Museums and Technologies of Presence

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6 Reconfiguring the Viewer

Modes of Perception and Attention in Immersive Museum Experience

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Introduction

Expanding access to physical artworks, artefacts, and cultural sites through emerging digital technologies has long been a chief remit of museum computing. As suggested by the Smithsonian Institute's digital-first strategy goal for 2018–2022, such digital approaches aim to reach 1 billion people per year (Smithsonian Centre for Learning and Digital Access 2017). Moreover, the COVID-19 pandemic shutdowns have further increased pressure on cultural organisations to provide more extensive access to their holdings (most of which lie hidden in storage) and reach more diverse audiences by technological means to ensure their continued relevance, hastening these institutions' belated digital transition.

Yet, even as museums and galleries rush to digitise physical artworks and artefacts to make them widely available online, what has become increasingly clear since the advent of the first online collections in the mid-1990s is that simply providing access to digitised versions of cultural objects for the purposes of reference and even re-use (in the case of open-access content) does not automatically ensure public engagement. In fact, there is a desperate lack of active users for digital tools and open collections (Roued-Cunliffe 2021). Aside from issues of context and digital literacy, making digitised content freely available online no longer guarantees enough engagement and arousal in the experience and attention economies, which have raised the benchmark for access from passive receipt to active participation.

At the same time, museums have embarked on several audience-oriented 'turns' over the past two decades to increase and diversify their publics by crafting more personalised and engaging experiences including 'affective' (Kidd 2015), 'participatory' (Barney et al. 2016), 'immersive' (Kidd 2018), and 'sensory' turns (Uchida and Jingyu 2018; Howes 2019). All of these have contributed to better positioning the sector within the experience and attention economies. Taken together, these turns have signaled a broad movement away from what museologist Laura de Caro (2015) qualifies as 'Western visualism', and towards more emotive, interactive, multisensory, and situated museum and heritage experiences designed to facilitate phenomenological exploration and

inquiry (Kenderdine 2016). If cultural institutions have increasingly adopted immersive approaches, it is to meet the public-facing objectives of providing 'more dynamic ways of communicating with the public' (i.e., appealing to new and more diverse audiences), encouraging 'rich – and more consequential – practices of participation' (i.e., augmenting public *agency*), and engaging 'users with sites, institutions, collections and themes' (i.e., offering alternative viewpoints and memorable, even transformative, learning experiences) (Kidd and McAvoy 2019, 8–9).

It follows that a growing focus in the cultural sector is on immersive systems that stimulate 'embodied cognition through multimodal, kinesthetic, and somatic hypermedia design' (Kenderdine 2016, 23) so that 'meaning-making becomes a whole-body endeavour' (Kidd 2018, n.p.). Stand-out immersive digital cultural heritage projects have shown great promise in this direction, providing an extended public with otherwise impossible, unique, and highly engaging cultural experiences. Nevertheless, the pursuit of providing embodied access to remote cultural objects and heritage sites to an expanded audience has obscured the effects of advanced technical systems on users, particularly in how these systems fundamentally reconfigure patterns of attention and engagement. Indeed, the museum sector's overwhelming preoccupation with access has focused critical discussions of the impact of digital cultural experiences predominantly on issues of authenticity and mediation – i.e., the faithfulness of their 'presence effects' in relation to the original encounter. Such focus ultimately presupposes a sense of transparency and, indeed, cultural normativity of the technical systems involved. As digital media/museum theorist Jenny Kidd (2018) incisively notes in her analysis of immersive experiences, many of these applications seek to capture the 'attentions' of visitors and users by any and all means possible, calling for an urgent consideration of the kinds of experience that they actually constitute. Crucially, beyond issues of authenticity and mediation, this urgent consideration also needs to extend to the ways in which the artificial modes and models of human perception provided by immersive digital technologies — namely virtual reality (VR) — are being recruited to affect different 'registers of presence' (Norman 1997), along with their impacts on users. Such work might help us go beyond the real-virtual divide that no longer makes sense in a world that creates ever-new 'configurations' between bodies and technologies, digital objects, and physical environments (Suchman 2012).

