

## ORIGINAL ARTICLE

# Virtual reality as a spatial prompt in geography learning and teaching

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**Abstract**

We examine the claim that virtual reality (VR) holds significant potential for pedagogical applications in geography. We do so with reference to results from a two-year research-teaching project embedded in a postgraduate course on “Heritage and Its Management.” We reflect on the implementation of a VR field trip to the Auschwitz-Birkenau State Museum enabled by the high-immersive *Inside Auschwitz* guided documentary, drawing on surveys and interviews held with students after their participation in the field trip. We found that VR technology may work as a (dis)inhibitor and provided users with a sense of social and temporal freedom to explore sites but in combination with a new set of spatial and perceptual constraints. The VR field trip generated curiosity about the “details” of the site, but we argue that learning with and through VR technology only became possible via active bodily adaptations and renewed understandings of bodily capacities and their inequalities. We conclude that VR works most effectively if conceived not as a journey into a self-contained virtual realm but instead as a spatial prompt designed to provoke new questions for students already on the path to developing geographical understandings and imaginations related to specific sites.

**KEYWORDS**

Auschwitz-Birkenau State Museum, dark heritage, field trips, geographical pedagogy, geography education, virtual reality

## 1 | INTRODUCTION

Like other digital technologies that have become integral features of university curricula, virtual reality (VR) applications have found their way into geography education (Detyna & Kadiri, 2020). VR has been described as a computer-generated visual environment that allows for different levels of interaction and sensory

immersion (Bos, 2021; Kitchen, 2020). As a technology, VR generates three-dimensional (3D) representations of real and fantastical phenomena, objects, places, and/or events that can be accessed using various devices including desktop computers, game consoles, headsets, smartphones, and theatre screens. VR has been integrated with sound, touch, and other sensory technologies and, more recently, with social networking technologies

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that provide real-time “affective connections” (Bos, 2021; Nakamura, 2020). Since the early 2000s, VR applications in geography education have facilitated myriad learning activities. Teaching, communicating, and collaborating can now take place in internet-based 3D virtual worlds such as *Second Life*, where students and teachers create their own interactive avatars (Minocha et al., 2010). More commonly used are VR applications that facilitate VR field trips (Stainfield et al., 2000; Tilling et al., 2017). For example, *Google Expeditions* allows for self- or teacher-guided tours through 360° photospheres and videos of locations around the world. In other instances, students have created their own VR content as a form of self-directed formative assessment through 360° recordings (Brendel & Mohring, 2020). In educational programmes centred on spatial planning and design, students have long developed virtual 3D models of spaces and communities, using software such as Esri’s ArcGIS CityEngine (University of Queensland, 2020).

VR has existed for several decades, but the relatively recent growth in uptake of high-immersion VR in higher education can be ascribed to a number of developments. These developments include the increasing accessibility of and advances in VR technology as well as policy-driven changes in higher education, which have emphasised digital literacy and employability within contemporary knowledge economies (European Commission [EC], 2018; JISC, 2014; Martin, 2008; Selwyn, 2007; Southgate et al., 2018). Increased participation in education has also resulted in growing demand for various forms of digitally enabled distance education (OECD, 2019). Consequently, government funders have sought to promote understanding of emerging technologies such as VR and their applications in education (EC, 2020; Southgate et al., 2018). More recently, the outbreak of the COVID-19 pandemic and related restrictions on mobility and in-person contact have placed greater urgency on the prioritisation of distance learning and digitally apt learning environments (EC, 2020; Mishra & Panda, 2020). Driven by neoliberal ideologies, many of the aforementioned policies and related developments “treat technology as an inherently ‘good thing’ that merely offers educational opportunities,” while ignoring the more complex sociocultural aspects of technology (Selwyn et al., 2020, p. 2).

With this study, we wish to contribute to a growing body of literature that aims to more critically examine the potential that VR holds for pedagogical application in geography. We do so with reference to the results from a two-year research-teaching project on “VR in learning and teaching geography” that was embedded in a postgraduate course entitled “Heritage and Its Management” offered in various degree programmes at

### Key insights

Virtual reality may function productively as a technology for students to wrestle with problems of spatial sense and perception including on highly challenging topics and in confronting sites. Far from being separate from the “real” world, virtual reality may actively help to interrupt conceptions of space and spatiality that can hinder university students from thinking geographically.

Macquarie University, Sydney, Australia. The main objective of the course was to critically reflect on how, by whom, and why certain places of historical, cultural, and natural importance are represented as sites of heritage.

