CHAPTER 8

Interdisciplinarity, Transdisciplinarity, and Health Humanities: Eye Tracking, Ableism, Disability, and Art Creation

Christian Riegel and Katherine M. Robinson

Introduction: Health Humanities and Interdisciplinarity

Health humanities is a field of intellectual inquiry and application that is conceived and constituted out of multiple disciplinary constellations that focus on the intersection of considerations of health and the humanities. Health is understood expansively, as are the humanities (Jones et al. 2014; Crawford et al. 2015; Banner 2019; Klugman and Lamb 2019; Crawford

C. Riegel (✉)
Department of English, Campion College, University of Regina, Regina, SK, Canada
e-mail: Christian.riegel@uregina.ca

K. M. Robinson
Department of Psychology, Campion College, University of Regina, Regina, SK, Canada
e-mail: katherine.robinson@uregina.ca

C. Riegel, K. M. Robinson (eds.), *Health Humanities in Application*, Sustainable Development Goals Series,
https://doi.org/10.1007/978-3-031-08360-0_8

2020), and thus disciplinary constituencies are varied depending on the specific question, intervention, or application. The health humanities thus inherently draw from multiple disciplinary orientations, drawing from concerns in individual disciplines that intersect with health and humanities. The health humanities are, further, exceptionally interdisciplinary and transdisciplinary in that they require integration of multiple knowledge domains alongside the disciplinary understanding, methodology, epistemology, and practices that define discipline-based work. They can, in short, only be understood in the context of such interactions of multiple disciplines even when they are practised with a disciplinary focus such as, for example, the study of pathographies, which are "autobiographical accounts of … [patients'] experience of illness and treatment" (Hawkins 1999a, 127), understood to emanate from literary studies (Frank 1995; Couser 1991; Hawkins 1999a, 1999b). To fully encompass the implications of any given pathography requires the methods of literary studies *and* contextualizing within a health and/or medical focus, be it breast cancer elegies or novels that examine mourning processes, or some other health-related consideration (see, e.g., Riegel 2017, 2020).

Jones, Wear, and Friedman describe medical humanities, the precursor to health humanities, as "an inter- and multi-disciplinary field" (2014, 6), and the health humanities take a broader emphasis to embrace interdisciplinarity (Crawford et al. 2010, 4). Olivia Banner notes that "health humanities educators are a diverse group of bricoleurs" (2019, 1) reinforcing the multitude of disciplines, perspectives, and approaches out of which those who are situated in health humanities construct their teaching, research, practice, and exploration. Klugman and Lamb argue that "health humanities is transdisciplinary" (2019, 6), as the field reaches beyond not only disciplinary boundaries but also outside formally academic realms into professional and communal spaces to include "patients, practitioners, communities" (7).

The space between *interdisciplinarity* and *transdisciplinarity* requires further reflection in health humanities research and teaching given the multiple perspectives on the relation between the various academic disciplines, professional domains, and community contexts that contribute to health humanities. In this chapter we examine questions of interdisciplinarity and transdisciplinarity as they apply to health humanities by articulating the contours of interdisciplinarity and transdisciplinarity, and by considering them in relation to a research project on eye movement art creation, technology, ableism, and disability in our interdisciplinary and

transdisciplinary research lab, the Interactive Media, Poetics, Aesthetics, Cognition, and Technology Lab (IMPACT) at the University of Regina, Canada. Our project draws from multiple disciplines and academic realms while also engaging with disability communities.

Crawford and co-authors (2015, 2020) assert the revolutionary and catalytic forces of the health humanities as agents of academic, research, social, and practical change. The health humanities have the potential for health to resituate how we recognize the role of the humanities in all aspects of health, providing potential for significant influence in a range of domains "for a more extensive, mutual and applied field of work for delivering better social and cultural futures" (Crawford et al. 2015, 19). Because of their expansive application, the health humanities by their nature rub against conventional assumptions about discipline-based work. Indeed, they presuppose that fully discipline-oriented work is impossible within a health humanities context: to larger and lesser degrees, comingling of, bridging between, fusion of, or knowledge sharing between disciplines occurs as an organic process of working in the health humanities. Additionally, due to the social, professional, and other practical applications of the health humanities, the social realm is implicated in the interdisciplinary impetus, thus often reaching into transdisciplinary concerns (Klugman and Lamb 2019, 6–7).