To situate this work and outline some of its ramifications for museum computing, this chapter begins by examining how museum studies have problematised the real-virtual divide, mainly in terms of authenticity and mediation. Critical discussion of user impact in the field has primarily focused on the quality of the experience and the corresponding level of user engagement. While both are crucial issues, they nonetheless overshadow some of the effects of coupling users with computational systems. Indicatively, the 'presence effects' of immersive digital cultural heritage experiences are chiefly conceived through the lens of two competing regimes of mediation: providing access to the original object either by means of an exact replica or an

interpretive model. As this part underscores, however, the fidelity of these regimes' presence effects substantially differs from that of fully immersive systems. Whereas the fidelity of the former is predicated on the simulation's relation to the original parent object, the fidelity of the latter depends on a credible sensorimotor-based feedback loop between the user's perception and action, and the computer-generated environment; that is, a new kind of perceptual reconfiguration of the agent/user. In this way, museum computing's overriding concern with cultural mediation has largely obscured rather than elucidated the nexus of immersion, presence, attention, and ability (i.e., the knowing/skilled body) at the core of immersive experiences, hence overlooking much of media studies, science, technology and society (STS), and media art histories' extensive critical thinking on the subject.

The next section delves into such critical thinking by tracing the historical development of Extended Reality (XR) technologies (which describes emerging immersive technologies that utilise Augmented Reality (AR) and VR head-mounted displays (HMDs), binaural audio and haptics, as well as other sensory interfaces) and the evolving understanding of these technologies' embodied affordances. What this brief historical overview reveals is that exploring the coupling of humans with computational devices can provide renewed insight into the use of immersive technologies to expand and enhance the public's access to culture. Finally, we consider the liminal case of modern and contemporary visual art, which effectively collapses the two regimes of mediation that digital cultural heritage relies on to provide contemporary audiences with access to remote cultural sites and artefacts. We argue that while cultural presence generally complicates the issue of technological mediation, modern and contemporary visual art actually provides a unique test case to disentangle immersion, presence, attention, and ability. This is because visual art's presence effects are sustained through a carefully constructed apparatus of display (the white cube gallery space) conditioning distinct perceptual modalities that are closely aligned with VR's visual, aural, and sensorimotor cues and affordances.

As the history of exhibition design reveals, museum experience, much like technology, is not natural – regardless of art historians and curators' continued emphasis on the unmediated face-to-face encounter with art. Indeed, museum experience is highly influenced and guided by those very sensorimotor contingencies, skills, and the kinds of bodies that can interact with them. These considerations are brought to the fore as a means to move beyond questions of authenticity, mediation, and engagement qua sustained interest. Instead, our goal in this chapter is to take into account the impacts of advanced technical systems' processing and subtle recalibration of modes of perception and attention in the curation and presentation of immersive cultural experiences.

From Embodied Access to Perceptual Politics

Since the first web-based museums in the mid-1990s, museum studies have problematised the real-virtual divide in terms of authenticity and mediation, viz.

'the antagonism between object versus reproduction and mediated versus unmediated experience', prioritising 'the unmediated experience of the museum object – "the real thing"' over the mediated experience via technology' (Schweibenz 2013, 39). This widespread credence in the primacy of the unmediated face-to-face encounter with 'the real thing' has not only delayed the cultural sector's uptake of digital technologies but also impacted the development of embodied museography. Museum studies and museum practice's recent sensory turn, for example, is initially driven by an essentialism that holds that media should be stripped away so that cultural objects can be directly encountered in an unmediated manner (Uchida and Peng 2019). Today, museum practitioners still frequently voice detraction over the use of digital technologies to mediate physical exhibits in-gallery: e.g., the use of mobile technologies, including phone-based Augmented Reality, to enhance displays through added informational layers together with multimodal, interactive modes of engagement (Marques and Costello 2018). These concerns are essentially rooted in the view that mobile devices draw visitors' attention away from the actual objects, suggesting enduring qualms over any technological interference with a more 'authentic' experience.

In contrast to face-to-face encounters, remote digital experiences of heritage sites or cultural artefacts presented in-gallery by means of a multimedia display or at home and on the go using a head-mounted display (HMD) or mobile device, do not pose the same mediation dilemma given the absence of an original parent object within reach. In such cases where direct access is not possible, digital mediation is necessary. Without it, there is no cultural experience to speak of. Nevertheless, until the COVID-19 pandemic, museums and galleries were equally reluctant to invest in remote digital experiences owing not only to a lack of resources and in-house digital skills, but also to the common fear that these applications might jeopardise in-person visits, leading to a loss in ticket sales, one of the main revenue streams of cultural organisations (Schweibenz 2019).

