Extending the Realities of Genocide Memorialization

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Abstract

Memorialization refers to preserving and remembering traumatic events and people who suffered or died during conflict or genocide. It aims at examining past trauma to address contemporary issues. In addition to documenting and telling facts and truth, memorialization helps with recognizing and honoring those who suffered and preventing "future atrocities through education and advocacy" (Thompson, n.d.). Memorialization plays an important role in post-conflict "reconstruction and redress". Genocide memorialization can take different forms such as museums, law, documentaries, education, and first-person accounts and testimonies (Bennett, 2020). Most recently, Extended Reality technologies like Augmented Reality (AR) and Virtual Reality (VR) started to push the physical and mental boundaries of genocide memorialization and storytelling. Through an extensive review of the related literature, our paper first surveys AR and VR-based genocide memorialization around the world. Through a selected number of case studies, we will highlight how AR and VR memorialize and engage affected and no-affected people with genocide. Our paper also discusses the impact of AR and VR-based genocide memorialization.

1. Introduction

Memorialization is the act and process of preserving and remembering memories, events, and people by individuals and or groups of people. Within the context of conflict and genocide, memorialization refers to preserving and remembering traumatic events and people who suffered or died during the conflict or genocide. Memorialization aims to create public memories ad memorials (Brett et al., 2007). It is about the creation of space, be it physical or psychological, for remembering past events, people, or places.

Memorialization and remembrance activities "seek to establish particular narratives about what happened, and thus, help to determine how to move forward" (Karabegović, 2019). Memorialization can positively contribute to psychological, sociological, and political needs such as processing grief, sense of community, public recognition, inclusion, reconciliation, democracy, human rights, social commemoration rituals for the victims, and justice (Gurler & Ozer, 2013) and (Collins et al., 2020). Memory and memorialization are recognized for their central role in transitional justice processes since memory is "an integral aspect of coming to terms with the past and an important part of any transitional justice process that seeks to set the historical record straight" (Naidu, 2017). So, memorialization can contribute to achieving and strengthening transitional justice (Karabegović, 2019). Within the context of post-conflict, memorialization is identified as a category of symbolic reparations "that seeks to recognize victims and contribute to broader reconciliation processes" (Naidu, 2017). Memorialization plays a constructive and positive role in shaping the cultures of democracy (Brett et al., 2007). In addition to playing an important role in truth-telling and contributing to victims' sense of social justice, memorialization can also offer social empowerment to previously marginalized groups (Jones, 2021). Remembering the past through memorialization does not only address the past but also foster "forward-looking approaches" for long-term social changes that potentially lead to "non-recurrence of violence and ensure a better future for younger

generations" (Jones, 2021). Effective genocide memorialization can promote social recovery and contribute to sustainable peacebuilding through deepening connections and increasing community empathy. It can also lead to positive touristic and human rights outcomes and support "stabilizing extreme narratives of violence in post-conflict and post-genocide societies" (Gigliotti, 2014). Genocide memorialization help with remembering, mourning, and witnessing unimaginable human cruelty and damages (Jacobs, 2011). Genocide acts may vary across culture, time, and place, but "the pain and tragedy of genocide is a universal theme that defines these monuments to death, even as they serve as warnings to the future" (Jacobs, 2011).

Genocide memorialization comes in different approaches and forms, tangible or intangible. Memorial museums, monuments, sites, and public arts are examples of tangible (physical) memorialization. Other intangible (nonphysical) memorialization forms include commemorative events or performances, policies, laws, education programs, documentaries, and first-person accounts and testimonies. Memorialization also comes in the form of "more organic, less permanent initiatives" that fulfill community needs such as "apologies, the renaming of public facilities, reburials, and memory projects" (Naidu, 2017).

The rapid growth and pervasiveness of technology have led to the emergence of "digital memorialization". Digital memorialization, be in the form of web pages, blogs, social media, applications, can be developed and experienced using various digital technologies. Unlike traditional forms of memorialization that are mostly confined to a geographical location such as a museum, monument, or archive (Zucker & Simon, 2020a), digital memorialization can be fully virtual (online) or integrated into physical spaces or objects. The continuous developments of and increased accessibility to digital technologies like Holograms, Artificial

Intelligence (AI), and Extended Reality (XR) technologies like Augmented Reality (AR) and Virtual Reality (VR) are opening new horizons and pushing the physical and mental boundaries of genocide memorialization and storytelling. XR technologies make it completely realistic to "recreate virtually Nazi society according to our (scholarly) ideas of how that society functioned" (Sindbæk Andersen & Törnquist-Plewa, 2017). These technologies are also changing the very nature of memorialization, including "simultaneously, and sometimes paradoxically, decentralizing and globalizing it" (Zucker & Simon, 2020b). Despite the growing use of digital technologies like AR and VR in the realm of genocide memorialization, the emerging literature lacks systematic investigation on "how" these technologies are used for genocide memorialization and what impacts they (potentially) have on how genocide events and stories are memorialized and engaged with. Our paper addresses these in the literature by surveying this emerging literature and AR and VR-based genocide memorialization projects around the world. In addition to identifying and examining the AR and VR-based genocide memorialization projects, our paper also highlights the impact of such genocide memorialization.

