Distance: digital immersive technologies and craft engagement

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Abstract

The DISTANCE project (digital immersive technologies and craft engagement) is a novel practice-led experiment in the use of immersive technology to enable dispersed craft practitioners to apply their haptic skills and material knowledge in a digital immersive space, learning from peers through remote collaboration. Craft practice is rooted in tactile interpretation of materials expressed through tacit, haptic processes (Ray, 2009). In this paper we ask; what role can haptic crafts skills play in a virtual studio environment? The paper reflects on the interaction between different craft disciplines and thus how different kinds of tacit knowledge impact on the act of creation in an immersive space (McCullough, 2004). How does a VR studio relate to a material studio practice (Corazzo, 2019)? Conversely, what are the drawbacks of such places in terms of collaboration when craft practices are rooted in material knowledge and haptic skill? Through a series of semi-structured workshops, practitioners shared their experiences of working alone and collaboratively within immersive space and discussed the unique challenges and opportunities of integrating and sharing haptic-driven creative processes and experiences with digital space. Thematic analysis of workshop discussions, interpreted by both craft and HCI experts, are presented alongside analysis of the work produced. This paper describes the role that haptic skills can play within immersive environments for craft practitioners and discusses current challenges to be addressed and opportunities for future work in hybrid digital-physical spaces. The paper also reflects on the role a virtual studio space can play as a shared learning environment. What are the barriers to adopting a virtual studio practice using VR? How does a VR studio connect to a physical making place? It is becoming increasingly important for creative practitioners to gain digital skills and competencies, both for creative production and for collaboration (Palani, 2022, Helgason *et al*, 2023). While the Covid pandemic meant that many more activities were conducted online or through digital means, this technological transformation has been underway for many years already (Cavalheiro *et al*, 2020). In the United Kingdom, the term "CreaTech" has been coined to describe the emergence and importance of this intersection where digital and data skills meet creativity (Bahkshi *et al*, 2019). Finally, the paper reflects on what role a virtual studio can play in supporting a sustainable craft practice: how does a virtual creative place that offers limitless options in terms of scale, material exploration, unhindered by physical limitations impact physical making practices?

Keywords

Metaverse; VR; digital fabrication; craftsmanship; haptic; remote collaboration; data driven innovation

Introduction

The DISTANCE project (digital immersive technologies and craft engagement) took place during the UK COVID-19 lockdown of 2021 and is a novel practice-led experiment in the use of Virtual Reality (VR) to enable physically dispersed craft practitioners to apply their haptic skills and material knowledge in a digital immersive space, learning from peers through remote collaboration. Here we consider craft practice as both a skill and process (Adamson, 2007, p. 3), as a way of doing things, rooted in a tactile interpretation of *materials* expressed through tacit, haptic processes (Ray, 2009) and embodied in both manual and mental skills (Pye, 1968). The craft practitioners involved in this project are referred to as makers throughout this paper.

The pilot DISTANCE I took place online between February and April 2021 involving six makers in three partnerships, whilst the DISTANCE II roll-out phase took place from June 2021-January 2022 and engaged with eight craft makers and three collaborations. The project was developed and managed by the makers collective, Applied Arts Scotland (AAS), who sourced the funding and resourced a technical expert to support the project. Each maker was loaned a VR set (Oculus) over a period of three months (phase I) or eight months (phase II): each headset was set up and preloaded with the software required and supplied with a set of tailored instructions with regular technical and peer support sessions across the period, thus making the 'threshold' lower than if makers would have undertaken on their own. The collective journey of the maker participants was important in this project. Each craft maker had a different material expertise which ranged from product design, weaving and knitting, ceramics and glass, silversmithing and jewellery making. It is notable that the group had diverse and uneven prior digital production

skills which ranged from novices to proficient digital fabricators using 3D modelling and 3D printing. This paper describes the impact VR had on this diverse group of craft makers and how this technology was adapted to individual as well as collaborative making practices. The paper thus reflects on the interaction between different craft disciplines and what different tacit knowledge bears on creating in an immersive space. Conversely, what are the drawbacks of such places when craft practices are rooted in material knowledge and haptic skill? This paper also explores the role that haptic skills can play within immersive environments for craft practitioners (referred to as makers throughout) and discusses current challenges to be addressed and opportunities for future work in hybrid digital-physical spaces. Finally, this paper sums up the role VR can play in future craft practices and outlines further scope for study.

