? enemies? etc.
- Extract story elements to inform realisation and creative production choices (i.e., the director's vision)

Creation of 'mood' or 'tone' is readily accomplished through strategic choices in setting, production design, costume, lighting, sound and other presentational attributes as well as through blocking, pacing and delivery of performances or portrayal of activity (if documentary). Film directors often also take advantage of existing audience knowledge about genre conventions, archetypes and stereotypes to support (or subvert) audience story expectations, helping to promote and enhance transportation. In the majority of film grammars, directorial choices have the specific objective of ensuring audiences engage strongly with story but not be distracted by technical means of presentation thus achieving 'suspension of disbelief' (see Bordwell, Staiger, and

Thompson [1988] for a detailed exploration of this classical model of filmmaking). This is done by establishing the 'rules' of presentation early, not only in terms of look, sound and style but also in the handling of physical impossibilities – e.g., that it is possible for people to fly, to walk through walls, to hear other's thoughts, etc. – to enable audiences to understand how to interpret what they are experiencing. Verisimilitude, particularly through the enabling of viewers to mentally construct compelling realities irrespective of the fidelity of pictorial or aural representations of story events, is necessary to achieve 'suspension of disbelief' and thus facilitate transportation in film.

It is argued here that the same consideration of directorial choices, viewer knowledge and expectations, and establishment of 'rules' of presentation is directly relevant to Virtual Reality projects although the manner in which they are enacted may be somewhat different. Where film and VR principally differ is in the handling of 'continuity'. In film, continuity takes different forms – *continuity of viewpoint*; *continuity of motion; continuity of setting*; *continuity of sound*, etc. as described by numerous people such as Katz (1991) and Bordwell and Thompson (2012) – and is a main consideration in many theories to maintain 'suspension of disbelief' for film viewers. However, this model is predicated on the assumption that multiple camera angles will be utilised in a film presentation (i.e., it will be edited) which is not directly transferrable to Cinematic Virtual Reality if contiguous recording is used. (Many CVR experiences are contiguous and presented as if in real-time although editing is beginning to be explored – Ijäs [2016] is one example of research in this area.) Still, it is argued here that continuity-led grammars can apply to CVR production. In part, this is due to the fact that a user in CVR is only able to look in one specific direction at any one time, meaning that other parts of the narrative environment are not visible, as is the case with

action off-screen in film. Accordingly, various film directing techniques should be directly adaptable to a 360° presentation environment. This is explored in more detail later.

Transportation in Virtual Reality and the notion of 'Presence'

'Presence' is the term developed to assess the level of transportation within Virtual Reality. Biocca (2002) defines it as a state where 'our awareness of the medium disappears and we are pushed through the medium to sensations that approach direct experience.' While this is useful as a broad definition directly related to transportation, Heeter's definition of three distinct types of presence (1992, 263-4) is more useful in the comparison of transportation across media as it addresses the different means of immersion possible in VR:

> *Social presence* refers to the extent to which other beings (living or synthetic) also exist in the world and appear to react to you […] Social presence may derive from conversing with other human beings, or from interacting with animated characters.
>
> *Environmental presence* refers to the extent to which the environment itself appears to know that you are there [e.g., via interaction with or modification of physical objects or setting] and to react to you […] If the environment knows you are there, that may contribute to you believing that you are there.
>
> *Personal presence* is based in part on simulating real world perceptions. You know you are "there" because sounds and images in the virtual world respond like the real world to your head movements.

Of these three sub-definitions only the last is relevant to Cinematic Virtual Reality given the lack of true interaction with the environment and the linear presentation used within the medium.

There is general agreement on key considerations in the design of virtual

experiences to maximize presence and thus transportation, as discussed by Slater and Wilbur (1997). Three of these are directly relevant to Cinematic Virtual Reality:

(1) The rules of interaction must be clear – how, where and when the viewer can move or change viewpoint

(2) Navigation must be simple and intuitive – enabling movement without distracting from visual or aural elements that facilitate transportation

(3) Movement within the environment must be smooth – with consistent increases or decreases in speed and no apparent visual artefacts when perspective is changed (e.g., seams between cameras used in creating 360° video)