2. Extended Reality Technologies and Genocide Memorialization

Extended Reality or XR technology is an umbrella term that refers to the immersive technologies that cover the Reality Virtuality continuum, namely, Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) (Marr, 2019). By creating full virtual worlds or mixing physical and virtual worlds, these technologies "can enhance, extend, or even supplant the material reality in front of your eyes"(Morton & Dabrowski, 2021). VR immerses users in a simulated real or imagined three-dimensional environment while AR overlays computer-generated entities seamlessly onto a user's view of the real world in real-time (Wang et al., 2013). VR replaces physical reality while AR supplements or modifies physical

surroundings (Javornic, 2016). AR is a form of MR in which real and virtual worlds are blended with the physical environment being dominant.

A growing body of research discusses AR and VR's effects in increasing cognitive and emotional engagement and eliciting empathy (Schutte & Stilinović, 2017), (Herrera et al., 2018), (Morie, 2006), and (Shin, 2018). These abilities have made them appealing technologies in various fields and applications. Most recently, AR and VR found their applications in human rights and difficult heritage domains, including genocide memorialization and advocacy. *Clouds over Sidra*, *Sea Prayer*, *We Wait*, and the *6×9 project* are some examples from a growing list of VR experiences from the United Nations and major media outlets like the Guardian and BBC that focus on human rights and humanitarian crises (Hosseini, n.d.), (Milk & Arora, n.d.), and (Gregory, 2016). The following sections summarize the current use of AR and VR to memorialize and engage with genocide.

2.1 Teaching about Genocide

One of the primary uses of XR technologies in the context of genocide memorialization is to teach about genocide in schools and immerse students in the stories, events, and experiences, and feelings of people involved with genocide. The Global Nomads Group (GNG), which uses technology to engage youth with global issues such as identity and human rights, developed a VR-based experience (*Siroun*) to teach high school students about the Armenian Genocide in (what they consider to be) a more emotion eliciting way in comparison to standard film or video (P, n.d.). The *Siroun* VR experience extends the central theme of an award-winning film, *The Promise*, by teleporting users into the onset of the Armenian Genocide in 1915. By combining the art of first-person and emotional storytelling and questioning with the science of immersive and interactive 360-degree videos and 3D reconstruction, *Siroun* immerses its

users in the sights and sounds of a rural Ottoman village in a critical moment in history. The VR experience unfolds around the story, questions, and regrets of a bystander Turkish boy towards his close Armenian friend (Global Nomads Group, 2017). The experience exposes its viewers to the "choices and experiences of everyday people caught at the crossroads of civil war and genocide" to create empathy (Global Nomads Group, 2021). The experience was designed to be used in high school social studies or history course units on various topics related to European history in the 20th century, including World War I. In addition to the VR experience, GNG developed a detailed "how-to" guide to high school teachers on how to use and develop learning and assessment activities around the *Siroun* experience to stimulate discussions on various topics (Global Nomad Group, n.d.).

VR and AR technologies are growingly used by different organizations for teaching about the Holocaust (also known as Shoah), the genocide of European Jews by Nazis during World War II. *Witness: Auschwitz* from the *Italian studio 101%* used VR technology to sensitively immerse viewers in the daily horror of the Nazi's extermination camp (Lebovic, 2020). In the simulated virtual world, viewers "interact with the world that surrounds them, with the people, with themselves, and become 'witnesses' to one of the most tragic events in the history of humanity" (BJ Blazkowicz, 2018).

2.2 Virtual Immortalization and Resurrection

One of the recent uses of XR technologies is the virtual immortalization of genocide eyewitnesses and survivors and the virtual resurrection of genocide sites, camps, and historic

events. Realizing the diminishing number of elderly Holocaust survivors and in an urge to preserve the experience and stories of Holocaust survivors for future generations, USC Shoah Foundation[1] and the United States Holocaust Memorial Museum (USHMM) have undertaken several virtual immortalization and resurrection projects with AR and VR technologies. The "Survivor holograms" from USC Shoah Foundation's Dimensions in Testimony (DT) project uses 3D projection AR to expose students and Holocaust museumgoers to interactive testimony videos from remaining Holocaust survivors. The AR experience combines advanced filming techniques, specialized display technologies, natural language processing, and speech-recognition algorithms to simulate face-to-face interaction and conversation with the avatar of Holocaust survivors for current and future generations. Each 3D digital projection with a survivor includes oral answers to over one thousand questions that can be potentially asked by the visitors. These questions range from personal questions such as "What was your most emotional moment in the concentration camp?" to philosophical and ethical questions such as "How can we prevent future genocides?" (Alexander, 2021a). The integrated natural language processing and speech-recognition algorithms match the visitors' questions with the virtual survivors' most relevant responses to resemble an in-person conversation. In doing so, the AR experience virtually immortalizes the survivors for inter-generational storytelling long after the last survivor has perished (Alexander, 2021a). In *The Last Goodbye* experience, VR technology immerses viewers inside the 3D reconstruction of Majdanek concentration camp, a Nazi death camp, in Poland with an eyewitness, Pinchas Gutter (Feldshuh, 2021). Through immersive storytelling and witnessing, Gutter, an 87-year-old Holocaust survivor from a family of four, takes viewers with him on his final visit to the camp where his family was murdered during World War II (Arora & Palitz, 2020). The avatar of Gutter takes viewers through 3D