In this article, we discuss our efforts to implement a VR field trip to the Auschwitz-Birkenau State Museum (ABSM) in the course. We question the potentially profound implications of VR for how geographical concepts are taught, but, equally, we show how geographical theories may provide an important platform from which to critically engage with VR as a pedagogical tool. As teachers with little prior experience using VR technology before starting this research-teaching project, we hope this article is of interest to other educators who consider implementing a VR field trip in their curriculum.

To contextualise our experiences implementing a VR field trip in a geography course, we begin with a brief overview of the literature on VR in the context of geographical education and the broader social sciences. Drawing on critical insights from recent work in digital geographies, we argue against enduring perspectives within geographical learning and teaching that conceptualise “the virtual” as a realm distinct from traditional, empirically real (that is, physical) fieldwork sites. Instead, we reflect on our VR field trip experiences to highlight and explore a series of interlinked themes that undermine any putative division between the virtual and the material and that we believe are of value in extending geography’s pedagogical engagement with immersive VR. Without wishing to generalise the utility of VR platforms from the limited data discussed in what follows, we characterise VR not as a gateway into an immaterial or metaphorical dimension but instead as an imaginative spatial prompt that complements, depends upon, and problematises established tools of geographical pedagogy.

## 2 | LITERATURE REVIEW

Geographical literature on the implications of immersive VR for teaching practice in geography remains scant, but in some works there are important insights as to certain elements of its efficacy. The capacity of VR platforms to inculcate in students a sense of presence within diverse environments has been heralded as offering a venue for meaningful experiential learning, enabling, for example, forms of role play that might complement or even replace more traditional work placements (Howard, 2011) or providing an experimental space to practise methodological skills and techniques (Kitchen, 2020). Furthermore, as Šašinka et al. (2019) have suggested, VR platforms have a specific relevance for geographical study, given their capacity to move between and juxtapose abstract geographical representations such as contour lines and concepts such as scale, which is achieved using visual simulations of environments and spatialities that these representations and concepts are intended to signify. More generally, the interactive and novel characteristics of immersive VR have been argued to “give students a level of autonomy [and] ownership of learning activities,” as well as increase students’ engagement (Detyna & Kadiri, 2020, p. 475).

Perhaps the most sustained engagement with the potential of immersive VR for geographical learning and teaching, however, relates to the traditional role of international field trips within undergraduate geography degree structures (Phillips & Johns, 2012). The common perception of immersive VR as offering instantaneous transportation to an entirely different realm has been embraced by geographers looking to complement or find alternatives to “real-world” field trips, given the expense and logistical difficulties of the latter and the added urgency of these concerns in the era of COVID-19. For example, immersive and interactive platforms have been presented as a way to prepare for field trips and enable students’ preliminary exposure to future field trip destinations (Kitchen, 2020; McMorro, 2005). Immersive VR has also been used as an integrated component of field trip activities, whereby VR and augmented reality (AR) can be used to provide alternative means of visualising and analysing the material landscape (Jones & Osborne, 2020; Priestnall et al., 2019). Alternatively, and closest in spirit to our project, VR has been conceptualised as affording a type of classroom-based field trip experience in itself (Stainfield et al., 2000), both using digital technology to expose students to “place-based experiences” (Lisichenko, 2015, p. 161) that might otherwise be inaccessible and providing opportunities to engage with “large amounts of geographic content shared in an experiential manner” (ibid., p. 162). Each of these

articulations of VR-inflected fieldwork offers possible ways to embed field trips into longer periods of geographical learning that exceed isolated time frames of a single physical excursion away from the classroom.

The emerging literature has tempered these expectations to some extent, with authors identifying ongoing challenges to implement immersive VR technology in geographical learning and teaching, mainly in relation to both teachers’ and students’ uneven technical literacy levels. Unfamiliarity with VR technology evidently requires an investment of time and resources in training among teachers to ensure meaningful use of these platforms in geographical pedagogy (Brendel & Mohring, 2020; Stojšić et al., 2016). At the same time, varied digital literacy levels among students potentially undermine the greater equality of access supposedly represented by VR field trips (Lisichenko, 2015; Šašinka et al., 2019). Before we delve further into discussions about implementation and optimisation, however, it is useful to address a more fundamental issue regarding the specifically *geographical* interpretation of VR technology and its discourses and practices as those relate to an anachronistic spatial imagination embedded in such ideas as a “virtual” field trip.

