Knowing VR through Practice

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Abstract

How might we come to *know* the particular qualities and affordances – as well as the constraints and biases – of the medium of Virtual Reality (VR)? Responding to this situation from the perspective of *Educations and Societies*, we submit that more nuanced understandings of the qualities (aesthetic, narrative, experiential) and affordances (conceptual as much as technical) of the medium can be gained if VR is approached as a form of cultural *and* research practice. In this paper we will present a curated selection of innovative creative research projects developed at SensiLab, a trans-disciplinary research centre based at Monash University in Melbourne, Australia; and do so in the interest of exposing some of the investigative ways that practitioner-researchers (media artists, creative technologists, content producers) are extending understandings of both studio practice and the medium itself by engaging deeply, experimentally and reflexively with immersive imaging technologies. Illustratively, these dynamic, discovery-led *PhD* projects – undertaken by Sojung Bahng (visual artist and filmmaker), Oscar Raby (VR director) and Lucija Ivšić (performing artist) – reveal how we might come to *know* the medium *through* practice in an iterative way by investing in creating, making and exhibiting throughout the research process.

Keywords

Extended Reality (XR), Virtual Reality (VR), Cultural Practice, Practice-Based Research

Introduction

Extended Reality technologies, such as Virtual Reality (VR), appeal to creative practitioners (filmmakers, visual and performing artists alike) who are drawn by the promise of augmented and virtual reality technologies for producing ever-more immersive, compelling and affective experiences. This paper asks: How might we come to *know* the particular qualities and affordances – as well as the constraints – of the medium of Virtual Reality? We submit that by approaching VR as a form of cultural *and* research practice, more nuanced understandings of the aesthetic, narrative, experiential qualities of the medium and its affordances (conceptual as much as technical) can be gained. Featuring a cross-section of representative projects developed at SensiLab[1], we will ask questions, offer explanations and share reflective insights gained through practice-based research investigations that thoroughly embrace a culture of experimentation.

Through curating a series of project "snapshots" that highlight the innovative creative research being undertaken within SensiLab, our exposition will showcase some of the investigative ways that practitioner-researchers (media artists, creative technologists, content producers) are extending understandings of both studio practice and the medium itself by engaging deeply and reflexively with immersive imaging technologies. Selected projects by Sojung Bahng (visual artist and filmmaker), Oscar Raby (VR director) and Lucija Ivšić (performing artist) embrace some of the broader challenges of XR by seeking to define the language of new media forms and exploring process and procedures (technical,

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[1] SensiLab is a trans-disciplinary research initiative hosted at Monash University in Melbourne Australia. Conceived as a creative space where new connections can be made between Art, Design, Computer Science and Technology, our ethos acknowledges that new thinking emerges from diversity, genuine collaboration, and an openness to the unexpected. Comprised of story tellers, artists, makers, hackers, designers, developers, musicians, coders, scientists, theorists, luthiers and builders, our collective research explores the innovative creative applications and undiscovered opportunities of technology. Research undertaken by members of SensiLab is typically interdisciplinary, linking IT and creative technologies with fields such as health, urban planning, design, media arts, as well as cultural heritage. Working across disciplines, methods and materials, we approach each inquiry with curiosity and rigour in order to learn through creating. We acknowledge process as well as outcome, and value the experiential and the sensory as modes of knowledge. VR as Cultural Practice is one of the lab's designated research themes along with AI as Cultural Practice, Speculative Design and the Multisensory Museum.

creative and critical) that stretch the narrative and experiential parameters of their respective practices. Bahng, Raby and Ivšić will share grounded insights into selective aspects of their creative research and how their studio investigations are testing the boundaries of the VR medium itself, in relation to spatial imaging, storytelling and exhibition-making. Illustratively, these dynamic and discovery-led *PhD* research projects will reveal how new discoveries are made iteratively through making, building and creating throughout the research process, not only at the culmination of their inquiry. Together, these inspiring case studies challenge preconceptions about VR specifically, and where the medium fits into the repertoire of expressive, investigative and experiential options available to visual artists, designers and researchers alike.