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[1] A nonprofit organization dedicated to making audio-visual interviews with survivors and witnesses of the Holocaust and other genocides

resurrected parts of the camp from bunks to the communal showers to the gas chamber (where his family was killed) and to the crematorium (where their bodies were burned) as he recounts his story of survival and loss (Arora & PALITZ, 2020). The combination of 3D reconstruction and 360-degree video enables navigation around the virtual space, contributing to an increased sense of presence and emotional engagement (N. Goldman, 2017).

The *Bergen Belsen AR* experience virtually resurrects and geo-locates the camp architecture (perished buildings) in their original locations at the Bergen Belsen memorial site through a tablet application. This AR app enables visitors of the memorial to walk around "the innocuous-looking forest landscape of Bergen-Belsen and have the buildings and other installations of the former camp, which were destroyed after WWII, reappear on the screen" (Alexander, 2021a). Instead of augmenting an actual Holocaust memorial site, a VR experience called "Auschwitz VR" immerses its users inside the digital reconstruction of Auschwitz-Birkenau, a Nazi concentration and extermination camp (Lebovic, 2020). The virtual site is accurately 3D reconstructed based on photographs, technical documentation, and other archival materials from the Auschwitz Memorial (Ośka, 2010). The VR experience enables viewers to walk through any part of the camp and enter the buildings reconstructed in detail. The project team has mentioned their plan to add additional components and layers of information-based historical research and the testimonies of survivors to facilitate learning scenarios for the VR experience (Ośka, 2010).

Some organizations saw from VR an opportunity to resurrect and immerse viewers in historic events related to genocide. An interdisciplinary team from the University of Connecticut used VR technology to resurrect the Nuremberg Trials, which was the first trial of the major war criminals in Courtroom 600 of the Justizpalast in Nuremberg, Germany between 1945 and 1946

(Ceglio, 2019). Named *Courtroom 600*, this narrative-driven VR experience immerses viewers in a 3D, human-scale reproduction of Courtroom 600, "where they can interact with the historical participants as well as pause the courtroom action to delve into contextual information and archival materials related to the people, places, and events central to the trials" (Lebovic, 2020). Through interacting with digital replication of the trial evidence and related materials in the virtual world, the project team aims to "engage adult learners in understanding the Nuremberg Trials, during which some key Nazi war criminals were convicted" and "create an experience that heightens awareness of the need to recognize and resist anti-Semitism and other racial ideologies in our own times" (Lebovic, 2020).

2.3 Investigating Genocide

Most recently, VR technology found its way into a courtroom in what is believed to be the last World War II Nazi trial (Freid, 2021). In *Nazi VR*, another Holocaust-related VR experience, a team of German forensic VR engineers recreated a 3D model of Auschwitz-Birkenau, using laser scans, historical blueprints of the site, aerial photographs, and witness testimonies (Freid, 2019). The VR experience enables investigators and judges "to climb the watchtowers and observe how prisoners would have been moved around the 15-mile camp, where more than 1.1 million people were murdered during the war" (Freid, 2019). The project was developed to enable the investigators and judges of the case of Reinhold Hanning (a former guard in the camp) to travel across time and space to investigate a genocide from 70 years ago in a crime scene "that has since been destroyed, along with almost all pertinent records" (Freid, 2019). The VR experience aimed to address Hanning's claim that he never personally witnessed victims being gassed to death (Freid, 2019). The detailed virtual reconstruction and human-scale immersion that came from the VR technology attempted to show the court prosecutors

what Hanning saw, "from the perpetrator's vantage point" (Freid, 2019). In doing so, the project team aimed at giving the court the evidence needed to link the former guard "to the charges in his indictment: monitoring -arriving prisoners as they were sorted into groups headed directly into labor or the gas chambers, a process that came to be known as 'selection'"(Freid, 2019). This was the first time that the prosecution used VR to dispute Hanning's claims that "he was not aware of the atrocities happening inside the camp" (Albalak, n.d.).