While at first glance it would seem that the first and second are addressed almost by default given the limitations in CVR world navigation, it is argued here that they still warrant detailed consideration by the director, particularly if transitions between scenes are to be used. Unlike film, grammars for interaction and navigation are not yet mature enough to be considered standardised thus it is important that they are considered in relation to other directorial choices made. As an example, navigation used in CVR projects such as *Invasion!* (2016), *Invisible* (2016) and *Great Performers: LA Noir* (2016) is completely transparent and does not use interface icons, relying solely on the viewer to physically orient his or her head to change the viewpoint of the scene. This arguably gives the best chance for full transportation although there is the risk that the viewer misses key action if the viewpoint is in the wrong direction. Other projects, such as *Escape The Living Dead* (2016), employ an opposite approach utilising an icon-based map to indicate to the viewer where to look at any given time. While this minimises the risk of the view missing important story points, it also makes the viewer acutely aware of the artifice of the viewing medium. The impact of interface design on transportation

is an interesting area for further investigation.

Directing for Cinematic Virtual Reality

Having looked at transportation in both film and Virtual Reality the goal now is to apply techniques from the one medium to enhance production of the other. It is argued here that the core preparation tasks undertaken by a film director are applicable to the creation of a Cinematic Virtual Reality project. However, 'realisation' must be considered slightly differently. Existing methods for film can be adapted to immersive presentation so long as they also take into consideration unique aspects of the CVR platform and are consistent with the needs of supporting presence. For example, potential issues with navigation in CVR were identified above. Yet, just as it can enhance a viewer's experience of a film, the effective use of drama and surprise can help to promote transportation in CVR through minimising the impact of these issues on presence. As Bouchard et al. (2008, 384) report, 'anxiety […] appears to have a direct impact on the subjective feeling of presence' so it follows that clever directorial choices in story interpretation and realisation to raise anxiety and evoke response to dramatic circumstance can help to facilitate transportation by masking potential issues unique to the CVR medium. In other words, the imparting of 'stakes' and 'jeopardy' in the viewers mental model of the story can enhance empathy with character circumstance and thus distract the viewer from the artifice of the CVR medium.

Earlier it was argued that continuity-led film grammars are applicable to Cinematic Virtual Reality projects. Central to this notion are two key elements:

(1) The director's ability to predict and control the user's viewpoint within the virtual scene

(2) The idea of 'organic' direction

Film directors have developed several means by which they can control audience attention and subliminally guide viewer gaze around the frame. Katz (1991) discusses various compositional tools to achieve this, all of which include visual differentiation of elements in some way. (These techniques are also discussed by many others and build on those developed by classical painters.) Although some of these rely strictly on the limits imposed by a finite 'window' into the environment (i.e., the film frame), several are applicable in a CVR context and can be used to promote the viewer's direction of attention. These include:

- Differences in grouping, where one element of a scene is offset from other elements – such as in the isolation of Juror 8 (Henry Fonda) in the jury room of Lumet's *12 Angry Men* (1957)
- Differences in colour, where one element of a scene has a different look to others – such as the use of the girl in the red coat in Spielberg's *Schindler's List* (1993)
- Differences in scale, where one element of a scene has a different size to others – such as the use deep low angle two-shot of George Minafer (Tim Holt) with Isabel (Dolores Costello) in the drawing room in Welles' *The Magnificent Ambersons* (1942)
- Differences in shape, where one element of a scene has a different look to other (usually similar) elements – such as the pudgy Herbie Brown (Lou Costello) in the military line-up of fit soldiers in Lubin's *Buck Privates* (1941)
- Differences in visibility, where one element of a scene is more easily seen given lighting or focus (note that the opposite approach, where an element is distinctly harder to see than others, can also be effective) –

such as the use of chiaroscuro lighting of the reporters in the screening room scenes of Welles' *Citizen Kane* (1941)

- Differences in motion, where one element has distinctly different movement to others – such as the chase through umbrellas in the assassination scene of Hitchcock's *Foreign Correspondent* (1940)

Techniques involving an understanding of human psychology can also be applied in a CVR context. These include the natural tendency to try to locate diegetic sound, be it expected or unexpected (i.e., a surprise), if the source is not immediately apparent. We also tend to look where other people are looking, particularly if we empathise or identify with them in some way or they are drawing specific attention to something within the world. All of these are effectively types of passive cueing.