Many purported benefits of VR described above are framed by the assumption that certain forms of travel and activity are difficult in the “real” or “material” world but are now possible in the “virtual” realm. This distinction between real and virtual spaces is problematic in at least two ways, and geographers have been prominent in articulating these critiques. First, the distinction assumes a “natural” mode of existence—one that lies outside of immaterial “virtual” reality—which is untouched by the digital (Kinsley, 2014). This assumption ignores the myriad ways that digital technology is imbricated into everyday existence (Dodge & Kitchin, 2005; Leszczynski, 2015; McLean, 2020); indeed, the centrality of software, data, and code to spatial experience in general is evinced by a cursory inspection of the practices that constitute traditional fieldwork and their contemporary dependence upon myriad geolocation technologies. Second, the notion that VR offers access to a distinct, self-contained realm implies a Euclidean and primarily visual understanding of space (Ash et al., 2016), which does little justice to the deeply embodied nature of digital geographies (Elwood & Leszczynski, 2018). Interactions *with* and experiences *of* VR environments can provoke embodied and affectual responses that are no less real than those experienced in material sites, as Jones and Osborne (2020) showed in their study of VR gameplay in historic landscapes. Users’ engagements with virtual environments may reshape their understanding of material worlds and generate memories of places they were

unable to witness or experience first-hand (*ibid.*). In short, it is incongruous that, in human geography of all disciplines, the pedagogical implications of this cutting-edge technology are often explored by way of an antiquated conceptualisation of space.

As such, in addition to the issues of access and equality raised in the literature, there are fundamental questions about space and spatiality that geographers can productively explore in relation to immersive VR in learning and teaching contexts. Just as there is no purely analogue field trip untouched by digital technology, so too that which is conventionally referred to as VR needs to be approached as another manifestation of the human–technology relationship that is constitutive of all spatial experience (Ash, 2010; Kinsley, 2014), to be understood on its own terms rather than as a generalised alternative reality that fails to hold up to (geographical) examination. Bringing discussions about VR and geographical pedagogy into conversation with broader geographical debates and theories on space, technology, and embodiment reveals a series of key areas of inquiry, including the spatial habits and bodily dispositions generated through engagement with VR (Ash, 2010, 2012); the material infrastructures that actualise VR and the embodied inequalities embedded therein (Kinsley, 2014); and the spatial imaginaries and identities cultivated by the particular simulations and frameworks generated by immersive VR.

### 3 | METHODOLOGY

Drawing inspiration from the ongoing geographical critique of the virtual imaginaries evident in much discourse on contemporary digital technology, we move on to explore the geographical pedagogical implications of VR. Following the installation of a VRoom (VR room) in Macquarie University's Library in November 2017, we first incorporated VR in the postgraduate course "Heritage and Its Management" in 2018. In the 2019 offering of the same course, we incorporated VR again but made modifications based on the lessons we learnt from our 2018 experience, as we will detail below.

The VRoom is a shared and semi-enclosed space within the library, separated from other communal areas by a glass wall (Figure 1). Here, students and staff can engage in a high-immersion VR experience using the "HTC Vive"—a personal computer-tethered VR system that includes a head-mounted display (HMD) device, motion controllers, and external sensors for whole-room VR. The HMD used in this study covers users' eyes and ears to provide multi-sensorial



**FIGURE 1** Photo of the Macquarie University VRoom in 2019, with Maartje Roelofsen trialling the HTC Vive. Source: Richard Carter-White

experiences through stereo sound and a stereoscopic display, which also responds to the movements of users' heads. This effect contrasts with the so-called low-immersion VR devices such as computer screens, which display 2D or 3D environments navigated manually using a mouse, keyboard, or game controller. The level of interaction and sensory immersion that these different VR applications afford affects how users experience the physical properties and feel of virtual sites and objects (Antonietti & Cantoia, 2000). We reflect on the implications of the use of the HMD in Sections 4 and 5.

Our VR approach was designed with generous support from Librarian and technical expert, David di Muro, who helped us use the VR equipment and explore VR applications that could facilitate a tutorial activity in the workshop themed "Difficult Heritage," which we ran in the 2018 and 2019 offerings of the course. That workshop centred on the practices and politics of memorialisation in places associated with death, genocide, trauma, and other violent histories. In the workshop, we incorporated VR field trips to the UNESCO World Heritage-listed ABSM in Oświęcim, Poland, a case study that was also discussed in the lecture section of the workshop and that is the subject of a burgeoning literature focused on digital education and remembrance (see Carter-White, 2018; Commane & Potton, 2019; Manca, 2021).