Yet, the pandemic lockdowns and recent hype around the Metaverse (Chen 2022) have considerably changed the field's outlook, prompting a reconsideration of remote digital cultural experiences. In addition to the intra-sectorial transformations brought about by the pandemic, the coinciding cultural and market hype around the Metaverse (the convergence of VR and something akin to the online platform Second Life) has also influenced cultural organisations to consider investing in networked XR (Extended Reality) technologies, given their promise to provide access to anything and anyone anywhere in the world. This sentiment is captured by Meta CEO Mark Zuckerberg's affirmation that 'we'll be able to feel present – like we're right there with people no matter how far apart we actually are' (Milmo 2021, n.p.). The explosion of virtual tours and proliferation of virtual museums during the lockdowns have certainly been a step in this direction and is indicative of a growing trend.

It then follows that as cultural institutions increasingly turn towards immersive and embodied technologies to enhance their brands, expand their

publics, and diversify their revenue streams, remote digital experiences are poised to reorganise the public's knowledge and perception of culture. It is therefore vital to unpack the ways in which the use of these technologies to generate the sense of the illusion of human interaction with objects, or even subjects, in a simulated informational reality actually impacts users.

So far, museum computing's chief preoccupation with access has focused critical discussions of user impacts on the quality of the experience and corresponding level of user engagement. Given the field's enduring pre-occupation with authenticity and mediation, the measure of success of digital cultural applications unsurprisingly hinges on the fidelity of their presence effects in relation to 'authentic' in-gallery experience: i.e., the ability of these digital applications to bring the object or site into believable focus, and thereby sustain user engagement. This prevailing outlook is clear, for instance, in Pujol and Champion's (2012) seminal paper 'Evaluating Presence in Cultural Heritage', which outlines six major aims for virtual heritage, none of which concerns technology's impact on users.

In addition to the paper's focus on the aim to capture objects of value and to present these as accurately and engagingly as possible, the authors define the notion of cultural presence as a combination of the feeling of 'being there' and 'the communicational, social and contextual goals of heritage through the addition of symbolism, explicit expression of self-identity, and learning' (2012, 88). Taking the presence effects of immersive systems as a given, they alternatively stress the notion that cultural presence is not simply achieved through credible reconstructions; cultural presence depends to a greater ex-tent on the simulation's thematic consistency with cultural conventions shaping the represented world (by contrast to its visual accuracy in relation to the measurable one).

In a similar vein, computational museologist Sarah Kenderdine (2016) distinguishes between two different mediating approaches in digital cultural heritage when defining the emergent practice of embodied museography: virtual cultural heritage and what she terms 'interpretive digital cultural heritage'. Virtual cultural heritage is a process of visualisation that mainly uses VR technology to present, preserve, conserve, and document natural and cultural heritage (Kenderdine 2016). The main preoccupation of this medi-ation strategy is 'replication and so-called re-construction or re-creation' (2016, 26). Interpretive digital cultural heritage, which Kenderdine advocates, moves beyond the goal of developing increasingly sophisticated digital models to explore 'strategies for creating and translating the digital record into narratives of engagement' (2016, 27). Rather than facilitating didactic learning and transporting participants back in time (like virtual cultural heritage), interpretive digital cultural heritage relies on cultural translations in order to make its object into a living asset.

In effect, these two distinct digital cultural heritage strategies are aligned with what Bruno Latour (2007) describes as the two regimes of mediation that enable 'la mise en présence' – i.e., allow for presence to be staged or to

take place. Crucially, each of these regimes of mediation carries a different understanding of fidelity. In virtual cultural heritage, fidelity provides direct, if distant, access to the original by means of an exact representation, which affords the user discovery. Virtual cultural heritage belongs to this regime. Such fidelity enables the public to 'travel back in time' and gain access to the original by means of an increasingly accurate replica – presumably as VR technology is perfected. In contrast, fidelity within the interpretive cultural heritage implies a re-*presentation* by means of a cultural translation, viz. a new presentation adapted to a given context, which affords the user revelation. By multiplying cultural translations, it strives to make the original come alive for diverse, contemporary audiences.

What transpires from these two regimes of mediation is that owing to museology's focus on access, the mark of fidelity that has evolved around digital cultural experiences considerably differs from that of the advanced technical systems used to create them. Whereas the fidelity entailed by the two regimes of mediation described above depends on the representation's relationship to the original cultural object or site, the fidelity of fully immersive technical systems such as VR depends on credible sensorimotor-based feedback loops between the user's perception and action and the computer-generated environment. Otherwise put, the fidelity of a VR simulation is not *strictly* based on its capacity to provide access to a thing: i.e., to generate authentic presence effects so as to bring an object or site within believable reach. Instead, it involves reconfiguring the user's perceptual cues and affordances; the user's sensory perception of, and sensorimotor interactions with, the object or site.