2.4 Adding Interactivity and Deepening engagement

A growing number of genocide museums and memorial sites are using XR technologies to add interactivity to their displays, collections, exhibitions, and even buildings. The U.S. Holocaust Memorial Museum in Washington used mobile AR to add interactivity to the holocaust victims' photos displayed in the museum (Goldman, 2018). The AR app enables visitors to place names and stories on the face of the Lithuanian villagers whose photos are featured in the "Tower of Faces" display at the museum (Takahashi, 2018). By pointing their smartphones at any photo in the exhibition, the AR app displays the name and information of the people from the photo. The AR experience gives visitors a different and unique experience to make "a personal connection to the families who lost their lives during the Holocaust" (Takahashi, 2018). This project was part of a long-term project to deepen young Americans' knowledge about the Holocaust (Takahashi, 2018) in the light of a study that showed a significant lack of Holocaust knowledge and visits to a Holocaust Museum in the United States ("A new survey by the Claims Conference found a significant lack of Holocaust knowledge in the United States.," n.d.).

2.5 Mobilizing Genocide Memorials, Collections, and Testimonies

Some genocide museums see from VR an opportunity to mobilize genocide memorials and facilitate virtual tours into powerful, but distant, genocide memorials. Concerned about the rise of neo-Nazism among uninformed American youth, a group of students developed ABSTRAKT. This is a VR exhibition that immerses viewers in the experience of walking through the Berlin Holocaust Memorial. By exploiting the fluidity and immateriality of virtual environments, the experience exposes the users to a range of emotions eliciting visual and sound effects to mimic the dark and cold journey of Jewish people during the Holocaust (Hughes, n.d.). Instead of mobilizing memorial sites, a UK-based charitable organization called *Remembering Srebrenica* digitized and mobilized various collections from the Bosnian genocide in a virtual exhibition. Named "Remnants of Genocide", this virtual exhibition features "more than 45 stories, paintings, photographs and items relating to the war, genocide and its aftermath" (Meholjic, 2003). Although this exhibition is accessed online, a VR-based version can be easily replicated. *Inside Auschwitz* is a VR experience from a German public broadcasting (WDR) that immerses viewers in 360° videos of the real scenes from the Auschwitz-Birkenau concentration and extermination camp today. In addition to virtually mobilizing the sights of the actual ghost memorial site, during the virtual tour, viewers are also exposed to oral narratives and testimonies of three Holocaust survivors who appear as virtual tour guides in the site or their home (Columnist, 2020).

2.6 Genocide Advocacy

Motivated by VR technology's potentials in putting people in other's shoes and concerned about the world's slow actions, a multi-disciplinary team used VR technology to initiate different and immersive genocide advocacy to raise awareness about and call for recognition, justice, and actions in the Yazidis genocide by ISIS in Iraq. Named *Nobody's Listening*, the

VR exhibition was initiated by Ryan Xavier D'Souza (a human rights advocate focusing on genocide prevention) and developed as a collaboration between Yazda (a Global Yazidi Advocacy Organization) and Surroundvision, a UK based VR film studio (Mohammed-Amin et al., 2021). The project team included human rights activists, legal professionals, Yazidi genocide advocates, and VR producers (Stylianou-Lambert et al., 2022). Through VR headsets, viewers are spatially and temporally transported and immersed in the sights, sounds, and stories of the ISIS attacks and genocide atrocities against the Yazidi community in 2014. The technology enables viewers to walk through the ruins of a 360 video of a Yazidi temple, village, and homes while listening to stories from a virtual character from the experience: a Yazidi woman survivor (who was abducted and sexually enslaved), her brother (a survivor of an ISIS massacre, or a local ISIS fighter, who attacked the village (Mohammed-Amin et al., 2021). The virtual exhibition concludes by immersing viewers in the dire living conditions that many Yazidis face today and calls for justice and action to help the Yazidi community.

3. Discussions

Our review shows a growing trend in the use of XR technologies like AR and VR for genocide memorialization. Holocaust Museums and Memorial Sites, by far, appear as the largest consumer and adapter of AR and VR technologies to engage people with the places, events, stories, and witnesses of the mass Jewish genocide during World War II. Some of the features of these technologies are pushing the physical and virtual boundaries of memorialization, facilitating new approaches and engagements for genocide memorialization. Within genocide memorialization context, our review identified six uses of AR and VR which are: teaching

about genocide, virtual immortalization, and resurrection of genocide witnesses and destroyed genocide sites, investigating genocide, adding interactivity and deepening engagement with genocide collections, mobilizing genocide collections, sites, and eyewitnesses, and genocide advocacy. Another potential use of AR and VR, which are yet to be explored within the context of genocide, is developing XR-based exposure therapy for genocide victims who suffer from mental health conditions such as Posttraumatic Stress Disorder (PTSD). Outside genocide, VR use for exposure is growing. Among the growing VR-based exposure therapy projects is the use of VR for treating Vietnam veterans and Iraq war military personnel with PTSD (Josman et al., 2006)& (Gerardi et al., 2008).

The content of some of the AR and VR projects is based on actual real objects or people digitized. Some other projects use 2D or 3D reconstructions based on various sources of historic information, including archives and oral testimonies. In some of these projects, viewers are passive witnesses, while in the others the viewers are active eyewitnesses and interact with the virtual or blended environments.