The selection of a site of exceptional suffering such as the ABSM may raise questions about how to apply the project's findings in ways that inform the wider implementation of VR within geographic pedagogy. Although

the site's selection was partly a pragmatic consequence of the workshop's focus on sites of difficult heritage, we also considered that its traumatic history constitutes an appropriate context in which to explore VR's pedagogical potential. Sites of difficult heritage have become common destinations in undergraduate geography field trips because of their capacity to raise complex moral and political questions (Maddrell & Wigley, 2019), but the value of such visits is predicated on the presumed importance of *being there*, physically present at sites whose materialities testify to a heinous past (Carter-White, 2018). Crucially then, our selection of the ABSM renders untenable any possibility of considering "virtual" travel to be equivalent to, and thus potentially a replacement for, "real" travel. Therefore, the selection also foregrounds a question we consider of central significance: What pedagogical value can VR offer once we set aside the idea it is replicating experiences of physically travelling to sites of educational interest? It is precisely Auschwitz's extreme emotional context that makes it effective for exploring the pedagogical utility of VR field trips. With this rationale in mind, we move on to discuss the design of our methodology.

Initially, in 2018, our cohort of 15 students was given the option to either visit a digital rendering of the site using Google Earth VR in the VRoom or, on their own computers, to take a low-immersion virtual tour of ABSM through the official website of the museum ([panorama.auschwitz.org](http://panorama.auschwitz.org)). That activity was accompanied by a survey inviting students to reflect on the possibilities and limitations of VR in representing and experiencing a heritage site such as the ABSM. The survey formed our "base study," and we indirectly refer to some of the results from that survey in our findings. Based on students' responses to the 2018 survey, we decided to explore alternative VR applications for the following year's offering of the course, and in 2019, we opted for the high-immersion VR documentary *Inside Auschwitz*, which was compatible with the HTC Vive device in the VRoom.

### 3.1 | Inside Auschwitz

According to its producer, West German Broadcasting Cologne, *Inside Auschwitz* was "the first ever global 360° project realised in Auschwitz-Birkenau" (WDR Köln, 2018). *Inside Auschwitz* is a guided tour of 9:36 minutes, freely accessible on YouTube. The guided tour is based on individual engagement and does not allow for real-time or synchronous (social) interactions with other participants on tour. The tour includes 360° recordings and drone footage of the grounds and remaining buildings of the Auschwitz I and Auschwitz

II-Birkenau camps today. The documentary is narrated by Holocaust survivors Anita Lasker-Wallfisch, Philomena Franz, and Walentyna Nikodem, who give accounts of their experiences in the camps. During the narrated tour, the documentary permits users autonomy to look around each scene within 360° by moving mounted headsets in different directions. Importantly, none of the scenes includes written descriptions of the sites in which the VR documentary tour is set, and much of the interpretation is left up to users. Throughout the documentary, references are made to the original functions of buildings and grounds. The three interviewed survivors describe what it was like to live, survive, and witness others die in the camps and refer to inhumane and violent acts performed on their bodies and others. Numerous references are made to harsh weather conditions and the pervasive odour of burned bodies from crematoria.

Two lectures on the Holocaust and the Auschwitz-Birkenau camps served as preparation for the voluntary documentary field trip; these also included visual material of the camps in different time periods that were mainly drawn from UNESCO's website. In advance, students were told that the documentary included 360° recordings of the present-day camp remains and interviews with Holocaust survivors and made aware of the possible side effects of high-immersion VR, including nausea and disorientation. They were also advised against participation if they were generally sensitive to such side effects or trauma responses.

### 3.2 | Participants and methods

In 2019, five students took part in the *Inside Auschwitz* documentary tutorial in the VRoom. In line with our human ethics application and approval from Macquarie University (5201937877327), students were made aware beforehand that their participation in the study was entirely voluntary, that it would not affect their assessment, and that they were able to withdraw their participation at any time. To avoid risk or harm to participants, the research followed the ethical principles of informed consent, participant safety, privacy, confidentiality, and anonymity. All students were given an individual time slot so they could familiarise themselves with the technology and experience VR with only the library technician and Richard Carter-White present for assistance and observation. Directly after their participation in the activity, participants were invited to share their perspectives on VR in a semi-structured interview. Four of five participants agreed to the interviews, which lasted approximately 25 minutes each and were carried out by Richard

Carter-White. With participants' permission, interviews were recorded and later transcribed and analysed thematically. The lessons we learned from the 2018 and 2019 VR field trips shared herein are a result of this research study and include an integrated perspective of both student perceptions and our observations as course convenor and human geography lecturer.