Interdisciplinarity

As Huutoniemi et al. (2010) point out, the concept of interdisciplinarity is fraught with challenges of definition and thus the boundaries of this term are at times contested in the scholarly literature: "Interdisciplinarity is … best understood not as one thing but as a variety of different ways of bridging and confronting the prevailing disciplinary approaches" (80). Siedlok and Hibbert (2014) remark that "the inherent complexity of interdisciplinary research *necessarily* defies a single approach, resulting in a rather muddled picture of a number of different, coexisting modes of interdisciplinary work" (195). As a starting point, interdisciplinarity can be seen simply as a type of research that "transgresses traditional disciplinary boundaries" (197), and more complexly as taking "place at multiple sites and on multiple levels, and in multiple types and forms. Ironically, interdisciplinarity is divided into scientific, humanistic, social scientific, and forms which not even its most ardent practitioners and proponents can easily transcend" (Frodeman et al. 2010, ix). While beyond the scope of this chapter, it is worth noting that considerable scholarly discussion has

taken place to define the concept of interdisciplinarity (e.g. Gibbons 1994; Balsiger 2004; Frodeman et al. 2010; Siedlok and Hibbert 2014; Aldrich 2014; Ledford 2015; Trussell et al. 2017; Marrone and Linnenluecke 2020).

Our specific interest is to recognize some of the qualities of interdisciplinarity that are especially relevant in a health humanities context, and then more specifically in the case of our work. Interdisciplinarity is particularly useful to the relatively young field of the health humanities as it emphasizes the forward-thinking nature of the field. As Frodeman (2010) notes, "[A]t its best, interdisciplinarity represents an innovation in knowledge production—making knowledge more relevant, balancing incommensurable claims and perspectives, and raising questions concerning the nature and validity of expertise" (xxix). Constituted in inherently interdisciplinary ways, a health humanities approach in our consideration is catalysed by articulations of knowledge for the sake of application and for further understanding of how the field itself is developing and comprehended. The integrative nature of the health humanities is well defined by Frodeman's characterization of interdisciplinarity as multi-modal:

> [S]uccess at integrating different perspectives and types of knowledge—whether for increased insight, or for greater purchase on a societal problem—is a matter of manner rather than of method, requiring a sensitivity to nuance and context, a flexibility of mind, and an adeptness at navigating and translating concepts. (xxxi)

Those engaged in health humanities work are perpetually in such a process of navigation and translation in the service of intersections of humanities and health, and the work functions, as Frodeman notes, apophatically: "it announces an absence, expressing our dissatisfaction with current modes of knowledge production" (xxxii). The mixing of disciplines, disciplinary practices and ways of seeing things, operates organically to fill voids of knowledge that the health humanities approach with the promise of limitless novelty rather than the disciplinary bounds that constrain conventionally. To think in interdisciplinary manners, then, requires us to think of the world ecologically as "everything is implicated with everything else" (xxxiv). Fundamentally, "interdisciplinarity is a means toward the end of preserving or achieving the good life in a complex, global, rapidly innovating society" (xxxii). By default, health humanities are interdisciplinary in their interaction with questions of health (Charise 2017, 433): how we better understand the human position in

relation to multiply constituted (socially, culturally, historically) elements of health, and interdisciplinarity has the advantage to address the "larger responsibilities of how knowledge contributes to the creation of a good and just society" (xxxiii). As Albert et al. (2020) remark, the aims are broad: "interdisciplinary research generates a better understanding of the world" (756). Advantages are the ability to approach major issues in multiple ways, as Okamura (2019) states: "Many of the world's contemporary challenges are inherently complex and cannot be addressed or resolved by any single discipline, requiring a multifaceted and integrated approach across disciplines" (2). The result is domains "of inquiry that include academics from a range of disciplines as well as stakeholders not engaged in discipline-based knowledge production, such as professionals, administrators, and policymakers, all of whom focus on a common subject with the aim of advancing both theory and practice" (van Enk and Regehr 2018, 340 qtd. in Albert et al. 2020, 756). Knowledge creation is thus more democratic (Albert et al. 2020, 756), which is suited to the aims of health humanities work (Crawford et al. 2015, 19; Crawford 2020).