Frames of Reference: VR as a form of cultural and research practice

Defining VR as cultural practice

The potential of immersive digital technology to tell stories in powerful, new and affective ways has been embraced by contemporary filmmakers and visual artists. At the risk of over-simplifying the range of motivations that drive creative practitioners, it is not an especially remarkable observation to say that 'as with the application of all new technologies, artists are driven to probe, experiment with and sometimes break the machine, challenging the possibilities of the medium' [1]. Even while the promise of Virtual Reality (VR) has been around since Jaron Lanier's pioneering efforts in the 1980s, cultural producers from across the contemporary visual and performing arts spectrum, ranging from Ólafur Elíasson to Tsai Ming-liang and Björk, continue to be drawn to the much-heralded ground-breaking potentialities that exist between immersive storytelling, filmmaking and Visual FX cinematography for VR as an art form. For instance, Marina Abramović's *Rising* (2018), produced in collaboration with Acute Art and realised using the HTC Vive platform, exaggerates the heightened sense of self-consciousness that the medium can precipitate; while *Clouds over Sidra* (2017) – produced in collaboration with Samsung and the United Nations by Gabo Arora with filmmaker Chris Milk's VR-dedicated production studio Vrse – provides a compelling

example for how a strong empathetic connection between the viewer and subject can be achieved with VR cinema.

However, developing other ways of "seeing" that extend beyond the depiction of virtual forms demands an appreciation of the actual nature of the immersive experience of Virtual Reality. As in the case of Alejandro Iñárritu's celebrated *Carne y Arena* (2017), the visual and narrative potential of Virtual Reality is taken beyond the pre-defined boundaries of the moving image by extending the application of digital technologies associated with computer-generated imaging from the virtual screen into the real space of gallery installation. In order to connect the subjective act of viewing with the social – and, by extension, political – space it's located within, we would do well to consider how we might come to know VR as a properly experiential medium, rather than an exclusively visual one [2].

Defining research practice

As a creative technologies laboratory spanning the faculties of Information Technology and Art Design and Architecture, each with their own established disciplinary foundations, SensiLab finds itself in a unique position to demonstrate, as well as critically reflect upon the nature of research and its contribution towards realising what our *data future*[2] might look like. At its core, SensiLab is driven by the creative engagement of people with technology. Despite the diversity of research areas and applications that SensiLab embraces – from virtual heritage reconstructions using VR technologies to specialist medical wearable devices, new performative musical instruments and creative artificial intelligence systems, all projects have their foundation in practice-based research.

Practice-based research (or Research-creation[3] as it can also be known) is a mode of enquiry that seeks to generate new knowledge through practice. Often, this mode draws upon investigative processes that involve gaining knowledge through physical exploration and direct action; or achieving *know-how* by engaging creatively in making, doing, building, experimenting and experiencing. It has been argued that 'the innovative and critical potential of practice-based research lies in its capacity to generate personally situated knowledge and new ways of modelling and externalising such knowledge while at the same time, revealing philosophical, social and cultural contexts for the critical intervention and application of knowledge outcomes' [3]. While practice-based and practice-led research[4]

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[2] The Monash Data Futures Institute (MDFI) was established in 2019 as a university-wide initiative bringing together leading cross-disciplinary expertise to address future transformations driven by Artificial Intelligence (AI) and other forms of digitalization in relation to questions of human empowerment, sustainable development and positive change.

[3] According to the Social Sciences and Humanities Research Council of Canada (SSHRC), Research-creation can be defined as an approach to research that combines creative and academic research practices, and supports the development of knowledge and innovation through artistic expression, scholarly investigation,

and experimentation; where the creative process is situated within the research activity and produces critically informed work in a variety of media (art forms) whose contribution to knowledge cannot be reduced to its interpretation or analysis.