One common example of this includes the increased use of spatialised audio techniques such as HRTFs (head-related transfer functions) that rely on sensor-based head-tracking technologies. These mathematical models, which simulate the time delay through which sounds arrive at our ears, enable wearers of head-mounted displays to localise virtual sound sources as they would with their ears in the physical world. More interesting is the use of audio spatialisation software such as Google's Resonance Audio plug-in, which can be used to model rooms with a wide range of materials, from grass to glass, and which allow users of VR devices to physically move through 'impossible' acoustic spaces. Other examples include the recent (as of 2023) availability (to developers of VR applications) of so-called video-based 'passthrough' technology in such commercially manufactured headsets as the Oculus Quest 2 (Anthes 2019).

Passthrough, an early kind of 'spatial computing' (Balakrishnan et al. 2021) technology, aims to simulate the experience of worn Augmented Reality, long depicted in science fiction films, in which cameras in the head-mounted display gives a real-time feed of what the user would see if they were directly looking into the real physical world. Passthrough presents a strange perceptual set of cues for the wearer. Due to the planar, non-stereoscopic cameras inside the headset, the resulting image (currently black and white)

appears to be 2D. The experience of the wearer, however, is that of moving inside a real, physical 3D environment to the point where virtual objects inserted into the passthrough need to be navigated as if they were really there. In other words, providing access to a virtual object does not hinge on creating an exact replica or interpretive augmentation of that object or site, but rather on creating a new kind of perceptual 'retooling' of the agent/user, as is evident in a few of the examples above.

While the rise of embodied museography has been driven by the belief that the more visitors/users are physically, emotionally, and psychically engaged, the more they will benefit from the cultural experience and gain agency, in effect, as the examples above show, advanced technical systems deploy artificial modes of sensing and affordances that entrench a certain political framework of perception and action. By focusing on the authenticity of digital cultural applications through their ability to grant access to a cultural object or site, the field has unfortunately mostly overlooked an entire history of critical thinking arising in media studies, science, technology and society (STS), and in media art histories (Grau 2010) around XR's reshaping of concepts such as immersion, presence, attention and ability (i.e., the knowing/ skilled body). As a result, it has not adequately considered and addressed these systems' perceptual assumptions and attention demands on users' minds and bodies.

Machine–Human Couplings

It should be clear from our argument that the relationship between presence and engagement in new digitally augmented cultural contexts is far more complex than simply that of the inaccessibility or 'corruptibility' of the real object due to the introduction of new digital technologies into institutions. Moreover, while many museum professionals assume that the introduction of XR approaches is a new techno-cultural phenomenon, the history and critical discourse around such technologies bear some discussion. VR/AR's periodisation dates back to military origins in the USA in the 1960s, with increased applications in gaming, space exploration, and industry in the 1990s (Chesher 1994; Mazuryk and Gervautz 1996). More recently, however,

VR/AR's role as key infrastructure in Meta's (Facebook's) future social media platform — also called the 'metaverse' — has brought these technologies into broader public awareness.

XR consists of two conceptual-technological paradigms: VR and AR. VR uses a headset to surround the wearer with a closed-off world of computer-generated images and sounds based on sensing head and body movement, while AR overlays and integrates digital information into a real environment (Azuma 1997). While both paradigms have different historical-technical genealogies, they both can be seen as 'reality media' which 'place themselves figuratively or physically between us and our perception of the everyday world and, in this sense … redefine or construct reality itself' (Engberg and Bolter 2020, 85).

AR has been primarily accessed on mobile devices, but large tech companies such as Microsoft, Google, Meta, and others have recently begun designing wearable AR headsets (e.g., Microsoft's HoloLens or Magic Leap's Magic Leap One).