Transdisciplinarity

Where interdisciplinarity functions as knowledge production that crosses or bridges disciplinary boundaries, transdisciplinarity "makes knowledge products more pertinent to non-academic actors" (Frodeman 2010, xxx), making it a useful concept for health humanities as they reach into professional, personal, and social realms, finding relevance for society expansively in ways that discipline-bound approaches rarely achieve. The advantage of transdisciplinarity is its ability to transcend boundaries to develop "increasing coherence, unity and simplicity of knowledge in which disciplinary boundaries become irrelevant or are radically reshaped" (Siedlok and Hibbert 2014, 198). Research paradigms and institutional landscapes are reconfigured leading to permanent impacts (198). A problem-solving perspective in the real world "is an important driver for integrative and collaborative research" that "transgresses academic cultures and engages in mutual learning with societal actors in order to account for barriers in real life and possible unintended effects of problem solving." Transdisciplinary attitudes to knowledge production respond "to societal needs for solving, mitigating, or preventing problems such as violence, disease, or environmental pollution." Integration of disciplinary practices and implementation of knowledge are key concerns in

transdisciplinary approaches (Hadorn et al. 2010, 431). Klein reinforces the transgressive nature of transdisciplinarity that leads to the "cultural study of social and intellectual formations" (2010, 25). Nicolescu underscores the integrative nature of transdisciplinary work that not only mixes disciplines but moves beyond disciplinary specificity: "Transdisciplinarity concerns that which is at once between the disciplines, across the different disciplines, and beyond all disciplines" (2014, 19). The combination of interdisciplinarity and transdisciplinarity as features of the health humanities reflects a field that innovates at the nexus points of health and humanities, bridging disciplines and academic domains with social contexts.

These considerations are of particular interest to us in our work in the IMPACT Lab as we aim to conjoin digital technology with accessibility and human experience with art creation, bringing together disciplinary expertise in literary study, digital humanities, cognitive psychology, visual and digital art, and hardware and software engineering to address challenges in how we understand the interaction of individuals with limited mobility and technology and in how we understand how individuals experience art creation. Our work thus fits with Roderick J. Lawrence's understanding that "transdisciplinary approaches combine more disciplinary contributions in order to generate a more comprehensive level of understanding by applying an enlarged systemic framework of several disciplinary and interdisciplinary contributions" (2010, 125). Transdisciplinary work is especially well suited to address complex real-world issues, such as public health challenges, and transdisciplinary work provides "an innovated framework for participatory research … rather than focusing on academic research" only (Lawrence 2010, 126; Klugman and Lamb 2019, 6–7). Interdisciplinary researchers thus move beyond the bounds of academically-oriented research practices to "incorporate a combination of concepts and knowledge not only used by academics and researchers but also other actors in civic society, including representatives in the private sector, public administrators, and the public" (Lawrence 2010, 126). Our individual disciplinary orientations in literary and digital humanities and in cognitive developmental psychology on their own fail to account for the integrative nature of the approach, which is methodologically and epistemologically driven by a straightforward articulation of a research challenge: to create technology tools that require only eye movements. To address the challenge requires integration of technology development, knowledge of disability studies and ableism, considerations of art and aesthetics, social science research methodologies, and collaboration with

community as integral partners in research, with no particular one of these domains holding primacy in how the research project unfolds.

Eye Tracker Art Creation

The authors are engaged in a multi-year programme of research that has as its core interest the development and deployment of art creation that uses only eye movements, as well as the study of the user experience and best practices for digital technology research and disability. We develop custom software for, and hardware adaptations of, eye trackers to allow for art creation that only requires eye movements. The research has implications for individuals with limited mobility as it makes art creation accessible, and it has resonances for how disability is conceived and understood in the context of ableism. Developing art creation tools addresses issues relating to the purposes of technology in relation to disability. Key purposes of creating with the eyes only refer to enjoyment of artistic creation and aesthetic pleasure, which are often subordinated to the practical purposes of assistive devices and the challenge of problem-solving as the goal of technology development in the realm of disability (Clare 2017).

