Chapter 7

Immersive journalism: The new narrative

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Immersive journalism is a subcategory of journalism that uses virtual reality (VR) and similar technologies to provide those engaging in such technologies with a sense of being wholly engrossed in the news story, thus allowing the news audience to form a direct impression of the ambience of the story. This chapter is intended to serve as a primer of VR use for news storytelling for individuals with an interest or background in journalism. The first section presents some essential background on VR and related technologies. Next, we present some research findings on the impact of VR, and review some of the early work in immersive journalism. We conclude by delineating a collection of thoughts and questions for journalists wishing to enter into this new exciting field.

1. The Technology

More than 50 years after the first demonstration of virtual reality (VR) technologies [Sutherland, 1965], it is apparent that VR is on the brink of becoming a form of mass media as VR documentary and journalism has been a central theme. Triggered by Facebook's acquisition of Oculus Rift in 2014, the technology industry launched the race to deliver compelling VR hardware, software, and content. In this chapter, we present the essential background for non-experts who are intrigued by immersive journalism. For a recent comprehensive review of VR research in general, we recommend Slater and Sanchez-Vives [2016]. Relevant issues from this review are elaborated below.

VR aims at providing a total experience, by blocking information from the "real" world while providing high-fidelity multi-sensory information about an artificially generated reality. Current consumer VR systems only cater to the visual and auditory senses. One of the factors contributing to VR's high degree of illusion is sensorimotor contingencies that cause the content in the VR to change in response to the participant's head movements. In the real world, the images projected on our retina keep changing as our eyes continue to move several times per second, and our brain proactively generates the sensation of a stable external world. Unlike viewing a movie on an external display, immersion in VR is similar to real-world perception. This is one of the reasons that VR is perceived by the brain to be more "real" than movies. Other factors include stereoscopic depth information and the occlusion of external information.

The result is a subjective experience that is entirely different from any other mediated (or non-mediated) experience. Most individuals report that they feel as if they are transported to another place, rather than simply watching a movie. This phenomenon has been researched since the early 1990s, under the concept of presence in VR [Lombard and Ditton, 1997; Sanchez-Vives and Slater, 2005]. More recently, Slater [2009] explained this fundamental illusion as a combination of place illusion — the degree to which you feel that you are in a place (as opposed to watching a place on a screen) — paired with plausibility illusion — the degree to which you believe that the events taking place around you are plausible. The most popular way to currently experience VR is through head-mounted displays, colloquially referred to as VR goggles. Since 2016, a wide range of VR consumer devices have become increasingly available. The lowest range devices include cardboard or plastic goggles that use smartphones as a display and for tracking head motions: Essentially any smartphone can be converted into a VR device at a cost of several dollars. *The New York Times* was a pioneer media outlet in VR use. In November 2015, the newspaper launched a VR smartphone app (https://play.google.com/store/apps/details?id=com.im360nytvr) and shipped 1 million cardboard Google units to their subscribers.

More comprehensive VR solutions provide better quality of experience due to several factors. First, they include external tracking, which allows participants to move around, in contrast to the phone-based solution that currently only detects head rotation. Current smartphone-based VR only tracks head rotation (three degrees of freedom) using the smartphone's accelerometer (smartphones with no accelerometer cannot be used for VR at all). The result is that smartphone-based VR solution users are not expected to move in space; if they do, their motions are not tracked, and individuals often experience nausea, referred to as simulation sickness. Technically, full head tracking that tracks the head's rotation in six degrees of freedom (i.e., both head rotation and head movement) is currently only possible when accompanied by an external tracking sensor (mounted on the ceiling or on walls; separate from the smart

device). So-called "inside-out" tracking, based on machine vision technologies, are under development in the industry, so next generations of mobile VR may be able to provide full tracking without external sensors. Another advantage of desktop-based VR systems is that they benefit from greater processing power in the form of dedicated graphics cards that can be added to personal computers.

It is estimated that 6.3 million VR devices were shipped to customers in 2016, not including cardboard and plastic goggles [Durbin, 2017]. While these are very impressive numbers for the early-stage penetration of a new technology, they are far from implying mass worldwide adoption. Nevertheless, VR and AR (augmented reality) devices are expected to eventually hit mass adoption; see below for more on AR. It is impossible to predict market trends, but it is clear that all major tech companies are involved in ambitious efforts to develop next generation devices and applications, which are expected to be launched in the next few years and offer new features. The ambitious goal of these teams is to replace the current paradigm of interacting with computers based on a display keyboard and mouse, which was introduced by Engelbart in the 1960s [Rheingold, 2013].