What is key about XR is its focus on the sensorimotor capacities of the wearer. This emphasis on the primacy of the sensorimotor body (Hansen 2012; Paterson 2021) as a 'technology interface' (Rheingold 1991; Ihde 2002; Sherman and Craig 2018) for embodied action, in which 'material structures are interpenetrated with informational patterns' (Hayles 1993, 148) and 'lay bare the enabling constraints of the body' (Hansen 2012:15) characterises XR as a 'perceptual technology' (Waibel et al. 2009) that models human perceptual mechanisms and traits. This embodied perspective is in contrast to scholars who situate VR/AR in the history of ocular-centric media, from frescoes and nineteenth-century panoramas (Grau 2004; Manovich 2006) to cinema and television (Engberg and Bolter 2020). For example, one of the earliest proposals for AR/VR is computer scientist Ivan Sutherland's 1965 article 'The Ultimate Display'. Sutherland's much-cited text describes both the 'immersion of an individual in a synthetic environment' by way of a visual scene that would update based not only on the 'user's head movement' but also by way of 'kinesthetic display' through the control of interface devices via muscle movement (1965, n.p.).

The tension between body and information also appears in related human-computer interaction (HCI) and computer graphics research, which argues that XR is anchored in the 'human experience of mediated space' (Barba et al. 2011), focused around vision. But there is also a strong claim that XR is a clear example of 'embodied interaction' (Dourish 2001) focused on 'the reality of experience in which the interplay between embodied perception and action becomes the 'focal point of design' (Flach and Holden 1998, 94).

The question of what kinds of gendered, racialised, and disabled bodies and subjectivities are included in XR's embodied vision, however, is mainly left out of technical research. In the 1990s–2000s, feminist media scholars and cultural scholars of technology (Benedikt 1991; Stone 1991; Bukatman 1993; Bailey 1996; Munster 2006) critiqued VR for its 'digital disembodiment' (Ajana 2005). VR's highly gendered tendencies also 'identify masculine subjectivity with mind and female subjectivity with body' (Hayles 1996, 3) and stage mainly White-based 'reenactments of Western cultural consciousness' (Todd 1996, 192). Importantly, media studies scholar Anna Munster points to a still under-researched and unresolved tension: the very 'strangeness of embodied technological experiences' in which technological spaces like 'VR environments produce both dematerialized senses of the self and intensified corporeal sensations or actualizations' (2006, 91). This tension strongly resonates with Viseu and Suchman's (2010) broader argument around the notion of *augmentation* in wearable technology, as 'the coupling of humans with computational devices, taken to extend the body's native capacities through information processing', 2). Indeed, we might gain insight from this

fundamental epistemological tension of embodied sensorimotor action that is sensed, captured, analysed, and processed by computational systems in contrast with the belief that interaction with and within such systems eventually becomes transparent and 'naturalised' (such as what historically happened with cinema). Such a distinction could thus provide new practices for the use of immersive, worn technology to design remote cultural experiences rather than simply focusing on how digital cultural applications shape access to content (i.e., the quality of the rendering and degree of user engagement).

Reconfiguring the Viewer

So far, immersive digital cultural experiences seem far from ideal test cases to explore the still under-researched tension of embodied technological experience (Munster 2006). As the accounts of cultural presence described suggest, far from disambiguating its effects, the cultural mediation involved in the design of these experiences only adds a further layer of complexity to the question of technological mediation. This partly explains why assessments of immersive digital cultural experiences have mainly focused on the accuracy/authenticity of the rendering and the degree of user engagement in relation to the applications' intended purpose in contrast to how the technical systems involved process and reconfigure users'/visitors' perception and attention. In this sense, these arguments have ignored a key historical element in the social-technical context of such immersive systems: that these systems have long been considered 'perceptual technologies' in that they attempt to model and simulate human perceptual mechanisms in order to 'establish entirely new configurations and parameters of perception and agency' (Denson 2016, n.p). Certainly, these assessments have contributed to exposing the clunkiness of existing technical systems (e.g., VR's graphic shortcomings such as lack of realism; difficulties in ergonomics, and wearability) in light of the particular demands of specific cultural objects. Importantly, however, their overriding focus on cultural understandings of presence in terms of objects has also obscured the broader role that these systems' reconfiguration of perception play in shaping user experience, as well as the need that such reconfiguration be taken into account in how digital cultural applications are curated and exhibited.

While granting that cultural forms of presence complicate efforts to understand the impacts of embodied technological experiences, there is one cultural object that could provide a unique test case to decouple these experiences' entanglement of immersion, presence, attention, and ability: modern and contemporary visual art. While visual art is often thought of as the cultural object *par excellence*, it does not pose the same mediation dilemma (replication versus interpretation) as cultural heritage. This is because modern and contemporary visual art's presence effects are not contingent on the same mediation regimes that are necessary to bring cultural heritage into focus for today's audiences. Aesthetic experience, in this case, is

otherwise predicated on a supposedly direct (i.e., unmediated), face-to-face encounter with art that precludes augmentation and/or multimodal interaction. In other words, fidelity to the work proscribes interpretative latitude.