[4] Linda Candy distinguishes between the different types of contribution that practice-based and practice-led research make. In the case of practice-based research, the contribution to knowledge recognizes the artefacts themselves as creative outcomes, manifestations or embodiments of the research; whereas, in practice-led research, the contributions concern new knowledge about practice itself and its implications to the cultural field. See: Linda

have existed for many years in the creative arts – in areas such as design, fine art, architecture, music and performance – the research cultivated in SensiLab aims to expand the domain and enlarge the scope of how research through practice might be applied in the creative technology field.

Broadly speaking, knowledge can be classified into forms of propositional knowledge (facts), procedural knowledge (skills), and acquaintance knowledge (objects). Tacit knowledge, on the other hand, is, by definition, an implicit form of knowing that cannot readily be communicated linguistically, where learning how to do something can only be gained through the act of doing it. In effect, "knowing-how" as opposed to "knowing-that". This kind of knowledge is dynamic, embodied and inseparable from the experience of doing; it recognises that all knowledge is situated in activity, as 'practices of knowing in being' that are integrally bound up with their social, cultural and material contexts [4].

For the most part, what practitioner-researchers do involves building physical or virtual artefacts and prototypes that in some way embody the ideas they are thinking about through making, or that test the physical, functional or material aspects of the subject of their research inquiry. Even in the age of digital tools and methods of fabrication, situated cognition, performativity and materiality play important roles in this investigative process, something that is often underestimated in technology-driven research. These processes draw on the individual nuances and subjective nature of experience, often multi-sensory, including kinaesthetics, proprioception, touch, sound, light, even smell and taste [5]. Ultimately, it is the connection between human experience and artefacts – including artworks and design prototypes – that embodies critical knowledge.

Because of the difficulty that codifying such knowledge implies, it is important to acknowledge the challenges that tacitly acquired understanding presents for articulating and sharing this "know-how" beyond the researcher themselves. The work of Donald A. Schön has been highly influential in developing just how vital the act of reflection is to creative forms of knowledge [6]. Applicable to design problem-solving as much as knowledge production, Schön identified reflective practice as a continuum that operates across three levels: 'knowing in action' (which is driven implicitly by the expertise of the practitioner); 'reflection in action' (which involves conscious acts of improvisational problem-solving that occur during the process of production); and 'reflection on action', whereby the practitioner considers their actions in an effort to articulate their decision-making process and form understanding of their practice. It follows, that it is incumbent upon the practitioner-researcher to recognize the relationship between materiality and discourse involved in their creative research – or what might be described as a 'material-discursive practice', whether through reflective

analysis or as a means of maintaining a reflexive engagement with the very basis of practice itself. [7] While apparently at odds with the more objective and rationalistic emphasis associated with scientific research, research through practice is not in conflict with this, but rather gives due voice to subjective experience and demonstrates the (critically) important values that experience – in all of its specificity (of culture, gender, positionality, affect and so on) – brings to an enhanced (and increasingly nuanced) understanding of the world.

Three Practice-Based Investigations

The curated exposition that follows will reveal some ways that we might come to *know* the medium *through* practice (in both formative and summative terms). We hope that by demonstrating how a spirit of adventurous inquiry infuses a practice-based research methodology that emphasises the values of cultural and knowledge production in equal measure, these short, focused accounts by Sojung Bahng, Oscar Raby and Lucija Ivšić will illustrate some guiding concepts applicable to creating affective artworks and mediated experiences that will both inform and inspire others to embrace the challenges of VR in critically reflexive ways.