Most VR content is synthetic, based on 3D models and animation, also known as interactive computer graphics (CGI). An alternative production pipeline, which at present plays a major role in immersive journalism, is 360° videos, which are captured using 360° cameras. Typical setups include at least two wide-angle cameras, and high-end devices may include dozens of cameras. The video feed derived from the multiple cameras then needs to be stitched, albeit this can be done automatically with only minor glitches. The 360° videos are then edited in a process similar to traditional video editing. Using this method, individuals can generate 360° videos, almost as easily as traditional video.

Although 360° videos are similar to traditional videos in some respects, such as that both these technologies allow for the narrative created to be portrayed from multiple angles, there are vital differences in their respective production methods, in the experience they offer, and the underlying principles of cinematic expression they use. Since the camera captures the environment in its entirety, plotting the scene and the shots is significantly dissimilar to that of traditional video, which merely captures motion pictures using digital image sensors. Many of the techniques that can be used by video editors in traditional frame composition are unavailable or irrelevant in VR. Unlike video, where the editor has a high degree of control over the visual experience of the audience, VR participants can turn their heads around using the 360° setting, allowing each participant control of their experience; as a result the editor loses a form of control over what and when the audience member will experience. Arguably, this makes 360° videos more appropriate than traditional video for journalism, since the material is arguably closer to the journalist's original experience and potentially less

amenable to manipulation by editors. Can 360° videos be considered a form of VR? Our view is that 360° videos have several interesting properties, such as sensorimotor contingencies and being surrounded by the mediated space, yet they lack properties such as including interactivity and the kinetic ability to negotiate virtual space.

Eventually, the convergence of CGI and video-based VR is expected, but this may take a few more years. Techniques such as volumetric video or dynamic photogrammetry will make it possible to capture a dynamic 3D scene automatically using multiple cameras. Unlike CGI, the visual content in this case is mostly natural and captured by a camera. Unlike 360° videos, the result is a complete 3D model, in which participants can walk around. Capturing a static environment into a 3D model has become quite straightforward and almost automatic: The current challenge is capturing dynamic events. Significant efforts are being made in several application domains, most notably sports broadcasting, with an obvious advantage: Imagine that viewers at home can watch the match from any angle, interactively, or even experience the match as if they were located on or above the sports field. What we are witnessing today are merely the first buds of these technologies, but given the massive industry efforts, we can expect rapid progress.

2. VR Storytelling

However, before considering whether and how VR can be used for storytelling in journalism, we must be aware of the ongoing debate over whether storytelling can be interactive. Hence, while video games seem to have solved the interactivity dilemma [Murray, 1997], there are still some arguments that interactive media has reduced the role of the storyteller to that of a game designer, i.e., designing the environment and the rules, while the narrative emerges from the interaction. According to this view, full interactive VR might actually be less suitable for journalistic storytelling compared to alternative paradigms such as world-building, because in the world of science fiction, world-building is a technique of designing visionary worlds whose cohesive social, geographic, cultural, and alternative features possess a lengthy history [von Stackelberg and McDowell, 2015]. An example is Rilao, an open source project that conjures up a fictional enclave in the Pacific Ocean. This world-building project incorporated parts of the actual cities of Rio de Janeiro and Los Angeles to design the story realm or rather, the DNA, for the Rilao project [von Stackelberg and McDowell, 2015]. Indeed, *The New York Times* senior editor Sam Dolnick commented on the shift from narratives to world building: "In traditional magazine journalism, often somebody comes up with an idea and the editors will say, 'That's a great world, but there's no story.' And now in VR, it feels like it's a little bit flipped. The editors will say, 'Well, that's a neat story. But we really need a world.'" [cited in Robertson, 2016].

As such, linear and non-interactive 360° videos, which are more easily assimilated into journalistic practices, may thus be deemed more appropriate for journalistic storytelling. Nonetheless, an amalgamation between these technologies is seen, as broached by immersive journalism pioneer Nonny de la Pena; while using CGI rather than video, she most often opts for linear, essentially non-interactive VR experiences. Even these linear VR experiences are subject to the challenges induced by assigning participants some freedom: Participants may miss crucial events by incidentally looking in the opposite direction when these events occur.

Despite many years of exploration by the academic and artistic communities [Friedman and Feldman, 2006; Galyean, 1995], our view is that the verdict is still out on whether and how VR can be used for storytelling. While the possibility of creating virtual reconstructions of real events has attracted much attention, it is not clear whether such applications will become mainstream, or what artistic, ethical, and/or professional guidelines would be applicable.