This paper has been based on data gathered 1) by active participation as makers by three of the authors, 2) from a series of semi-structured workshops facilitated by AAS in which the fourteen practitioners shared their experiences of working alone and collaboratively within the immersive space, and discussed the unique challenges and opportunities of integrating and sharing haptic-driven creative processes and experiences with digital space and 3) additional thematic analysis of workshop discussions, informed by both theory and practice. We use the terms immersive space and digital space throughout this paper as overlapping terms, since the project relied on shared non-physical spaces that were occupied as immersive spaces within VR headsets and/or as supporting digital spaces where work created could be supplemented, edited and curated, with the makers moving back-and-forth between these dimensions as needed.

Distance project: digital pivot

The DISTANCE project was developed for and by craft makers through AAS. DISTANCE I was financed by Creative Informatics, a four-year R&D project funded by the UK Arts and Humanities Research Council (AHRC), to support Data Driven Innovation (DDI) in the creative industries in Edinburgh and the South of Scotland region whilst DISTANCE II was funded by Creative Scotland with further plans for an international rollout. It is this cascading effect of small R&D interventions which deserves attention as well as the innovative collaboration developed in this project.

During the period of global lockdown of 2020/21, the cultural and creative sector became a proving ground for data driven innovation. The shift towards digital technologies was significantly accelerated by the global pandemic, condensing five years digital adaptation into two months (UNESCO, 2020; Baig *et al*, 2020). The swift digital pivot of the creative industries in the wake of the pandemic highlighted possibilities in the use of online spaces for not only disseminating creative work, but to connect, share, collaborate and create. Access to physical spaces for creative production was made difficult or impossible during lockdown, halting not only production of works but also limiting scope for research and development for creative practitioners who routinely rely on access to physical spaces and specialist equipment to create work. Whilst the use of online platforms enabled creatives to connect digitally in a virtual space, the DISTANCE project brought an added dimension by exploring how craft practitioners might be able to collaborate and create together in a virtual three-dimensional space, remotely.

The recent democratisation of VR through a marked decrease in the purchase price of VR headsets has enabled more creatives to explore this technology. However, this has coincided with the adoption of the software (e.g. Tiltbrush, owned by Google) and hardware (e.g. Oculus Quest, owned by the Facebook company Meta) by tech giants. VR technology is evolving rapidly which makes this risky for sole practitioners to experiment with as the technology may no longer be supported in the near future, making their investment of time and capital obsolete. The large tech companies are proving critical in both lowering access thresholds and potentially providing stability longer term. It also, however, opens ethical debates: an Oculus Quest at the time required a mandatory Facebook integration and is thus linked to a personal Facebook account (at time of writing requires an Oculus account) with known issues around data tracking (Bujlow *et al*, 2017). The DISTANCE project circumvented this by setting up a project Facebook account thereby avoiding linking to individuals' accounts which was shared across multiple headsets. With changes linked to the transition from Facebook to Meta, this approach is no longer possible.

The loan model of the VR headset fits within a sharing economy model where the upfront costs of technical equipment, including software is taken on by a third party, in this case AAS on behalf of its members. The sharing economy grew from DDI in the economy using digitised platforms (Belk, 2014) including Libraries of Things (Ameli, 2017). This sharing model supports not only a change in consumer behaviour by reducing resources (Edinburgh Tool Library, 2020), but critically also supports access to tools and specialist equipment for marginalised groups, those on lower incomes or with lesser means to invest in technology (Hamari *et al*, 2016: Hellwig *et al*, 2015) and fits with AAS' ethos of supporting sustainable making practices of and for its members.

The DISTANCE project was a collective learning project which occurred within a safe and trusted peer-led space that enhanced risk taking and exploration within digital space (Jaramillo *et al*, 2019). It evidenced that working remotely collaboratively can take place in both synchronous and asynchronous ways: collaborators could work on joint projects in shared digital space at separate times or they could work on it together, at the same time, in the same digital space. This enabled those with non-normative working patterns to fit around caring responsibilities or enabled those for whom travel was perhaps difficult for health reasons or with career responsibilities elsewhere, to be flexible in their collaboration. Regular scheduled sharing sessions meant that issues - technical or creative- were shared and addressed in near-real time.

Skills

Learning to use and understand this new technology required completely new skills, both haptic skills in terms of acquiring the tactile skills of handling the handsets and headset but also the mental challenge of different ways of working and thinking. Learning these skills did not come naturally to all the makers: some were "struggling" or "frustrated" with

the technology, with a reluctance to fully engage with the VR experience: "always more interested in the real world" whilst for some the physical experience of wearing a VR headset for a prolonged time confronted them with nausea and headaches, thus limiting their time in VR. Others, however, took to it easily. All makers were transferring existing skills into VR: from drawing to making skills such as weaving or throwing ceramics. It was notable that the more experimental adopters of the technology were willing to abandon their tacit knowledge of making and materials to play and explore.