The literature on AR and VR-based memorialization is still emerging. Preliminary reported reactions by project teams, users, and media suggest that the technologies could positively contribute to genocide memorialization and create novel interactions and experiences with genocide sites, events, and eyewitnesses. Also, some findings from AR and VR applications in education, cultural heritage, tourism, medicine, and others indicate the XR technologies' potentials for increasing attention, surprise, engagement, and empathy.

Still, rigorous systematic and comprehensive evaluations with various user groups are needed to justify the wide development and implementations of AR and VR technologies in the

sensitive context of genocide memorialization, education, and (potentially) therapy. Our review could not find systematic and formal evaluations for most of the related projects we identified and presented in this paper. To test their effectiveness, the project teams of both the *Bergen Belsen AR* and the AR app of the "Tower of Faces" display at the Holocaust Memorial Museum in Washington invited students to test the apps. About 80 students participated in the pilot testing of the later project. Video recordings and verbal feedback from some of the participating students show an overall excitement and deeper engagement as appearing from how they describe their experiences and how they connected to the photos of the Lithuanian villagers displayed in the "Tower of Faces" display and Bergen Belsen memorial site (Goldman, 2018; Group, 2014). Another XR-based genocide memorialization project that has undergone impact evaluation is the *Nobody's Listening* VR exhibition that we led. Our evaluation was systematic and formal, involving a total of 127 Iraqi nationals from different backgrounds across five cities in Iraq. A data collection session with a participant lasted 30 to 45 minutes. This time included using the 12 minutes VR experience by participants and completing and answering the pre and post VR experience questionnaire and semi-structured interview questions. Our team also collected and analyzed the participants' body language reactions. The findings suggest that the VR experience contributed to increased awareness about the Yazidi genocide and community and created a high cognitive and emotional impact on the majority of the participants (Mohammed-Amin et al., 2021). A high majority of the participants (70.8% of 120 responders) indicated that the VR-based exhibition changed their previous knowledge and impressions about the Yazidi culture (Mohammed-Amin et al., 2021). Many of the behaviors and verbal responses of the participants indicated a high level of empathy with the Yazidis and their genocide cause. We also observed that participation in the *Nobody's Listening* VR exhibition has the potentials to inspire positive change and actions in response to the Yazidis genocide and support of the Yazidi community (Mohammed-Amin et

al., 2021). A high majority of 92.2% of participants asked for justice for the Yazidi genocide cause after using the VR exhibition (Mohammed-Amin et al., 2021).

Outside systematic and formal evaluation, public reactions to some of these projects are not without controversy or critics (de Jong, 2020). The effectiveness and impact of digital immortalization and resurrection are questioned by some critics who believe that the digital version of a person or site does not match real ones (Cox, 2018). For example, the critics of the *Bergen-Belsen* AR fear the possible interference from the augmentation of the 3D reconstructions with the visitors' "direct visual communication" with the 'real' memorial site of Bergen-Belsen (Kansteiner, 2019). Some other critics express concerns about the sensibility and morality of "gamification" of tragic genocide-related events, stories, and sites (BJ Blazkowicz, 2018). Other critics question the dramatized and movie-like nature of these experiences if the goal of memorialization is historic accuracy and knowledge preservation (Gardner, 2017). Some concerns are centering around XR technologies' ability to desensitize the viewers to violence and graphic imagery or traumatize viewers (Gardner, 2017) & (UK, 2017). Some project teams address these by avoiding highly accurate representations of real-life events, while others use them for prioritizing accuracy and realism (Gardner, 2017). The emotion and empathy eliciting ability of VR technology also raises ethical concerns, especially for engaging with emotionally intense topics such as genocide.

Despite these critics, digital memorialization has been and continues to be in proliferation (Zucker & Simon, 2020b). Supporters of AR and VR-based digital memorialization argue that the benefits and positive impacts of these memorizations outweigh their drawbacks and negative impacts.

Findings from other applications of XR technologies show the cognitive and emotional impacts of interactive and immersive storytelling and narrative (Mohammed-Amin et al., 2021). The "multi-perspectival and kaleidoscopic" storytelling that comes with technologies like VR enables "multiple viewpoints or multiple paths" of exploration that can enhance compassion (Gregory, 2016). The opportunities that come with "immersive witnessing" have not only led to a "creative explosion in the field of VR" (Alexander, 2021b), but also to a growing number of "virtuous VR" projects that seek "to preserve and transmit the experience of disadvantaged and suffering people through immersive stereoscopic video" (Nakamura, 2020). VR technology enables presence and embodiment both "literally feeling like you are someone else, or that you are walking in someone's shoes both in point-of-view 360 videos as well as volumetric (computer-generated) virtual reality" (Gregory, 2016). VR can also create place illusion (being in a real place) and immerse viewers in that place. Such features enable remote visitors to travel across time and space to witness genocide sites, people, and events.