3. Perspective Taking, Empathy, and the Virtual Body

One of the most interesting and powerful means of countenance in VR is the first-person body ownership illusion, which has been applied from neuroscience research to VR. The feeling of owning a body is adaptive and is caused by a human being's ability to relate to their sensory environment. In the original rubber-hand illusion experiment [Botvinick and Cohen, 1998], the participant's real hand is obscured and a rubber arm is placed on a desk, in a plausible location. By tapping on both the real and the rubber hands simultaneously, the experimenter induces in participants a strong illusion that the rubber arm is their own. The illusion is induced by the mismatch between the visual and tactile information entering the brain. It has been shown that this illusion can also be induced by a virtual arm in VR [Slater *et al.*, 2008] (see Figure 1), and even an entire "out-of-body illusion" can be induced [Ehrsson, 2007]. Participants donned a head-mounted display that streamed a video of the viewpoint of a camera behind them, through which they could see the back of their body. Upon being touched on the back, they would see the exact action being replicated on the body in front of them, causing this illusion.

After establishing that VR is suitable to study this illusion, researchers continued to use VR to explore additional virtual body illusions, with the ultimate aim of exposing the underlying neural mechanisms of body ownership, and the extent to which they can be manipulated [Slater *et al.*, 2008, 2009]. Specifically, it has been found that an illusion based on visual-motor synchronization is stronger than an illusion based on visual-tactile synchronization. In other words, virtual body ownership in VR is an effective tool for manipulating the sensation of body ownership.

Figure 1. Screenshots from Time-Body Experiment, a media art installation by artist Daniel Landau, which also served as the framework for a scientific experiment by one of this chapter's co-authors. The VR installation builds on the rubber-hand illusion using a 360° video technique. The participant places his or her hand on the table, and views, from a first-person perspective, a video showing a pair of hands on a table. The hands depict different genders and age groups. The video shows a woman tapping the hands or touching them in various ways. An experimenter touches the real hands of the participant in exactly the same manner at the same time points.

This line of research demonstrated that VR and the body ownership illusion can be used to explore what it is to "become someone else" in a new manner, more visceral than ever. These academic investigations spread from research to popular culture when attendance at one of Slater's VR experiments inspired a young Spanish artist and a group of Barcelona-based artists (BeAnotherLab, retrieved from http://www.themachinetobeanother.org/) to set up, in 2014, a project entitled "The machine to be another".

The strong public interest in this topic raises the question of whether VR holds the potential to be effectively used in order to allow our audience to "be someone else", and what exactly this means. First, we stress the difference between perspective taking and the body ownership illusion. In perspective taking, you see the scene from different perspectives, or from different points of view; Perhaps you even view yourself from the perspective of another human (in a 360° video) or an avatar (see Figure 2).

(i) (ii) (iii)

Figure 2. Screenshot from "The Checkpoint", a media art installation by artist Daniel Landau [2015], which also serves as the framework for a scientific experiment by one of this chapter's co-authors. The VR experience is based on a directed scenario that is fictional, but aims at being realistic. The scene describes a pregnant Palestinian woman, accompanied by her husband, on the way to hospital. The couple reaches a checkpoint manned by two Israeli soldiers, who have just received an alert regarding a woman terrorist. The result is a tense event, with both sides apprehensive of the other. The scene is portrayed to participants from different angles: (i) from the perspective of the Palestinian couple, (ii) from the perspective of the Israeli soldiers, and (iii) from a "neutral" wide-angle perspective. In this case, virtual body ownership was not possible, so the director opted to use an over the shoulder camera placement to create a third-person perspective.

In a full body illusion, the sensation is radically different, and consequently the behavioral impact is much stronger. You find yourself inside a virtual body, and the most important aspect of this vestige is the sensorimotor contingencies — you move your hand, and you see the virtual hand move; you move your leg, and you see the corresponding virtual leg move accordingly. Current consumer VR devices lack the technical capacity for full body tracking, and thus preclude a high-quality illusion of body ownership, for the time being.