It is important to acknowledge that the following findings are specific to and deeply contingent upon the documentary makers' representation of the ABSM. VR developers have often presented VR technology as "empathy machines" capable of provoking affective connection and therefore teaching "ethical decision-making and moral education about the world" (Nakamura, 2020, p. 49). Yet, critics have warned that such affectual experiences are based on a manipulative set of design principles. In their study of virtual landscapes and their role in creating "postmemories," Jones and Osborne (2020, p. 204) have demonstrated that "the balance of power between designer intent and user imagination" can be problematic because "individuals are manipulated through their exposure to and co-creation of these virtual landscapes." Similarly, *Inside Auschwitz* was designed to provoke certain understandings and imaginations of the ABSM, and those design choices are clear in the makers' selections of spaces and survivors' accounts and their use of a set of specific VR technologies, such as drone cameras. Nonetheless, the intended "e/affect" of virtual landscapes such as *Inside Auschwitz* changes alongside the ways in which users "interact with and co-construct these landscapes" (Jones & Osborne, 2020, p. 187). Distinctive ways of knowing, being, and thinking that are brought to bear by each participant influence *what* is seen and *how* it is seen, meaning that interpretations of the documentary are also culturally constructed and embodied (Rose, 2014). We therefore conceive of the VR documentary as a digital cultural object that mediates the (re)production and experience of the ABSM. In line with work by Gillian Rose (2016), we contend that *Inside Auschwitz* is a digital cultural object that is inherently unstable in its mutability and multimodality because of what specific VR technologies enable and what users do with them. For that reason, our findings are intended neither to stand in for or exhaust the vast number of potential manifestations or experiences of VR as an educational resource nor its possible incorporation into geographical pedagogy. Instead, our observations are organised into three themes meant to stimulate debate in relation to aspects of VR prominent in our study and that we think are relevant to geographical preoccupations and approaches, not least in their refusal of a clear divide between real and virtual worlds.

## 4 | FINDINGS

### 4.1 | (Dis)inhibition

Writing in the context of videogames, Ash (2010) has discussed the dynamics of "teleplastic" technologies that engender in their users new forms of bodily orientation, habit, and spatial sense. This range of capacities is imbued in users as they negotiate limits to and possibilities for action designed into technological interfaces and environments: operating within the range of possibilities offered by a given technology, its 'inhibitors' and 'disinhibitors' (ibid., p. 417), means that new and unconscious modes of spatial sense emerge. And indeed, the question of (*dis*)inhibition loomed large in our interviews. This issue's prominence was partly a consequence of our selection of VR platform, as the guided nature of the 360° video used in our study overtly restricted participants' navigation of the site representation. In contrast to notions of VR as something offering effortless movement through cyber space, participants expressed frustration at the inability to direct their own site navigation and to pause and explore spaces and objects of particular interest, although they said the 360° perspective provided an engaging sense of immersion in the heritage environment. However, from within this ecology of technological inhibitors, participants identified some unexpected forms of disinhibition in their VR experience. Chief among these was a sense of social freedom:

[Sometimes] when we are present in a place where it is ... difficult to act in proper ways, you do not know how to act, so you do not know how you ... might offend some people. When you watch it [the VR video] in this way, whatever [way] you act, it does not really matter because you have your freedom whatever you think or however act. (Lin)

Here Lin was heralding the freedom offered by VR from a perceived obligation to perform expected emotions and affects, with VR becoming a performatively "amoral" site of engagement with the history of the Holocaust. This freedom was framed positively because Lin said it enabled her to concentrate on the informational contents of the heritage site; in other words, the VR video's inhibition of her spatial movement was compensated by the disinhibition of her attention to the video contents, freed from the distraction of social norms and expected behaviour. Other participants extrapolated from the spatial limitations of VR a certain temporal freedom, in the ability both to instantaneously travel to the site and to replay and repeat ephemeral experiences that might be missed

in a physical visit, enabling participants to relax and concentrate on the narrative presented by the 360° video:

[You] pretty much do not have to physically go to a place, it can be on your fingertips, you can go where you like, and as many times as you like. Even if you miss something you can always go back and try and try and like ... recapture it. (Ray)

Although participants sometimes lamented the inability to pause and inspect objects and spaces of interest, it was precisely the linearity of this VR experience and the relative solitude induced by the headset used in this study that made it possible to rewind and review sights that might have been missed. As Ash (2010, p. 418) has noted, inhibition and disinhibition are not opposed but are instead “fundamentally and dynamically linked,” working together to constitute a field of possibilities that subtly alters the orientation, comportment, and expectation of users. During interviews, our participants seemed to accept the loss of movement that initially frustrated them, in the course of appreciating the advantages that this loss enabled.

The pedagogical implications of this shift in participants’ perspectives on VR are rather ambivalent. The removal of certain social and temporal pressures may facilitate easier or more convenient experiences of a site such as the ABSM, but it could be argued that negotiating social etiquette and dealing with consequent moral and ethical reflections are fundamental to the process of meaningfully engaging with the dark heritage status of such a site. Similarly, although the instantaneity of VR is logistically convenient, the process of travelling to and from a place imbued with such emotional weight may be significant in providing a liminal space for students to prepare for and reflect upon their experiences; as such, the elimination of this transitional space may not be necessarily positive, either pedagogically or psychologically. Nor is the capacity to infinitely replay the virtual experience to be unequivocally welcomed, should this cultivate a more superficial engagement with the site than that required by a guided or otherwise time-constrained tour.