Also, despite critics, serious games and game-based storytelling and narratives (including AR and VR-based games) are growing for raising awareness and addressing humanitarian issues. The emergence of terms like "virtual humanitarianism" is a reflection of such a trend. Digital games facilitate a new way and quality for absorbing, "shared immersion in narrative cultural worlds, including realistically shaped historical worlds, based on rapid multi-sensory input, ludic pleasure, and a significant degree of narrative and especially spatial control" (Sindbæk Andersen & Törnquist-Plewa, 2017). Digital games (in all its formats) has been "hailed as a new form of technology, a new way to tell stories, often as something more than other mediums like print or film"(O'Brien & Berents, 2019). Some digital games (especially those from AR and VR) can be different, unique, and accessible, which makes them appealing for use by advocacy and humanitarian aid organizations (O'Brien & Berents, 2019).

Some scholars argue that XR technologies are not only changing "how and where" collective memory like those of genocide is "formed and retransmitted", they are also changing the nature of memorialization by decentralizing and globalizing mass atrocities (Zucker & Simon, 2020a). Virtual or digital memorialization is loosening (if not shattering) state controlling narratives of memorialization (Zucker & Simon, 2020b). Digital memorialization of wars, genocides, and mass atrocities has the power "to elevate new voices, allow geographically disparate communities to share experiences and learn about their shared past, and enable others to compose their own virtual memorials outside the official domain of the state" (Zucker & Simon, 2020b).

4. Conclusions

Memorialization is symbolic, but an essential way for recognizing genocides, honoring victims, and building peace and social justice. Memorialization can take different forms and approaches. AR and VR-based memorialization is an emerging approach in digital memorialization that can create new and unique memorialization interactions and experiences. Our review identified six different uses of AR and VR in the context of genocide memorialization. As the literature of AR and VR projects for genocide memorialization is growing, so does the need for systematic evaluation for the use of technologies within the sensitive context of genocide. Despite the limited number of systematic evaluations, some scholars and critics warn about the technologies' limitations and drawbacks. Others believe that the positive impact of these technologies to engage people (especially youth) with genocide subjects outweigh their drawbacks and risks. Some of those drawbacks and risks can be even mitigated with responsible and sensitive design decisions and content selections. In both cases,

we believe that AR and VR technology's ability to elicit strong psychological (cognitive and emotional) reactions necessitate a responsible and ethical approach in utilizing these technologies, especially in the context of genocide memorialization.

References

Albalak, M. (n.d.). *Nazi VR: The High-Tech Prosecution of a World War II War Criminal*. Retrieved November 6, 2021, from https://melmagazine.com/en-us/story/nazi-vr-the-high-tech-prosecution-of-a-world-war-ii-war-criminal-2

Alexander, N. (2021a). *Obsolescence, Forgotten:"Survivor Holograms", Virtual Reality, and the Future of Holocaust Commemoration*. Cinergie–Il Cinema e Le Altre Arti. https://cinergie.unibo.it/article/view/12205

Alexander, N. (2021b). *Obsolescence , Forgotten : " Survivor Holograms ", Virtual Reality , and the Future of Holocaust Commemoration 1 Introduction : " Maybe You Should Try to Reboot ." 19*, 57–68. https://cinergie.unibo.it/article/view/12205/12999

A new survey by the Claims Conference found a significant lack of Holocaust knowledge in the United States. (n.d.). Retrieved from https://www.claimscon.org/study/

Arora, G., & Palitz, A. (2020). *The Last Goodbye*. https://www.oculus.com/experiences/rift/1973329179388804/

Arora, G., & PALITZ, A. (2020). *The Last Goodbye*. https://www.oculus.com/experiences/rift/1973329179388804/

BJ Blazkowicz. (2018). *Videogames' portrayal of the Holocaust does a disservice to both players and victims*. https://www.pcgamesn.com/jewish-opinions-on-nazis-in-videogames

Brett, S., Bickford, L., Rios, M., & Sevcenko, L. (2007). Memorialization and Democracy: State policy and civic action. *Memorialization and Democracy: State Policy and Civic Action*. https://www.ictj.org/sites/default/files/ICTJ-Global-Memorialization-Democracy-2007-English_0.pdf

Ceglio, C. (2019). *Courtroom 600: A Virtual Reality Encounter with Evidence of the Holocaust*. https://greenhousestudios.uconn.edu/projects/courtroom-600/#

Collins, H., Allsopp, K., Arvanitis, K., Chitsabesan, P., & French, P. (2020). Psychological Impact of Spontaneous Memorials: A Narrative Review. *Psychological Trauma: Theory, Research, Practice, and Policy*. https://doi.org/10.1037/tra0000565

Columnist, C. G. (2020). *Inside Auschwitz – in 360°/VR*. https://cyprus-mail.com/2020/07/20/inside-auschwitz-in-360-vr/