Sojung Bahng

Sojung Bahng's PhD research (*Cinematic VR as a reflexive tool beyond empathy*) investigated VR as a cinematic and rhetorical device to elicit self-reflection and awareness in sociocultural contexts. Seeking to go beyond the notion of an *empathy machine*[5], a concept that is too-readily used as a means of understanding of quality of viewing experience associated with the medium itself, Bahng's investigations focused on ways that presence and embodiment can elicit a sense of identification and critical reflection in the viewer. The set of VR projects produced as part of her practice-based research – *Floating Walk – Gangnam Kangaroo* (2017)*, Anonymous* (2019) and *Sleeping Eyes* (2020) – emphasised the limitations of immersive engagement. Instead, she designed storytelling methods aimed at promoting a sense of physical estrangement and cognitive disorientation. Through introducing more reflexive elements into the cinematic narrative of these works, Bahng provided the viewer with scenarios to explore unfamiliar sensory experiences that encourage them to reflect on their own sensations rather than simply immersing themselves in the virtual environment.

For Bahng, VR was approached as the main artistic medium for her research practice. Her studio-based investigations exploited three constraints associated with VR media, namely 360-degree video, mobile interactive VR and

Candy, *Practice based research: A guide* (Sydney: Creativity & Cognition Studios, University of Technology, Sydney, 2006).
[5] The term *empathy machine* was first used by Chris Milk at the TED conference in 2015 to describe the propensity for VR to democratise human experience and strengthen the empathetic

connection between the viewer and subject(s) represented in the media. See: Chris Milk, "How virtual reality can create the ultimate empathy machine", Ted website, accessed October 22,.2019, https://www.ted.com/talks/chris_milk_how_virtual_reality_can_create_the_ultimate_empathy_machine?

navigable interactive VR. Her creative research was influenced conceptually by the *estrangement effect*[6]. Inspired by German playwright Bertolt Brecht's use of various staging and acting techniques to break simple immersion and prevent audience members from identifying with the characters and situations in his stories, she translated this approach (which is also referred to as the alienation- or distancing-effect) to cinematic VR storytelling in order to promote embodied reflexivity in more phenomenological and ontological ways. Distinctively, Bahng also drew upon Buddhist philosophy, particularly in relation to *meta-awareness*[7], which is a mode of self-reflexive awareness that lets people observe their multiple sensory experiences while experiencing them. Across the studio processes involved in conceiving, designing, prototyping and producing these creative works, Bahng was able to identify and test the function of reflexive elements based on certain technical constraints associated with various forms of spatial interaction, and through embracing experimentation, managed to introduce new storytelling and aesthetic methods into her work.

Bahng's creative processes meshed productively with the theoretical and methodological questions guiding her research. She asked: What are methods and techniques related to Cinematic VR that enable the medium to be approached as a reflexive tool that exceeds certain idealised framings of empathy? How can reflexive VR storytelling effectively elicit self-reflection in response to sociocultural situations and contexts? And ultimately, how might Cinematic VR artworks provide viewing experiences that encourage the viewer to critically reflect on issues of alienation, disconnection and isolation? These lines of enquiry enabled her to examine how the technical infrastructure and material properties of VR shape the viewing experiences associated with each of her artworks. For example, *Floating Walk – Gangnam Kangaroo* harnesses the potential of a 360-degree video as a means of autobiographical self-expression and an autoethnographic tool that promotes the reflexive thoughts about migrant identity. *Anonymous* contributes design factors and technical implementations for using VR to elicit self-reflection on loneliness and death. While *Sleeping Eyes* demonstrates how phenomenological and participatory engagement in VR storytelling can elicit critical awareness of narcolepsy and counter social ignorance. (Figure 1) Collectively, this body of creative research provides in-depth knowledge about reflexive modes of immersive storytelling while considering the various technical, design and narrative elements available to Cinematic VR in a creative-critical way.

Figure 1. Sojung Bahng, *Sleeping Eyes* (2020). Variable; 8-12 mins. Production still. © The Artist.