## 4.2 | Deferral

There was no declared expectation among our participants that VR might function as a like-for-like replacement for a traditional field trip to the ABSM. There was, however, a tendency to discuss the pedagogical strengths and weaknesses of VR in relation to their *deferred*

anticipation of the real, material heritage site. For example, when prompted to comment on VR’s effectiveness for learning about the history of Auschwitz, participants said the advantage was VR’s unique capacity to generate curiosity about the details of the site when compared with other forms of representation:

[It] feels very real, as if you are there standing in that particular place. So that develops an interest. So, studying it from books or talking about it ... It might be that people lose interest. But this is something that keeps on going and you pay attention to every detail of the place. (Nadia)

The immersive VR representation was regarded as a more compelling representation of the ABSM than that offered by more familiar representational forms but, by the same logic, the feeling of “reality” described above was vulnerable to disappointment when users encountered the immersive limitations of the medium:

[As] a person who is experiencing this for the first time ... it is not flowing ... it is going around, like, from one place to the other. Everyone is telling a different story and it is jumping from one context to the other context ... I think it is all over the place, like a jumbled puzzle ... Seeing in VR it gives you like an eye opening, like, very visual idea what a place is about, but actually visiting a place is a totally different thing. It gives you a different feeling ... I think in the sense of this VR tour, you just sort of see what’s around you. It is a good thing, a very good tool ... But actually visiting the place, physically, it is a different aspect. (Ray)

The stimulation provided by VR’s immersive representation of the ABSM was tempered by a series of immersion-breaking problems identified by participants, including the fragmented spatial depiction of the ABSM; the limited sensorial engagement of this primarily audiovisual medium; and an elusive sense of affective absence. If the VR experience succeeded in developing interest, ultimately, it is an interest in visiting the material site to which the VR video constantly alludes and is unavoidably anchored:

I would really love to go to the place and study more about it. ... It’s like, now you want to go to the movie, when you have seen a trailer for 5 minutes. (Nadia)

For Nadia, the “virtual” reality offered by the VR video was akin to a preview of a fuller reality that can only be accessed by physically visiting the material site. In this instance, VR fundamentally defers attention outside itself by generating curiosity for an experience that it cannot itself provide. Relatedly, our survey and interview data suggest that those students who were able to derive some historical or critical insight from their virtual tour did so because of existing knowledge of the camp acquired from other representational sources, for which the VR tour essentially provided illustration:

[Our lecturer] told us a little bit of context as to what [ABSM] is about. And I also did some research, in a kind of, get to know what this tour is going to be about. So, I had a bit of a context in the background, so I knew where I was. [Another lecturer] gave a lecture ... showing how people were taking selfies and balancing on that train track [of the ABSM]. So, I did have that feeling where I was, that was the entrance to the camp ... But for a person who has got no idea, I think [they] would not know whether that is inside or outside [the camp]. (Ray)

Recall that one of the established uses of VR within geographical pedagogy is to prepare students due to undertake field trips by familiarising them with an immersive digital rendering of that same location. Yet it was evident from our interviews that VR cannot be assumed to provide meaningful prior exposure to a given site in and of itself. In this case, the pedagogical value of VR was largely identified as dwelling outside itself, in a supplementary relationship with external information about the ABSM, which served to orient and contextualise the VR depiction of the site.

### 4.3 | Embodiment

Emerging from interviews and survey data was a consistent impression that VR offers an experience of the ABSM that is divested of a series of spatial, monetary, social, and temporal obstacles and pressures and is also significantly informed by participants’ prior knowledge and anticipated futures. Yet, it also became apparent that resulting experiences of VR vary among users and that embodiment proved to be one of the main conditions for learning about the ABSM through VR. This finding echoes longstanding feminist critiques of science’s “equation of a disembodied ‘view from nowhere’ with objectivity” and an evolving literature on digitality and embodiment,