In reference to the two aforementioned mediation regimes, creating an accurate replica of modern and contemporary visual art, the main challenge of virtual cultural heritage, is a fairly straightforward matter: it merely depends on adequate technical means. Unlike cultural heritage (e.g., archaeological artefacts and heritage sites), modern and contemporary visual artworks are almost always intact and readily available for reference purposes: they are not worn, damaged, or destroyed, barring the need for speculative enhancements and reconstructions (e.g., restoring original colouring, assembling broken pieces or reconstituting ruined architectural structures). In fact, Latour and Lowe (2010) have gone so far as to assert that under the right technical conditions, the aura of the original can migrate to the copy, thus supporting the premise that identical presence effects can be achieved in the digital domain.

Meanwhile, conceiving an adequate interpretation of the work, which is the main challenge of interpretive digital cultural heritage, can actually prove detrimental to visual art's presence effects, which are essentially made manifest through the user's skilled engagement: i.e., through enactive viewing (Noë 2012). Unlike cultural heritage, the historical contextualisation of recent artworks is unnecessary given that the 'artist and viewer are contemporary and take part in the same material culture' (Brinck 2018, 206). The viewer is expected to directly interpret the work without excessive signposts. Accordingly, most in-gallery curatorial strategies today neither mediate modern and contemporary art by providing supplementary information next to the works on display nor do they design elaborate multimodal exhibition scenographies. Instead, contemporary exhibition-making practices typically minimise any interference with the visual impact of singular artworks. This often means that written and acoustic communication devices (e.g., wall texts, labels, audio-guides) traditionally used to convey supplementary information to viewers to facilitate their interpretation of the works are deliberately omitted from the exhibition space. Generally speaking, contemporary curators merely contextualise visual artworks in-gallery by selecting and arranging them within a white cube space following standard display conventions so as to support individual aesthetic experience. In sum, visual art's presence effects are not contingent on the augmentation of objects but, rather, on the construction of space. This spatial configuration typically signifies a pared-down environment — stripped of extraneous architectural and design features liable to compete for optical attention — so as to minimise any and all distractions, and thus facilitate artistic appreciation.

Notwithstanding this, such a pared-down environment does not mean that the art gallery is an open site fostering free agency, as is often assumed. Even while many art historians and curators continue to uphold the idea of an unmediated encounter with art that endows the public with agency, the white

cube in reality precisely configures the public's experience of modern and contemporary visual artworks. If aesthetic experience is not contingent on a mediation regime designed to grant contemporary viewers access to historically and culturally remote objects, it still depends on a carefully configured apparatus of display that conditions specific attention demands and modes of engagement through calibrated sensory modalities and a narrow set of affordances amounting to a highly constructed experience.

As the history of exhibition design reveals, the white cube is, in fact, the culmination of two-hundred-years' worth of curatorial experiments in perception and attention, notably driven, at the end of the nineteenth century, by the latest research in sensory physiology (Cain 2017). Beginning with the emergence of the first major public museums in the eighteenth and early nineteenth centuries, these experiments aimed to establish the best possible conditions for the appreciation of visual art, meaning, among other, making art 'more accessible from a sensory perspective' (Maak et al. 2011, n.p.). Thus, early dense, floor-to-ceiling wall displays inspired by the Paris salons were gradually replaced by increasingly minimalist installations designed to facilitate direct optical perception and focus viewers' attention on singular artworks. This is achieved, for example, by repositioning individual artworks at eye level (i.e., the eye level of non-disabled adults of 'average' height) to minimise 'physical strain' (e.g., craning one's neck or bending down to view a work) (Cain 2017), thereby also limiting bodily engagement. Popularised in the 1930s by MoMA director Alfred Barr, the white cube is effectively the outcome of these different experiments. Its characteristic neutral walls, controlled lighting, absence of architectural ornamentation, and airy displays isolating individual works are all designed to train the visitors' attention on the art rather than the surrounding space, under the pretence of letting art 'speak for itself' (Cain 2017). Despite the numerous critiques that have targeted it over the years (most famously O'Doherty 1999), the white cube's enduring ubiquity in the art world close to a century later, speaks to the fact that it is still predominantly seen to offer the best conditions to experience modern and contemporary art. Indeed, the white cube's pervasiveness suggests that artistic appreciation is still widely considered to be contingent on a distraction-free environment, where embodied affordances are reduced to basic sensorimotor contingencies to bring discrete artworks into view: e.g., adjusting one's body in relation to the work by moving forward or backward to gain different perspectives and navigating through the exhibition space.