The rationale for the makers to opt into DISTANCE ranged from simply wanting to explore this new technology as part of their ongoing professional development "to challenge myself" or "take me out of my comfort zone". All makers specifically explored how experimentation in a virtual environment would inform their analogue practice. Some makers who had prior experience of working with digital technology had specific aims in mind: "Discover and exploit the main advantages that working in VR with [Gravity Sketch] GS-VR has over other 3D modelling programmes". This mix of knowledge proved valuable to the collective learning experience during both the online collaborative sessions and the formal workshop exchanges facilitated by AAS. Access to the technical expert proved a key asset in the success of the DISTANCE project and enabled the makers to explore and solve practical problems, often relating to how to integrate their analogue practice into their VR. This maker led approach to making proved an equally fruitful learning experience for the technical expert as different questions emerged from maker queries than perhaps VR content developers might ask.

Whilst there are other technologies that enable remote collaboration, through file sharing of digital drawings for example, VR enabled creation and collaboration in a three-dimensional virtual space both in real time and asynchronous time. But unlike other creative technology, such as CAD, the immersive virtual reality tools offered a *playfulness* perhaps hitherto not experienced but which belies its origin in the gaming industry: "When I am in the headset I am not on the clock – I am playing". It was clear that the ability to play and experiment with this technology with low financial risk (headsets loan) did require an extensive investment of time to develop the necessary skills required: "Being able to deal with new stuff needs time to be digested and help each other". Furthermore, VR enabled craft makers to explore making without the usual physical boundaries of a material practice: no gravity, scale limitations, mess or carbon footprint of materials (acknowledging of course the digital carbon footprint): "immersive technology allows you to break the rules". This "limitlessness" was considered both an opportunity and a barrier when constraints can be useful as a framework to work against. Transferring haptic skills to a virtual environment required a fundamental understanding of what haptic skills each maker possessed: what were the actions which constitute their daily making practice? And how did these actions translate into bodily movement? Transferring these haptic skills to a VR hand controller with little haptic feedback proved challenging. The tactile setting in the hand controller enabled the weaver to successfully receive haptic feedback on the use of virtual materials in VR: "that feedback 'rumble' really supports the feeling of touching something". This was, however, not experienced by the other makers.

Augmented craftsmanship

The COVID-19 pandemic highlighted the need for digital literacy as more activities migrated to online, but this shift was part of a longstanding process. This digital transformation trend is disruptive, and it is changing the way that designers and artists create and distribute their work and influencing how audiences and clients access these creative outputs (Cavalheiro, 2020). Consequently, acquiring and improving digital skills is becoming more necessary for creative practitioners (Helgason *et al*, 2023). Digital technologies have pushed craft practice to new boundaries, enabling new ways of making work and creating new visual vocabularies (Cutler, 2012; Shillito, 2013) and VR is another in the toolbox. The exploration of material qualities in VR relied on the capacity of the software to mimic materials in a three-dimensional virtual world. Some materials were easily translated. Others, such as the drape of fabric, the fluidity of thread or the transparency of glass, required more exploration and experimentation with a limited palette. A weaver tried to emulate the woven textile. Only once the actual weaving action was abandoned and instead images of prior constructed woven fabric were imported, did the ability to construct or disregard components quickly become apparent. The ability to repeat knitted samples in an exploratory fashion would not be possible in real life without physically knitting them: "Gravitysketch helped me to visualise the things that are possible in real life". Furthermore, being able to walk around the constructed assemblages at different scales enabled her to envision her work on a scale hitherto not possible. The scalability in VR proved a key asset to most makers and supported the element of play. The liberty to "play" required a change of mindset. A potter consciously had to "forget" his tacit and material knowledge so as not to preclude experimentation in VR as the experiment "won't' work" in the analogue studio. A furniture designer was "making all these things that I cannot make in reality". A glass maker was experimenting with fluid 3D forms "that would be almost impossible to make at this scale and in this form as it defies gravity". In other words, experiments in VR might not be easily translatable in studio production: one maker felt a "responsibility to make work that is not possible in any other way". The experimentation in Gravitysketch had a freedom of expression that was "mindblowing", not easily found in material practice. It was noted by several makers that whilst tacit knowledge is critical for designing objects and products which will "live in the real world", this inherent knowledge can stymie the playfulness to which VR lends itself and which proved valuable for exploration and experimentation. For some makers, the playfulness generated in VR space was then taken back into the physical studio, generating a shift in process.