which evinces how “digital subjects know and are digitally known” from a situated subject positionality (Elwood & Leszczynski, 2018, pp. 3–4). During interviews, references were often made to how participants’ uses of VR and newly acquired knowledge of the ABSM depended on their bodies’ capacities. Some alluded to the complex entanglement of the human body with computerised technologies and the capacities of these entanglements to (re)configure understandings of the self, the world, and, in this case, the ABSM. We refer here to Donna Haraway’s (1990) important work on the cyborg, a figuration that acts as an entry point for thinking and problematising boundaries between and among human, organism, and machine (Wilson, 2009). Participants’ accounts did not suggest they passively gazed upon the ABSM with VR technology as detached and objective beings. Instead, as digital subjects, they spoke of attempts to situate themselves while coming to know the ABSM’s spatialities (Wilson, 2009). In various ways, participants’ embodied learning was enacted through the different VR technologies and the movements of the 360° camera used by the documentary makers, which, for many shots, was attached to a drone: participants’ perspectives alternately *hovered* above the ground, *zoomed* through the sky, and remained statically *fixed* to the ground. Together, participants’ bodies and the camera formed an inter-corporeal and multimodal way of seeing and moving through the ABSM. The mobilisation of these kinds of visual effects by the documentary makers provoked a set of physiological responses, which varied along with the movements of participants’ bodies. Although participants initially fixed their eyes on 3D images projected in front of them, they soon discovered that they could move and direct different ways of seeing, prompting a different set of physical reactions:

Initially I was just watching a video when I realised ... ‘I can look down,’ and it felt like I was at a great height and [it] felt that I should not take a step ahead ... [In] my mind it was [like] ... I might just step down because of the height so I preferred standing in the place that I am ... When I was looking left and right throughout the video that was also fine with me. But I was just not stepping ahead or moving a bit, feeling afraid that I would fall. (Nadia)

Seeking balance, participants developed their own strategies to negotiate their bodily discomforts, primarily to (re)gain an internal sense of movement and position. These strategies included adapting their initial modes of viewing, for example, by directing their head and vision

forward or to the left and right, rather than up and down. A guided documentary such as *Inside Auschwitz* can thus also induce physiological (stress) responses and embodied skills that suppress feelings of confusion or tension: as soon as Ray “started to focus on what went on around” him on the ABSM grounds “the tension just died.” Sensing what their “immersed” bodies were (already) capable of doing became integral to learning about the ABSM as participants moved along with the camera from one VR scene to the next. Although *Inside Auschwitz* has decidedly not been conceived as a game as such, it clearly incorporates elements associated with gameplay, such as learning to navigate and interact with virtual landscapes (Jones, 2020).

Bodily adaptations were not always possible, however. References to bodily (dis)comforts emerged in interviews and were often linked to the conditions that the VR headset and video imposed on participants’ movements. Kathryn’s efforts to self-direct through the ABSM were constrained by the headset design, which was not (and could not be) attentive to the shape of her body and which produced physical discomfort. In ways that correlate with efforts in geography to attend to the materiality of digital geographies (Ash et al., 2018, p. 3), she said the headset “is too heavy so I have to hold it. Because the size for me is too big, the device is so heavy.” In this case, the VR headset appears designed with a particular physiology in mind, and indeed the physical discomfort experienced by some participants was an issue we had not anticipated given our own use of the headsets. Other examples of the interrelation between body and environment were evident as the VR video continued into the digital rendering of the former barracks, gas chamber, and crematorium. Participants mentioned their struggles to understand the scope and scale of these spaces because they were devoid of other human beings and materials that they could potentially relate to:

When I saw the [VR] video, I cannot imagine this is the room of the bed, I cannot imagine the real site. So, I just see this as a square but I do not know what the size is. The room size, the bed size? So, I cannot scale it ... So, I do not know the meaning. (Kathryn)

A designer who “always draws with scales,” Kathryn also said that comparing with other people and materialities helped her understand objects’ dimensions. In trying to establish a scalar relationship between their own bodies and the “de-humanised” spaces of the ABSM through which they moved, other participants also started to look for indicators to enable comparison and measurement. Birds and potholes that featured in the documentary

were mentioned as familiar corporeal entities that enabled a meaningful “somewhere” from which to observe and comprehend the site’s scale and orientation. Learning about the ABSM via the VR video thus depended upon participants developing a relationally embodied understanding of the dimensions of the site.