Oscar Raby

Oscar Raby is an accomplished VR director and documentary producer working in the field of real-time narrative VR. Through his production studio, VRTOV[8], he has developed corresponding creative workflows and technical pipelines tailored to VR media production. Inspired by Dziga Vertov, the Russian filmmaker who explored the potentialities of new moving-image technology at the beginning of the 20th Century, Raby's critical approach towards understanding VR through knowing its *technê*[9] exemplifies that of a 'reflective practitioner'. This stance recognises that the type of innovative applications that Vertov and his collaborators derived from the movie camera were not centred on the way they embraced this industrialised piece of technology, but rather in how they embodied its unique language, as expressed in its famous dictum: 'I am a mechanical eye. I, a machine, show you the world as only I can see it. (…) I decipher in a new way a world unknown to you'. [8]

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[6] The *estrangement-effect* was Brecht's principal means of overturning a sense of unwitting complacency in the viewer (and by extension society at large). As an aesthetic technique, Brecht would 'stage theatre in such a way that the viewer is denied the habitual comfort of forgetting that they are watching a play and becoming (what psychoanalytic film critics call) sutured into the events on stage. Thus, he would discourage actors from "becoming" their characters and using that to elicit the empathy of the audience, preferring that they create a sense of "distance" between themselves and their character that would put the audience in two minds about what they were watching' (Buchanan 2018).
Ian Buchanan, *A Dictionary of Critical Theory* (2nd edition) (Oxford: Oxford University Press, 2018). Also, see: Bertolt Brecht, *Brecht on Theatre* (New York: Hill and Wang, 1964).

[7] Meta-awareness involves the ability to take explicit note of the current contents of consciousness. See: Bhikkhu Bodhi, "What does mindfulness really mean? A canonical perspective", *Contemporary Buddhism* 12(1), (2011):19–39.

[8] http://www.vrtov.com/

[9] The term comes from the ancient Greek τέχνη (meaning art or craft) and used in general reference to a technique, principle, or method by which something is achieved or created. The Stanford Encyclopaedia of Philosophy makes note, however, that '*Epistêmê* is the Greek word most often translated as knowledge, while *technê* is translated as either craft or art. These translations, however, may inappropriately harbor some of our contemporary assumptions about the relation between theory (the domain of "knowledge") and practice (the concern of "craft" or "art")'. (See: https://plato.stanford.edu/entries/episteme-techne/)

In his case, Raby's current PhD research provides him with a platform to revise the assumptions that the medium carries along with it, on its technology layer (hardware, software) as well as the language embedded into it. His practice-led critique takes aim at the identifiable features that are already present (or *preset*) in the software environments used to create VR works, such as Unity's *Timeline* or Unreal's *Actors*, with the ambitious goal of defining a materiality that is not the simulation of something else, but the *actual* material of Virtual Reality.

For Raby, Virtual Reality has been instrumental in the observation of the thought processes involved in thinking about narrative circumstances, character motivations, and stories that ultimately become the experienced work. The self-referential nature of VR, namely, in that it presents a situation to be *acted upon*, is a place in which the moment of engagement with the spectator/user can facilitate the witnessing of their own thought process as they find themselves navigating the situation. This particular feature of the medium has two crucial aspects to it. Firstly, singular interpretation is actively resisted since real-time narrative is naturally expansive in the creation of meaning because this process is performed by a necessarily active *reader*. Secondly, the thought process exercised and witnessed *within* the artwork can be exercised again *outside* the artwork. It is in this realm that the work is capable of activating a powerful, political reverberance.
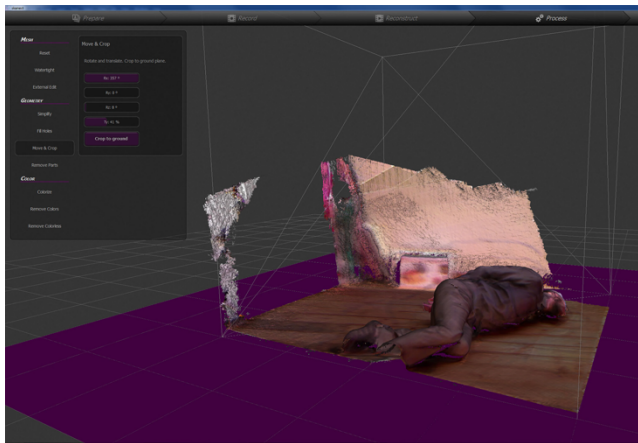

Figure 2. Oscar Raby, *Assent* (2013). Production screen capturing Skanect software showing a 3D scan of Raby as a character in *Assent*. © The Artist.