When considered towards the design of remote cultural experiences, it transpires that these 'ideal' conditions for the appreciation of modern and contemporary visual art are uniquely suited to being simulated in VR on account of the technology's sensorimotor features: namely, its head-tracking coupled with six degrees of freedom sensing technologies that enable freedom of movement. These features effectively meet the sensorimotor contingencies necessary to bring paintings, drawings, sculptures, photographs, and videos into view, especially in light of the fact that these static and moving image

works are typically installed at eye level, thus perfectly positioning them for HMDs' planar perspective and head-cum-camera apparatus. Even within the spectrum of extended reality, visual art still presumably favours VR over AR (or mixed reality (MR)) when it comes to remote, at-home experiences because AR and MR layer content directly onto the user's surrounding environment, which is generally too busy and distracting for a proper engagement with visual art, unless the physical environment in which artistic works are sited is directly taken into account.

What follows is that if VR's immersive modalities and affordances are uniquely aligned with and capable of supporting remote experiences of contemporary visual art (Janković et al. 2019), these experiences, in turn, provide a valuable test case to reflect on VR technology's attention demands and its impacts on user agency (e.g., how subtle perceptual distortions might affect the abilities normally picked up in-gallery through repeated engagement with art). In contrast to the recent trend in remote immersive experiences to augment visual artworks so as to support more embodied, multimodal, and/or interactive encounters[1] in line with the experience economy's mantra to capture the user's attention at all costs (Kidd 2018), what we are proposing is a different consideration of augmentation and embodiment. Our claim is that the way in which wearable technologies 'augment' users by sensing, capturing, analysing, and processing sensorimotor action should equally be taken into account in the curation and design of future immersive experiences, rather than assuming that the technology will eventually become transparent and 'naturalised' once software and hardware are perfected and VR's novelty effect wears off.

Even while the white cube art gallery may provide the best conditions for the appreciation of modern and contemporary visual art, this context does not guarantee, in and of itself, art's presence. In contrast to the aforementioned digital cultural heritage accounts of cultural mediation and cultural presence, philosopher Alva Noë (2012) points out that access to art is not *given* but rather *achieved*. In other words, art's presence effects are the result of a change in the viewer, not in the work (Noë 2012, 1) – a change that comes about through a process of enactive viewing (viz. skilful embodied looking). It follows that faithfully simulating modern and contemporary visual art's presence in the digital domain does not fundamentally entail creating virtual experiences that enhance or augment artworks, for instance by animating their content or by enabling audiences to 'penetrate' inside them.

The crucial point is that enactive viewing (the process through which audiences achieve art's presence effects) takes skill (Noë 2012) that is acquired through repeated engagement with art. And this is precisely where the nexus of immersion, presence, attention, and ability (i.e., the knowing/skilled body) comes to the fore. What transpires from this conception of 'access to art' – in contrast to cultural presence – is that VR's presence effects, which depend on sensorimotor feedback loops between the user and the computer-generated environment, are congruous with modern and contemporary visual art's presence effects. These are likewise achieved through a visual and

sensorimotor engagement with the work. The congruity of such presence effects thus opens up grounds for an exploration of VR technology's perceptual 'retooling', along with any competing attention demands between maintaining a sense of being there (in the virtual environment) and bringing the artwork into focus. In this sense, one possible trajectory would be to incorporate cues raising awareness of how technology processes and reconfigures attention and perception in immersive experiences of modern and contemporary visual art. For instance, analytics tracking eye movement and navigation could be overlaid, or provided at the outcome of the experience. Alternatively, users' body position and head movements could trigger the appearance and disappearance of artworks, or remodel the environment. Or again, the virtual environment could alternate between 2D passthrough and 3D spatial rendering depending on whether users are focused on image-based or installation works (concurrently shifting users' appearance from a video image to an avatar or disembodied consciousness).