Cox, D. (2018). *Will "digital resurrections" let us bring back the dead? In the not-too-distant future, chatbots and VR could let us interact with lost friends and relatives.* https://www.nbcnews.com/mach/science/will-digital-resurrections-let-us-bring-back-dead-ncna865806

de Jong, S. (2020). *Witness Auschwitz? How VR is changing Testimony*. https://public-history-weekly.degruyter.com/8-2020-4/witness-auschwitz-vr/

Feldshuh, T. (2021). *The Last Goodbye*. https://mjhnyc.org/exhibitions/the-last-goodbye/

Freid, D. (2019). *A VR Model of Auschwitz Helps Catch Nazis*. https://www.theatlantic.com/video/index/586567/nazi-vr/

Freid, D. (2021). *Nazi VR*. https://davidfreid.com/portfolio/nazi-vr

Gardner, E. (2017). *Does a VR Auschwitz simulation cross an ethical line?* https://www.alphr.com/life-culture/1007241/does-a-vr-auschwitz-simulation-cross-an-ethical-line

Gerardi, M., Rothbaum, B. O., Ressler, K., Heekin, M., & Rizzo, A. (2008). *Virtual reality exposure therapy using a virtual Iraq: Case report*. *21*(2), 209–213. https://onlinelibrary.wiley.com/doi/pdf/10.1002/jts.20331?casa_token=VCXKtTgkzKwAAAAA:QQH7jvQpD3Ufuhy_Spu0MI0EKv5NfyoQRjR9xjN5p1JkF8k756Yr9V7bVcCq1b2ZwluavWNtZYWNrm0

Goldman, M. H. (2018). *Connecting to History through Augmented Reality*. https://www.youtube.com/watch?v=HHyYWLyi4Ik&t=89s

Goldman, N. (2017). *VR IN HOLOCAUST EDUCATION: BALANCING TECHNOLOGY AND AUTHENTICITY*. https://www.vfxvoice.com/vr-in-holocaust-education-balancing-

technology-and-authenticity/

Gregory, S. (2016). *Immersive Witnessing: From Empathy and Outrage to Action*. https://blog.witness.org/2016/08/immersive-witnessing-from-empathy-and-outrage-to-action/

Group, Global Nomad. (n.d.). *Siroun: a vertical reality film and teachers guide*. Retrieved November 6, 2021, from https://currikicdn.s3-us-west-2.amazonaws.com/resourcedocs/5bccb01409235.pdf

Group, Global Nomads. (2017). *Siroun the Virtual Reality Experience*. https://www.youtube.com/watch?v=_V7uPBeRhrU

Group, Global Nomads. (2021). *Siroun- A Virtual Reality Experience*. https://thepromisetoact.org/educator-resources/siroun-a-virtual-reality-experience/

Group, S. (2014). *Bergen Belsen guide application*. https://www.youtube.com/watch?v=vvYp0VlkqBA&t=408s

Gurler, E. E., & Ozer, B. (2013). The Effects of Public Memorials on Social Memory and Urban Identity. *Procedia - Social and Behavioral Sciences*, *82*, 858–863. https://doi.org/10.1016/j.sbspro.2013.06.361

Herrera, F., Bailenson, J., Weisz, E., Ogle, E., & Zaki, J. (2018). Building long-term empathy: A large-scale comparison of traditional and virtual reality perspective-taking. *PloS One*, *13*(10), e0204494. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0204494

Hosseini, K. (n.d.). *Sea Prayer*.

Hughes, I. (n.d.). *VR Holocaust Memorial with Zeros2Heroes*. Retrieved November 6, 2021, from https://www.youtube.com/watch?v=zKhqy-Yky_Q

Jacobs, J. (2011). 2010 paul hanly furfey lecture: Sacred space and collective memory: Memorializing genocide at sites of terror. *Sociology of Religion: A Quarterly Review*, *72*(2), 154–165. https://doi.org/10.1093/socrel/srr023

Javornic, A. (2016). Augmented reality: Research agenda for studying the impact of its media characteristics on consumer behaviour. *ELSEVIER*, *30*. https://www.sciencedirect.com/science/article/abs/pii/S0969698915301351#:~:text=Aug

mented Reality (AR) is a real-time direct or,combines real and virtual objects.

Jones, S. (2021). "Simply a Little Piece of GDR History"? The Role of Memorialization in Post-Socialist Transitional Justice in Germany. *JSTOR*, *27*, 154–181. https://www.jstor.org/stable/pdf/10.2979/histmemo.27.1.154.pdf?refreqid=excelsior%3 A01d87cb8049fbfb72efea455130fc817

Josman, N., Garacia-Palacios, A., Reisberg, A., Somar, E., L.(Tamar) Weiss, P., & Hoffman, H. (2006). *Virtual Reality in the Treatment of Survivors of Terrorism in Israel*. https://books.google.iq/books?hl=en&lr=&id=OLNURC8lijkC&oi=fnd&pg=PA196&dq =Virtual+Reality+in+the+treatment+of+survivors+of+Terrorism+in+Israel++&ots=ppN dU7yPPW&sig=- xRO3smZo0BDMdBYmG4CMdIPfFA&redir_esc=y#v=onepage&q=Virtual Reality in the treatment of survivors of Terrorism in Israel&f=false