The current wave of VR has been regarded largely as a medium of isolation and individualism. Somewhat paradoxically, these same features place it in counterpoint to the barrage of social media engagement and connectivity that has prevailed in the same era. Discounting that the convergence of these two positions has already been well and truly initiated (one only has to note the prominence of Facebook in the technical and commercial drive of the technology), Raby's research inquiry presents an opportunistic and timely response that both takes stock of how the medium of VR has evolved under these cultural conditions and captures the epochal tension between the individual and the collective with a tool and language that stems directly from it.

At the current juncture of his research, Raby is progressively working towards codifying a practical method of development that prioritises the narrative construction of time over the prevalent metaphor of spatial simulation. As a way of bridging the concerns that have sustained his creative practice, Raby is revisiting the first work he produced in VR, *Assent* (2013), as the basis of self-reflective critique. (Figure 2) By deconstructing the technical and conceptual settings involved in its original production, Raby is seeking to expose how the experience of time is created in the medium. While the actual form that the thesis will assume remains open-ended, this inquiry-driven project illustrates how theory and practice might correspond with each other *productively* across inter-related processes of analysis, critique, prototyping and creative production; ultimately, giving rise to new knowledge about the time-based nature and programmed methodologies of VR.

Lucija Ivšić

Even though VR technology is not her main form of creative practice, it has nonetheless found itself playing an influential role in Lucija Ivšić's initial studio investigations as part of her recently commenced PhD studies. At this formative juncture, VR has served primarily as a didactic tool that has enabled her to create surreal environments to inspire further exploration. By purposing VR in this way, and through immersing herself in this investigative process, valuable insights into the kinds of relationships we establish with physical spaces have been gained. Ivcisc's research inquiry draws upon a posthumanist approach to identity. [4] The self is exposed, in all of its multiplicity and performative aspects, as a certain identity, character or role we play in accordance with the specific social context in which we perform. This act of identity formation might also be studied as an assemblage that does not begin or end with the individual but rather extends to surrounding places and objects. In this respect, the places we dwell in, like our home or workplace, simultaneously form and reshape our identity as well as their own behaviour through the relationship we maintain with them. This relationship is reciprocal and can generate unique behaviour patterns that shift or alter our perspective of how we experience and see places. That being said, throughout the preliminary experimental phase of her practice-based *PhD*, VR technology has enabled Ivšić to transform intangible and otherwise transitory qualities of spatialised data, acquired from 3D scanning and processing of point clouds, into a comprehendible whole. The dichotomy inherent to the VR medium, that being the blending of both cinematic (real) and artificial (game) spaces, is exactly what has allowed Ivšić to audio-visually (re)construct virtual environments that contain commonly imperceptible and ephemeral constituents that make up our real-worlds.

Figure 3. Lucija Ivšić, *What homes are made of: The Architecture of Displacement* (2021). Production still. © The Artist.