A small number of research laboratories that have experimented with full body tracking, and make use of the full body ownership illusion, turned to scientifically explore whether we have the proficiency to enable our participants to "become someone else". A range of studies looked at the behavioral and psychological effects of being in alternative bodies, and the results are dramatic. Participants embodied in a child avatar overestimated the size of objects, and had significantly more rapid reaction times in an implicit association test when the self was classified with child-like compared with adult-like attributes [Banakou *et al.*, 2013]. Interestingly, being embodied in a member of a different race has been shown to reverse the in-group bias effect: When embodied in a black virtual body, white participants treat blacks as their in-group and whites become their out-group, as indicated by body mirroring behavior [Hasler *et al.*, 2017]. This reversed in-group bias effect was obtained regardless of participants' level of implicit racial bias. Maister *et al.* [2015] published a recent comprehensive review and proposed a theoretical framework for the psychological impact of virtual re-embodiment.

4. Beyond VR

VR as discussed so far can be considered a subset of a larger family of technologies that includes: (a) VR, which makes you believe you are in an imaginary place; (b) AR, which, makes you believe that some imaginary entities or objects are present with you in the real world [Witt *et al.*, 2016]; and (c) telepresence [Heeter, 1992], which makes you believe you are in a real yet remote location. All three technologies can be delivered to a single participant or to multiple participants simultaneously (creating multi-user environments). AR and telepresence involve technological challenges beyond VR, mostly capturing and understanding the real world. As a result, these technologies may be further down the road, and the opportunities they offer are beyond the scope of this chapter. Unlike VR, which has been available to a wide public since 2016, head-mounted AR and telepresence devices are typically not available to non-professionals, which explains why no practical attempts have been made to harness their potential for journalistic storytelling. AR and telepresence will arguably enable a wider range of applications compared to VR; they are expected to introduce an even more significant disruption to the way

we produce and experience mediated content, and the impact of these technologies on journalism is also likely to be dramatic.

5. Immersive Journalism: Early Steps and Current State of the Art

The historic roots of immersive journalism can be traced to the field of newsgames: journalistic storytelling using video games. Newsgames is a subgenre of gaming that was inspired by real situations and conflicts in society. Newsgames, a term coined by Frasca, have been described as a "simulation meets political cartoons" [Treanor and Mateas, 2009] and as tools that "utilize the medium with the intention of participating in the public debate" [Sicart, 2008, p. 27]. Newsgames are thus not merely a form of gaming, but rather a genre of public debate that was formed to illustrate news in an interactive manner. The goal of this type of gaming is not to persuade but rather to illustrate what traditional printed news cannot. Newsgames showcase the role of news in society and the way the news affects various cultures.

A notable example of the transition from newsgames to immersive journalism is Gonne Gitmo [De la Peña and Weil, 2007]. De la Peña, a social activist and journalist, frustrated by the inaccessibility of Guantanamo prison to journalists and by the impossibility of documenting it using traditional tools, reconstructed the prison in the massive multi-user online world Second Life. This virtual world is a non-gaming virtual environment, experienced non-immersively on laptop and desktop computers. Through this fictional experience, participants are taken through several steps of being a prisoner in Guantanamo Bay prison camp. As explained by De la Peña, "We make these pieces because we can put you on the scene, make you feel like you're a witness to an actual event. You're not separated by a television or a screen, you actually feel like you're there" [Schupak, 2015, p. 1].

The fact that many times stories are narrated by visionaries, writers, tech intellects, and design teams raises the question of the journalist's presence in the virtual world. A prime example of the exclusion of a journalist in the VR world is illustrated by "Clouds over Sidra" — a story about Sidra, a 12-year-old girl residing in Zaatari, a Syrian refugee camp in Jordan [Arora and Milk, 2015]. The journalist and camera crew are completely omitted from the VR world in order to focus on the ultimate aim of enabling the participant's presence in the VR world without distractions. The production of this story focuses on the participant's firsthand experience of what Sidra sees, promoting the participant to identify with her on a human level. Such a VR-based storytelling format raises the question of whether the journalists' role in the future will be one that is replaceable by a digital simulation. If this kind of immersive interaction becomes commonplace, the need for investigative writers can be expected to decline as automated machinery gradually takes their place.

De la Peña's first full VR documentary, Project Syria (https://docubase.mit.edu/project/project-syria/) was triggered by her desire to create news that places the participant in the scene of the actual situation. Along with her creative team of developers, designers, and producers, De la Peña recreated situations in Syria with photorealistic editing and audiovisual recordings. The team gathered photos and videos from Syria and replicated actual people paired with recordings and visuals as seen through their own eyes. The scenes depict typical moments in the war in Syria, including scenes from a bustling street in Aleppo. While a song is playing, a rocket emerges from nowhere and an explosion occurs. In the next scene, a refugee camp is shown with the participant portrayed as a resident of the camp, in order to communicate how it feels to be a refugee forced to flee from his home. Following the Gonne Gitmo project, De la Peña created a short VR piece as an immersive experience illustrating another controversial prison, Abu Ghraib in Iraq, and authored an influential manifesto for the field of immersive journalism [De la Peña *et al.*, 2010].