Because of the lack of frame boundaries in CVR, these techniques are potentially more difficult to apply than for film. Practical research into this area is in its infancy, e.g., Nilsson (2016), etc., however, it is argued here that through careful design and directorial choices, often using multiple techniques in parallel, this should be possible (if mainly applicable to narrative projects).

Central to this is the idea of 'organic' direction whereby production choices made are motivated based on a consistent interpretation of story elements, setting and character that are logically supported by script analysis. Each aspect of the production needs to reinforce others to create a coherent virtual world with clear 'rules' if transportation is to be achieved.

To use a film example, but considered in terms of Cinematic Virtual Reality production, the transition from the objective chaos of the Omaha Beach landing to the personalised shellshock of Captain Miller (played by Tom Hanks) in *Saving Private Ryan* (1998) represents a highly principled directorial approach, much of which is

applicable to CVR. Spielberg's stated intention for the sequence was to 'shoot the same way a combat cameraman shot World War II' (AFI, 1999) to enable audiences to experience the horror of war with limited narrative intervention. This was at odds with the dramatic requirements of the script, which needed to show Miller getting caught up in the slaughtering of troops around him and then regaining control of his faculties to ultimately lead his squad off the beach. Spielberg did not want to affect the audience's transportation into the battle and needed to find an organic way to transition from a (comparatively) objective presentation of the landing (where the viewer is actively choosing where to look) to Miller's emotional perspective (where the viewer's attention is on him and his plight). First, to enable the audience to ultimately pick out Miller from the slews of other soldiers landing on the beach, Spielberg made the choice that Miller would not be wearing his helmet thus visually offsetting him. Helmets often come off in battle so the artifice of the intention of the choice is completely hidden by audience knowledge of the setting. Second, Spielberg blocked the scene so that Miller was the only person approaching camera and the camera also moved to him. Given the movement is away from a particularly active part of the battle where many are being killed, this too represents an organic choice motivated by situation. These choices are wholly consistent with the 'reality' Spielberg sought to portray yet also facilitated his control of viewer perspective, empathy and attention. In both this scene and CVR, there is a need for transparent direction and internal consistency within the narrative world to maximise viewer transportation.

Were the sequence to be designed for a 360° Cinematic Virtual Reality environment, the considerations and choices would need to be slightly different but the realisation of the sequence could be much the same. Assuming the scene to be in one shot without any editing (as is common in CVR), the blocking and positioning of action

would take on more importance and the primary driver in controlling the user's specific angle of view. Through the timing of explosions (to promote head movement to seek sound sources), subject movement (to ensure certain soldiers 'stand out' visually and blocking their motion toward the area with Miller such that it promotes the user's view to get close to the area of significance) and the use of 'dead zones' (areas within the virtual environment where there is little or no activity or visual interest to promote the user to look elsewhere), the user's gaze could be controlled. The choice for Miller to have no helmet and to approach camera would be the same and should evoke the same dramatic significance. The use of camera movement to move toward Miller (as Spielberg did) could potentially be problematic as the user has no direct control over the change. However, if the move is subtle, and the dramatic engagement with the emergence of Miller strong, it may not adversely affect the level of transportation if the timing of the move seems to be motivated by other aspects of the scene (e.g., the approach of Miller).

Conclusions and Future Areas for Research

This paper has explored the relationship between film directing techniques and Cinematic Virtual Reality production drawing on transportation theory to better enable consideration of how techniques from one medium can be applied to another. The applicability of existing film grammars and directing methods was considered including how they might be applied were an existing film sequence adapted to CVR.

Research into this area (and into Cinematic Virtual Reality in general) is comparatively new so the argument that film grammars can be applied to CVR is something that needs further (and more practical) exploration. For CVR directing methods to become more refined and mature, a number of important questions need to be considered:

- To what degree can film directing techniques be utilised in Cinematic Virtual Reality production? When does the artifice of cueing become apparent to users and affect transportation?
- What is the relationship between the level of user autonomy and transportation within CVR?
- How can fixed screen, CVR and immersive VR versions of a story be compared to gain insight into the applicability of film techniques on CVR and VR experience development?
- What techniques from other media, such as traditional stage-based or participatory theatre, are applicable to CVR and how can they be used effectively?

It is hoped that insight gained through investigation into these and other related areas will enable Cinematic Virtual Reality to become firmly established as a viable and effective storytelling platform.

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