In *What homes are made of: The Architecture of Displacement* (2021), Ivšić has embarked on an artistic exploration of the intangible components that every place consists of. (Figure 3) By underscoring memory through visualising elements such as the fall of light on surfaces and the sound of materials, she is questioning the relationship we enact with the spaces we have known and come to know. Her work asks how this knowledge affects our identity versus the identity of the place itself; and questions the role that memory plays in our perception of these places. What sensory components of daily situations are stored forever, constructing the notion of *home* in our memory, and how does that translate to space itself, enacting and adding up to an existing identity of ourselves and of others. By deliberately recording binaural sounds present on an ordinary Sunday afternoon in the apartment she grew up in in Vinkovci, Croatia, and strategically placing them within her current apartment in Melbourne, Australia, Ivšić materializes the importance of *time* (Sundays) and *place* (home) in the process of memory stimulation. The visual model of her Melbourne apartment was generated from point clouds generated with LIDAR. Through this technology and its immediately recognizable aesthetics, a VR scene is constructed from meticulously measured spatial points, varying in density, simultaneously creating exact, almost photographic resemblance of reality, yet adding an obvious dreamlike ambience. This work was designed to take advantage of VR specifically by seamlessly blending two realities that exist simultaneously on opposite hemispheres (Europe/Australia; then/now; real/virtual) to create a window into the first-hand experience of displacement. While the viewer is granted access and invited to inhabit this otherwise mundane yet personal place, one is immediately unsettled by the true origin of the sounds they hear, and how they synthesise with the visuals they are able to surreptitiously inspect. Inspired by the expressive spatial poetics of Gaston Bachelard – who wrote that 'Memories are motionless, and the more securely they are fixed in space, the sounder they are', Ivšić has called upon VR to give expression to this sense of displacement by registering our feelings to the spaces we live in as a way to "see" how memories are etched and intertwined so deeply in our everyday lives. [9]

Upon Reflection

In this paper, we have considered practice-based research as a mode of enquiry that generates new knowledge through practice, i.e. by actively making, doing, building and experimenting. Creative practitioners intuitively understand that the generation of new knowledge is embodied in their practice and emerges in the studio as part of a material-discursive practice; often involving the use of knowing-how types of knowledge, gained through physical exploration, direct action, performance and experience. Here practice is concerned not only with achieving resolution, in the form of definitive creative outcomes, but with gaining greater understanding of the reflexive processes by which the practitioner-researcher achieved them.

The three cases represented here highlight some of the unique qualities of knowledge production that research through practice enables: by placing an emphasis on making and learning through experimentation, instilling a spirit of inquiry that values process as much as outcome and embracing implicit forms of knowing. As these examples attest, research through practice can benefit how we might come to *know* new technologies – i.e. the communicable and expressive qualities of the artform and its aesthetic language (as in the resolved or speculatively developmental work of Sojung Bahng or Lucija Ivšić, respectively), or as a means of challenging the predispositions and idiomatic structures that (quite literally) underwrite the basis of the medium itself (in the form of software processes and code; as per Oscar Raby's critique). Equally committed to the values of creativity and research, these dynamic, discovery-led *PhD* projects make important contributions towards building the know-how of communities of practice in emergent fields of cultural and knowledge production.

References

[1] Julianne Pierce, "Virtual Reality – Ways of Seeing," *Artlink* 38:4, (December 2018): 8-11

[2] Vince Dziekan, "Actually Submersive (Not Totally Immersive)," in *MuseWeb 2019: Selected Papers and Proceedings from an International Conference,* ed. Nancy Proctor and Rich Cherry (Silver Springs, MD: MuseWeb, 2019), 165-174.

[3] Estelle Barrett, "Introduction," in. *Practice as research: Approaches tocreative arts enquiry,* ed. Estelle Barrett and Barbara Bolt (London: I. B. Tauris, 2007), 1–14.

[4] Karen Barad, "Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter,*" Signs Journal of Women in Culture and Society*, (2003): 28, 801–831.

[5] Jon McCormack, *et al, "*Multisensory immersive analytics," in *Immersive Analytics*, vol. 11190 of *Lecture Notes in Computer Science*, ed. Kimball Marriott, *et al.* (Cham, Switzerland: Springer, 2018), 57–94.

[6] Donald A. Schön, *The reflective practitioner: How professionals think in action* (New York: Basic Books, 1983)

[7] W. J. Orlikowski and Susan V. Scott, "Exploring material-discursive practice," *Journal of Management Studies*, 52 (5), (2015): 697-705.