Kansteiner, W. (2019). The Holocaust in the 21st Century. In *Digital Memory Studies* (Issue September 2017). https://doi.org/10.4324/9781315637235-5

Karabegović, D. (2019). *Who chooses to remember? Diaspora participation in memorialization initiatives*. https://doi.org/10.1080/01419870.2019.1577473

Lebovic, M. (2020). *The 'virtual' future of Holocaust education is already here*. Holocaust Museum and Education Center. https://www.timesofisrael.com/the-virtual-future-of- holocaust-education-is-already-here/

Marr, B. (2019). What IS Extended Reality Technology? A simple Explanation For Anyone. In *Forbes* (pp. 1–5).

Meholjic, S. (2003). *Remembering Srebrenica Memories of Genocide virtual exhibition*. https://curat10n.com/remembering-srebrenica/

Milk, C., & Arora, G. (n.d.). *Clouds Over Sidra*.

Mohammed-Amin, R., Katifori, A., & Economou, M. (2021). *NOBODY'S LISTENING - Virtual Reality Exhibition: Impact and Analysis*. https://iraq.iom.int/publications/nobody's-listening-virtual-reality-exhibition-impact- and-analysis

Morie, J. F. (2006). Virtual reality, immersion, and the unforgettable experience. *Stereoscopic Displays and Virtual Reality Systems XIII*, *6055*, 60551X.

Morton, M., & Dabrowski, G. (2021). *An Introduction to Extended Reality: What It is and How It Can Help Your Students Learn (CTE7541)*. https://uwaterloo.ca/centre-for-teaching-excellence/events/introduction-extended-reality-what-it-and-how-it-can-help

Naidu, E. (2017). *From memory to Action:A Toolkit for Memorialization in Post-Conflict Societies*. https://www.sitesofconscience.org/wp-content/uploads/2017/07/Memorialization-Toolkit-English.pdf

Nakamura, L. (2020). Feeling good about feeling bad: virtuous virtual reality and the automation of racial empathy. *Journal of Visual Culture*, *19*(1), 47–64. https://doi.org/10.1177/1470412920906259

O'Brien, E., & Berents, H. (2019). Virtual Saviours: Digital games and anti-trafficking awareness-raising. *Anti-Trafficking Review*, *13*, 82–99. https://doi.org/10.14197/atr.201219136

Ośka, S. (2010). *Auschwitz Birkenau Historyczna Rekonstrukcja VR test - ENV*. https://auschwitz-vr.pl/en/about

P, G. L. O. B. A. L. N. O. M. A. D. S. G. R. O. U. (n.d.). *Siroun*. Retrieved November 6, 2021, from https://currikicdn.s3-us-west-2.amazonaws.com/resourcedocs/5bccb01409235.pdf

Schutte, N. S., & Stilinović, E. J. (2017). Facilitating empathy through virtual reality. *Motivation and Emotion*, *41*(6), 708–712. https://doi.org/10.1007/s11031-017-9641-7

Shin, D. (2018). Empathy and embodied experience in virtual environment: To what extent can virtual reality stimulate empathy and embodied experience? *ELSEVIER*, *78*. https://www.sciencedirect.com/science/article/abs/pii/S0747563217305381

Sindbæk Andersen, T., & Törnquist-Plewa, B. (2017). The Twentieth Century in European Memory. In *The Twentieth Century in European Memory*. https://doi.org/10.1163/9789004352353

Stylianou-Lambert, T., Bounia, A., & Heraclidou, A. (2022). *Emerging Technologies and Museums: Mediating Difficult Heritage*. https://www.chapters.indigo.ca/en-ca/books/emerging-technologies-and-museums/9781800733749-item.html

Takahashi, D. (2018). *Holocaust Memorial Museum uses augmented reality to make history visceral*. https://venturebeat.com/2018/08/31/holocaust-memorial-museum-uses-

augmented-reality-to-make-history-visceral/

UK, T. F. (2017). *Virtual Reality and Ethical Issues*. https://www.vrs.org.uk/virtual-reality/ethical-issues.html

Wang, Z. B., Ong, S. K., & Nee, A. Y. C. (2013). Augmented reality aided interactive manual assembly design. *The International Journal of Advanced Manufacturing Technology*, *69*(5), 1311–1321. https://doi.org/10.1007/s00170-013-5091-x

Zucker, E., & Simon, D. (2020a). *Digital memorialization for a global age*. https://www.thejakartapost.com/academia/2020/06/29/digital-memorialization-for-a-global-age.html

Zucker, E., & Simon, D. (2020b). *Digital Memorialization For A Global Age – Analysis*. https://www.eurasiareview.com/26062020-digital-memorialization-for-a-global-age-analysis/