The interaction between the virtual and analogue proved to require some flexibility of mind. Some makers found the amount of time required "disproportionate to the results" to create something in VR "to then bring it back out into the real space to then make it". Those most adapted were those who had an ability to "start with nothing". One potter produced a multifaceted form in VR. This was translated into a 3D printed form from which a negative multi-part casting mould was made from which a ceramics form was slipcast and fired. The use of VR and 3D printing "took four steps out of the mould making process" so here too VR facilitated both time and ma-

terial saving contributions. This 3D object was brought back into the virtual environment by minting it as bitcoin. These different processes, outputs and learning were presented as an exhibition in a 3D environment, Frame V, that could be viewed and navigated via web browser on any compatible device, including immersive versions in the VR headset (Fig 1.)

Figure 1. Frame V digital immersive exhibition space of DISTANCE II, Applied Arts Scotland, with work by Chris Donnelly showcasing glaze testing of 3D printed form created in VR created slipcast and glazed before being turned back into digital through NFT mining. Source: https://framevr.io/distancechrisgallery. With kind permission from the artist.

The space included the opportunity to embed film, audio and 360-degree photo collages alongside 3D models, and for the viewer to take self-directed virtual walk-abouts. Linked spaces exhibited the work of individual makers and collaborative groups. This offered "a guided tour of everything that is possible in a virtual space" in terms of making practices. Furthermore, social media supported these collaborations to be shared and enabled immediate feedback on the processes and work made. This exploration between the virtual and analogue revealed different opportunities to interact with the initial form and transform it into different immaterial and material iterations, each with their constituent feedback to the maker (Spence et al, 2020 & 2022). The ability to import analogue works through photography and film into VR which could then be manipulated, 3D printed or made in the studio and then brought back in the VR made some makers question: "What is reality? Am I looking at x in VR or in VR looking at x?".

Conclusion

In DISTANCE the VR studio became not only a site of individual experimentation but a shared learning environment. Once basic VR skills were acquired, the virtual studio offered a creative place that offered limitless options in terms of scale, and material exploration, unhindered by physical or financial limitations, it enabled a certain amount of risk taking and exploration that would be prohibitive if executed in real terms. It is notable that the pandemic gave unprecedented "licence to play" as other commitments and responsibilities had temporarily been removed. Both the socially and environmental *inclusivity* of the technology make this a potential *sustainable* option. This is however, potentially offset by the rapid changes in software development, making investment in soon-to-be-obsolete hard- and software a non-viable option for creatives for whom training in new technology requires an upfront investment of time, even when hardware costs can be shared through a loan model. Furthermore, obsolete hardware, unless recycled in closed loop, wastes materials and resources. The barriers to adopting a virtual studio practice using VR were either physical (nausea and headaches), limited time to experiment and learn the necessary skills, inability to let go of innate material knowledge to facilitate playful learning and experimental making, and the limited material palette in the existing software. Conversely, the tacit knowledge of the makers can be used to arguably improve the experience of the tool itself. The facilitating factors were access to R&D funding, access to specialist equipment (sharing economy model), expert advice and support and an extended period within which to experiment. The funded R&D interventions are highlighting DDI in the creative industries that are worth paying attention to and are a model that deserves investment going forward. It is also worth reflecting on the value of a community of practice in a physical studio space, where *haptic* skills are paramount. If we consider the community of practice to be composed of shared experience, expertise and meaning (Jaramillo *et al*, 2019), then VR can replicate much of the intellectual and emotional aspects of experience, expertise and meaning but still falls short of the physical, at least whilst the VR studio is limited to a headset. A question going forward might be how immersive technology can integrate the embodied experience of making when the current focus is mostly audio and visual senses rather than haptic ones. However, technology is developing fast to include resistance and feedback loops to make the sensory experience more complete. What might this mean for material practices such as craft, design and architecture, where embodied material and haptic knowledge are fundamental to learning and acquiring skills? And what implication would this have on the 'playfulness' of VR?

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References

Adamson, G. (2007) *Thinking Through Craft*. Oxford: Berg

Ameli, N. (2017) Libraries of Things as a new form of sharing. Pushing the Sharing Economy. *The Design Journal*. 20 (sup1), S3294–S3304.

Baig, A., Hall, B., Jenkins, P., Lamarre, E. & McCarthy, B. (2020) The Covid-19 recovery will be digital: a plan for the first 90 days, *McKinsey Digital*, 14 May 2020. Available at: https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-covid-19-recovery-will-be-digital-a-plan-for-the-first-90-days

Bakhshi, H., J. Djumalieva, & Easton, E. (2019) *The creative digital skills revolution*. London: Creative Industries Policy Evidence Centre/NESTA.