[8] Dziga Vertov, Kino-eye: the writings of Dziga Vertov (Berkeley, Ca.: University of California Press, 1984).
[9] Gaston Bachelard, *The Poetics of Space* (Boston: Beacon Press, 1994)

Authors' Biographies

Sojung Bahng is an artist and filmmaker working as a postdoctoral researcher and instructor at Carleton University (Ottawa, Canada). She completed her *PhD* thesis (*Cinematic VR as a reflexive tool beyond empathy*) with SensiLab at Monash University (Melbourne, Australia) in 2020 and is presently a Postdoctoral Research Fellow in the School of Journalism and Communication at Carleton University (Ottawa, Canada). Sojung's VR works have been exhibited or screened at many international festivals and symposiums, including FIVARS (Canada), SIMA (USA), BIAF (South Korea), TSFM (Italy), TIAF (Georgia), TEI (Australia) and ISEA (UAE).

Vince Dziekan is a Senior Academic and Practitioner-Researcher at Monash Art Design & Architecture (MADA), Monash University, Australia. Vince's work engages with the transformation of contemporary curatorial practices at the intersection of emerging design practices, creative technology and museum culture. The scope of this interdisciplinary investigation has been outlined previously in his book, *Virtuality and the Art of Exhibition: Curatorial Design for the Multimedial Museum* (Intellect/University of Chicago Press, 2012), and more recently *The Routledge Handbook of Museums, Media and Communication* (co-edited with Kirsten Drotner, Ross Parry and Kim Schroder, Routledge, 2018). He has published widely in traditional, scholarly as well as non-traditional modes through his independent curatorial practice. He is associate editor of *Curator: The Museum Journal* (Wiley), general editor of *The Encyclopaedia of New Media Art* (Bloomsbury), founding curator of *MWX*, the exhibition initiative of the Museums and the Web conference (Museweb), and Series Co-Editor of a newly launched book series, *Critical Perspectives on Museums and Digital Technology* (Routledge).

Lucija Ivšić is a Croatian-born emerging new media artist, composer and experienced performer, currently residing in Melbourne, Australia. At just 14 years old, Lucija formed Punčke, one of the first all-girl bands in Croatia. Over the course of a decade, Punčke releasing five critically acclaimed albums, being nominated for an MTV EMA Award in 2014, and playing over 400 shows worldwide. Relocating to Melbourne in 2019, Ivšić commenced her practice-based PhD research at SensiLab, Monash University. Resonating posthuman visions, Ivšić's work explores identity formation and the relationships we establish with physical spaces through VR and mixed-media installations. Lucija holds a Master's Degree in Geodesy and Geoinformatics from the University of Zagreb, where she specialized in remote sensing technology (laser scanning).

Jon McCormack is a research Professor in the Faculty of Information Technology, an Australian Research Council Future Fellow and director of SensiLab, a bespoke, trans-disciplinary research centre, based at Monash University in Melbourne, Australia. A practicing artist, he is the recipient of more than 19 awards for both artistic creativity and technical research, including the Eureka Prize for Innovation in Computer Science, the Lumen Prize for Digital Art (still images). In 2016 he established the practice-based PhD within the Faculty of Information Technology. A first for IT doctoral research in Australia, this innovative form of PhD encourages creative and dynamic projects that make discoveries through making, building and creating.

Oscar Raby is a visual artist and creative director at VRTOV, a Melbourne-based Virtual Reality studio behind the projects *The Turning Forest* and *Easter Rising: Voice of a Rebel*. His autobiographical Virtual Reality documentary *Assent,* has been part of Sundance New Frontier, IDFA DocLab and Sheffield Doc/Fest (where it received the Audience Award for Cross-platform) as well as festivals in Australia, Canada, USA, Mexico, the Netherlands and the UK. Oscar completed his *Masters in Animation and Interactive Media* at RMIT (Melbourne, Australia) in 2013 and commenced his *PhD* research with SensiLab in 2010 focusing on the software metaphors underpinning the development of narrative XR work.