## 5 | DISCUSSION AND CONCLUSION

In this study, we aimed to explore the implications of VR for geographical pedagogy and how geographical theories may enable critical engagement with VR as a pedagogical tool. One of the more troubling findings is that, after navigating the novel inhibitors and disinhibitors of a VR experience of the ABSM, students seemed to conclude that an encounter with “difficult” heritage should be *convenient*: that is, divested of the logistical barriers of distance and expense entailed in a visit to the physical site of the ABSM and freed from the moral and ethical obligations that one may expect when setting foot in the real, historical site itself. Although some virtual environments may act upon users’ affective capacities and creative abilities to construct knowledge of places and events they have never “personally witnessed” (Jones & Osborne, 2020, p. 189), experiencing virtual environments of trauma in relative solitude may also remove expectations to *be affected*, countering claims of VR’s visual and ethical exceptionality (Nakamura, 2020). The notion of “convenient” difficult heritage is a misnomer that sits uneasily with the nuanced and, as it were, *difficult* moral reflection that sites of trauma and remembrance are typically intended to facilitate (Cooke & Frieze, 2014). Yet, abstracted from the specific set of debates at stake in our use of VR, there is a broader point to be made from this (rather unexpected) finding. There is no reason to assume that the vast field of possibilities engendered by diverse VR technologies will inevitably alter student subjectivities in the way outlined here, but what can be more confidently suggested is that such alterations, conscious and unconscious, are fundamentally unpredictable and open-ended and prohibit any possibility of VR acting as a straightforward substitute or replacement for the very different set of limitations and constraints inherent to traditional field trips.

Notwithstanding the observing presence of the researchers, the relatively isolated qualities of the VR environment used in this study are not necessary for all VR environments. It is equally possible that classroom use of this technology can enable multiple participants to view and interact with each other within the VR environment, potentially introducing an entirely new set of

inhibitors and disinhibitors. Our participants' embodied experiences of VR show the potential productivity of this open-endedness. In one sense, our data can be described as highlighting a certain inadequacy in VR's representation of scale, and thus, it might be suggested that VR risks failing to provide the meaningful sense of embodied presence that is often touted as a primary pedagogical benefit of this technology, at least in the context of identifying alternatives to traditional field trips. Yet the fact that participants were required to compensate for the scalar distortions of the VR illusion counters any assumption that theirs were passive gazes from a disembodied vantage point, in the face of an overly deterministic or totalising representational form. Instead, learning with and through VR technology became possible only via active bodily adaptations and renewed understandings of bodily capacities and their inequalities. It is the spatial flaws and idiosyncrasies of this technology that challenged participants to make embodied sense of the ABSM and perceive it anew, in ways that could potentially be harnessed in subsequent iterations of this activity focused more directly on the scale and arrangement of the heritage site's landscape.

Recent work in digital geography has advanced critiques of widespread notions of VR as a distinct realm that might function as a direct substitute for traditional field trips, and our findings support ongoing efforts to depart from this geographical imagination. Again troubling common associations of VR with convenience, it is important to emphasise that the pedagogical meaningfulness of our VR field trip itself depended on preparation and knowledge acquisition that preceded and exceeded any self-contained experience that might be labelled "the virtual." The spatiality of the VR field trip used in our study can therefore perhaps better be described as a *threshold* between the contextual knowledge that gave the VR experience meaning and the anticipated visit to the material site in which students located its pedagogical value. The primary educational benefit identified by our participants was the tendency of VR to build and defer interest to an experience outside itself, in an inversion of the spatial imagination typically deployed to discuss VR. Here, the value of VR was located not in the escape it offers into a frictionless cyber space, but instead in the veiled promise of the real implied by both the immersive capabilities of VR and the *failure* of these capacities: All of this rests on the capacity of VR to powerfully immerse students in a visual environment, an immersion that, we suggest, becomes all the more pedagogically impactful in those moments when it breaks down. There may therefore be value in shifting the entire geographical debate about the virtual in this direction—away from anachronistic

spatial imaginaries that distinguish certain technological experiences from a mythical real world, towards a focus on the varied capacity of all manner of new and established learning technologies to immerse students in radically different times and places.

Accordingly, and with regard to our reflections on high-immersion VR platforms, we suggest it might be productive to relinquish the question of whether or how VR can replicate a real-life field trip and instead consider the merits of a VR perspective on its own flawed and unpredictable terms and ask how it might support broader geography degree programmes. Within the narrow confines of our study, VR works most effectively if imagined not as some journey into a self-contained virtual dimension but as a spatial prompt designed to motivate and provoke new questions for students already on the path of developing a geographical understanding and imagination of dark heritage sites, among others. Extended to the broader set of topics and empirics that populate human geography courses and degree programmes, it may function productively as a technology that can pose problems of spatial sense and perception for students to wrestle with, which, far from being separate from the real world, actively help to interrupt those tacit, sedimented, and common-sense conceptions of space and spatiality that can so often hinder university students from thinking geographically. It is, therefore, the unpredictable, idiosyncratic, and even frustrating aspects of VR that we most valued as geography teachers upon reflection on this study and that we suggest should be considered in ongoing efforts to develop a critical geographical pedagogy of VR.

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#### CONFLICT OF INTEREST

The authors declare there is no conflict of interest.

#### ETHICS APPROVAL

This study was approved by Macquarie University's Human Research Ethics Committee.

#### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are only available on request from the corresponding author. The data are not publicly available due to privacy and ethical restrictions.

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