Importantly, De la Peña's methodology [De la Peña *et al.*, 2010] gives top priority to journalistic principles rather than to sophisticated VR technology. The first stage in her work is always collecting primary sources, mostly still images and audio recordings, from the real world. In the second stage, the scenes are reconstructed in VR, using the original images and sound recordings. Thus, the act of reconstructing the scene in VR is arguably even more authentic than a documentary video, in which editing and postproduction techniques may be used to manipulate the portrayal of events.

Ben Khalifa is a photojournalist and war correspondent who has witnessed the consequences of geopolitical shifts while photographing war-stricken countries. His project "The Enemy" was born of an aspiration to foster world peace by portraying the conflicts in our world. He uses VR to bring participants face-to-face with combatants from three conflict zones: Maras in Salvador, Democratic Republic of the Congo, and Israel and Palestine. He uses room-scale tracking technology to create realistic VR interactions with the reconstructed combatants, who are based on real human combatants. Khalifa's work evokes in participants the question, "Could I be you if I were on the other side?" in an attempt to show that we are all human beings whatever our circumstances.

6. Discussion

The emergence of immersive journalism has opened a portal to an entirely new frame of reference for journalism, one that reshapes the way people view news stories and their production. In contrast to texts or videos viewed on a mobile device, whose impact is fleeting, immersive journalism offers an impactful experience that has the

potential to resonate through our entire senses and linger. Through this multifaceted form of media, people are able to place themselves in situations as they would appear in real (palpable)-life.

Ben Khalifa, a war correspondent and photographer, felt that the photos he took barely brought to light the people he captured and therefore sought to strike a chord in people by revolutionizing the way we view stories. Similarly, De la Peña, a social activist and documentarist, searched for a medium that would penetrate audience indifference and create tangible social impact. Both journalists turned to VR as a new medium that potentially overcomes the shortcomings of traditional media — photographs and video. Advertisers were also quick to exploit VR's potential to generate behavioral impact: AT&T, along with Reel FX, a VR company, created a campaign for its mobile network called "It Can Wait". The campaign included, but was not limited to, the placement of VR simulators in flagship AT&T stores, comprising a VR headset that participants wear while seated on a car model. The participant views himself driving in a neighborhood but is maneuvering while text messaging. What they see next follows a stream of dangerous events that could occur had they really been texting in real life. As a result of this project, 10 million individuals pledged to not handle their phones while driving [Shiroishi, 2016].

Is VR an effective tool for persuasion? Anecdotal evidence from these news and advertising projects is joined by accumulating scientific evidence that if its principles are applied correctly, VR can increase audience engagement, and may thus have a stronger impact on opinion change, and possibly also on behavior change. However, the overwhelming majority of the available scientifically validated results are based on one-off experiments in research laboratories on academic campuses. The growing adoption of VR will now allow us to learn much more about the ecological validity of these results, and understand whether VR has a stronger impact on attitudes and behavior than traditional types of media.

As such, the question evolves of whether VR is an "empathy machine". Based on the former, we propose that first-person body ownership illusions hold the potential to be an enticing tool, as they have shown to have significant psychological effects. Nevertheless, we suggest caution. We do not yet know if VR evokes empathy or under what conditions. Evidence that the effects of such "embodied-in-someone-else" VR experiences transfer to and persist in the real world is, as yet, anecdotal. Importantly, none of the present scientific studies attempted to use VR to induce empathy toward a member of an out group in a situation of group conflict. In such a case, it is not unlikely that hostility toward the out group might contradict the effects of VR, and possibly generate undesired effects.

How should we use VR for news storytelling? Our view is that the language of VR is yet to undergo major developments. VR is not an extension of cinema, just as

cinema was not an extension of theater. Although many of the techniques available to cinematographers, especially frame composition, are unavailable and irrelevant in VR, VR offers a wide range of new means of artistic expression. Our view is that the language of VR is yet to be defined. This is not unlike the early days of cinema, when directors such as D. W. Griffith were compelled to convince their producers that a close-up makes economic sense. With the increased adoption of VR by the masses, by VR artists, and by producers, we expect to see the artistic language of expression evolve rapidly and assume greater sophistication in the next few years. As a part of this process, we expect the guidelines for immersive journalism to emerge.

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