Belk, R. (2014) You are what you can access: Sharing and collaborative consumption online, *Journal of Business Research*, Volume 67, Issue 8, 2014, pp. 1595-1600, DOI: https://doi.org/10.1016/j.jbusres.2013.10.001

Bujlow, T., Carela-Español, V., Solé-Pareta, J. & Barlet-Ros, P. (2017) A Survey on Web Tracking: Mechanisms, Implications, and Defenses, in *Proceedings of the IEEE*, vol. 105, no. 8, pp. 1476-1510, Aug. 2017. DOI: https://doi.org/10.1109/JPROC.2016.2637878

Cavalheiro, S., Nikou, S. & Widén, G. (2020) Effect of digital literacy on the use of digital technology: micro-entrepreneurs in the creative industries. In *Proceedings of 33rd Bled eConference* – Enabling Technology for a Sustainable Society: June 28-29, 2020. Online Conference Proceedings. DOI: https://doi.org/10.18690/978-961-286-362-3

Corazzo, J. (2019) Materialising the Studio. A systematic review of the role of the material space of the studio in Art, Design and Architecture Education. *The Design Journal*, 2019. 22(sup1): p. 1249-1265.

Cutler, V. (2012) *New Technologies in Glass*. London: A C & Black

Edinburgh Tool Library (2020) *A Carbon Calculator for Tool Libraries*. Available at: https://edinburghtoollibrary.org.uk/carbon-data-for-sharing-libraries/

Hamari, J., Sjöklint, M. & Ukkonen, A. (2016) The sharing economy: why people participate in collaborative consumption. *J. Assoc. Inform. Sci. Technol*. 67 (9), pp. 2047-2059.

Helgason, I., Smyth, S., Panneels, I. Lechelt, S., Frich, Rawn, E. J. & Mccarthy, B. (2023) Digital Skills for the Creative Practitioner: Supporting Informal Learning of Technologies for Creativity. In *Extended Abstracts of the 2023 CHI Conference on Human Factors in Computing Systems* (CHI EA '23), April 23–28, 2023, Hamburg, Germany. ACM, New York, NY, USA, 5 pages. https://doi.org/10.1145/3544549.3573825

Hellwig, K., Morhart, F., Girardin, F. & Hauser, M. (2015) Exploring different types of sharing: a proposed segmentation of the market for 'sharing' businesses. *Psychol. Market*. 32 (9), pp. 891-906.

Jaramillo, G., Hocking-Mennie, L., Prosser, Z., Booker, C., Lightbody, L & Sinclair, C. (2019) Distributed Capabilities: towards hybrid ways of making in collaborative arts/design practices. *Making Futures Journal*. 2019. Available at: https://makingfutures.aup.ac.uk/journal-2019/george-jaramillo

McCullough, M. (2004) *Digital Ground: architecture, pervasive computing, and environmental knowing*. Cambridge, Mass.: MIT

Palani, S., Ledo, D., Fitzmaurice, G. & Anderson, F. (2022) I don't want to feel like I'm working in a 1960s factory: The Practitioner Perspective on Creativity Support Tool Adoption, CHI '22: Proceedings of the 2022 *CHI Conference on Human Factors in Computing Systems*. April 202. Article No.: 379. Pages 1–18. DOI: https://doi.org/10.1145/3491102.3501933

Pye, D. (1968) *The Nature of and Art of Worksmanship*. Cambridge: Cambridge University Press

Ray, Tim (2009). Rethinking Polanyi's concept of tacit knowledge: From personal knowing to imagined institutions. Minerva, 47(1) pp. 75–92.

Shillito, A.M. (2013) Digital Crafts: Industrial Technologies for Applied Artist and Designers. London: Bloomsbury

Spence, J, Dimitrios Paris Darzentas, D.P., Cameron, H.R., Huang, Y., Adams, M., Farr, Y.R., Nick Tandavanitj, N. & Benford, S. (2022) Gifting in Museums: Using Multiple Time Orientations to Heighten Present-Moment Engagement, *Human–Computer Interaction*, 37:2, 180-210, DOI: 10.1080/07370024.2021.1923496

Spence, J, Dimitrios Paris Darzentas, D.P., Huang, Y., Cameron, H.R., Beestin, E. and Benford, S. (2020) VRtefacts: Performative Substitutional Reality with Museum Objects. In *Proceedings of the 2020 ACM Designing Interactive Systems Conference* (DIS '20). Association for Computing Machinery, New York, NY, USA, 627–640. https://doi.org/10.1145/3357236.3395459

UNESCO (2020) Culture in Crisis: policy guide for a resilient creative sector. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000374631?dm_i=FES,757N2,20OB3H,SWYXO,1