A recent empirical study (Deng et al. 2019) examining the impact of highly vivid and interactive[2] simulations of art exhibitions on users' consumption intention (i.e., users' intent to visit the actual show) has hinted at this significance of the skilled, enactive body. Among the different experiments conducted, one involved users with high enduring involvement (i.e., accustomed to visiting art exhibitions) and another with low enduring involvement (i.e., users with only occasional contact with art exhibitions). These groups were asked to evaluate their intent to visit the Art Institute of Chicago prior to and after exploring an online, screen-based, 3D walkthrough of the museum created using 360° video captured through Google Street View. The study found that engaging with the 3D walkthrough significantly decreased consumption intention in users with low to moderate enduring involvement. This was owed to the perceived similarity of the simulation with what they imagined to be the actual exhibition. In contrast, the virtual experience either had no incidence or actually increased consumption intention in users with high enduring involvement because these users picked up and focused on the differences between the simulation and what they imagined to be the actual experience, extrapolating based on other in-gallery visits. Whereas the 'elitist' divide between art experts and the general public has traditionally been based on the viewer's level of cultivation and art historical knowledge, Deng et al.'s (2019) study suggests that highly vivid and interactive virtual experiences of modern and contemporary visual art threaten to drive a further wedge between experts and non-experts by exacerbating already unequal abilities (skilled engagement) acquired through repeated experience (enduring involvement).

This observation is merely the tip of the iceberg. The cultural sector's increasing reliance on immersive systems to provide remote cultural experiences to a much wider public than in-gallery visitors raises a vital set of questions around the growing coupling of humans with computational systems that the museum computing field has yet to address. This lack is mainly on account of its overriding preoccupation with providing better-quality

digital access to culture. Yet, as art organisations increasingly rely on advanced technical systems to deliver vivid and engaging digital experiences, how will this coupling reconfigure visitors' perceptual cues, affordances, and forms of interaction? If non-expert publics cannot tell the difference between virtual and real experiences, and increasingly engage with art through digital applications given the time and cost of visiting physical galleries and museums, what kind of engagement skills will they gain? How will this reshape a culture which increasingly hybridises the physical and the digital?

Conclusion

We have argued that the deployment of new digital technologies within museum contexts is a more historically, conceptually, and social-culturally complex task than at first seems apparent. Indeed, as immersive technologies become increasingly prevalent across cultural, educational, financial, and social life, these systems will demand more intensive debate on how they work, what they do, and what effects on the world they will have. One particular avenue is that these technologies do not simply 'impose' a technologically mediated, disembodied perspective on an otherwise unmediated optical visual art space. As Noë (2012) points out, the experience of art itself demands perceptual skill through sensorimotor engagement, and it is vital to take this into account in its historical, cultural-social contexts (particularly around how technology tries to model this in human beings) when thinking about deploying newly emerging immersive technologies within such contexts. This is especially urgent now given the string of recent studies (including Gulhan et al. 2021 in the context of modern visual art) that have set out to demonstrate the equivalence between VR simulations and actual experience to justify the naturalised use of virtual environments as viable substitutes for empirical research into human experience, including aesthetic experience, beyond the laboratory setting.

Uncritically taken on board, these studies suggest that merely replicating exhibitions using VR would suffice to democratise access to art by providing an equivalent experience with supposedly identical effects to a wider public. Instead, our contention is that the similarity between these experiences offers an opportunity to critically reflect on the perceptual contingencies that museum experiences, both real and virtual, produce, the kinds of bodies that can engage with them, and the agencies that they foster so that these considerations can be taken into account in the curation and design of future cultural experiences.

Notes

1 In actual space, a prime example is the highly popular multimedia exhibitions presenting the work of famous artists, including Vincent Van Gogh (e.g., 'Beyond Van Gogh: The Immersive Experience') and Pablo Picasso (e.g., 'Imagine Picasso: The Immersive Experience') that immerse visitors in specially designed architectural environments overlaid with floor-to-ceiling, oft-animated HD projections of blown-up artworks and magnified details unfolding to the sound of dramatic musical scores. In virtual space, another example consists of VR experiences that enable users to virtually enter and explore the spaces depicted in two-dimensional artworks: e.g., artist Frederick Baker's *Klimt's Magic Garden* (2018) based on Gustav Klimt's 1905 sketches *Expectation* and *Fulfillment* for the mosaic frieze in the dining hall of Stoclet House, and the VR experience *Dreams of Dalí* (2016), which takes place inside the fantastical environment of Salvador Dali's painting *Archaeological Reminiscence of Millet's "Angelus"* (1935).
2 In this case, interactive signifies the possibility to zoom in on the works and virtually navigate through the exhibition space.

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