The programme of research arises not directly out of the disciplinary practices of the authors, but rather out of shared interest in harnessing the potential of eye tracking technology for research and applied purposes. Katherine M. Robinson is a cognitive developmental psychologist and Christian Riegel is situated in literary studies, digital humanities, and health humanities. The work on eye trackers and art creation developed over a multi-year period to occupy an interdisciplinary and transdisciplinary space that is best accounted for within a health humanities context. The purpose of the remainder of the chapter is to outline the development of our work into the health humanities realm.

In 2010, we received a Canada Foundation for Innovation grant to construct and equip the IMPACT Lab. The goal of the lab was to develop research streams that used eye trackers as data collection tools as well as to integrate other digital resources. Robinson's primary interest was to conduct studies that examined aspects of mathematical cognition, and Riegel was interested in examining how individuals read poetic and other forms of literary language on digital screens, and their collaboration related to combining cognitive psychology with the literary study of poetry. Several studies were conceived that examined cognitive processes relating to how individuals read conventional and postmodern poetry. This work can be

defined as primarily multi-disciplinary as each researcher brought their own disciplinary lens to bear on the creation of the research questions. However, as we explored the possibilities of the large data sets that our eye tracker generated (Riegel et al. 2017), we realized that there was much potential beyond the conventional social-science-oriented statistical analyses initially considered.

Indeed, by taking the data and recasting it in visualizations, we argued that new understandings of the data could be developed that relied on aesthetic and humanities approaches. As we noted, the "particular configuration of researchers from divergent disciplinary practices … discovered that the technology and methodology of the lab opened up interdisciplinary and collaborative possibilities that were not imaginable at the outset of the lab's planning" (Riegel et al. 2017). We thus moved into an interdisciplinary mode exploring new research epistemologies: "Eye tracking technology permits volumes and types of data that were hitherto unimaginable, and the software tools of an eye tracker … allow for interesting and useful empirically based understandings of the data. Yet, in our explorations of the data we conclude that a purely empirically based output only takes us so far: the data can be put to further uses, pushing into the realms of data visualisation and art, as well as into epistemological considerations for the processes involved in managing and exploring data" (Riegel et al. 2017).

One study we conducted asked participants to read conventional poetry (e.g. a Shakespeare sonnet) and postmodern poetry (e.g. John Mac Low's "Words nd Ends from Ez") while we tracked their eye movements. We used conventional eye tracker data from X and Y axis gaze points and produced visualizations whose purpose was to "serve as alternative interpretive frames to traditional narrative-driven modes of scholarly expression, with the further potential to be conceived as aesthetic objects" (Riegel et al. 2017). For example, eye tracking data of 21 participants reading a Shakespeare sonnet created a 79,000-line two-column data file. The data shows that readers of the sonnet maintain a tight focus on the lines of poetry, thus reinforcing strong attention to the material. Our visualization recast the data so that the image reflects focus and attention. The longer lines in the image reflect stronger focus and attention points in the data. When the same participants read the postmodern poem, which would be unfamiliar in form, content, and comprehensibility in comparison to Shakespeare, the data shows that readers pay little attention to the lines of poetry and there are few points of focus. The resulting visualization

contains short lines to reflect this lack of focus and attention (see Riegel et al. 2017 for visualizations). The visualizations thus serve as aesthetic alternatives to the narrative modes common to scholarly work.

This study suggested the promise of eye tracker data in the aesthetic realm, and we quickly realized that there was potential to employ live data streams generated by eye movements for the purpose of art creation. Artist Jody Xiong in her work "Mind Art" and artist Lisa Park in "Eunoia I & II" provided exciting models for how brain waves can be used as live data streams to create art and we felt that eye movement data used as a live data stream also had the potential for art creation. If art could be created by eye movements only, then there were possibilities for individuals with limited mobility to create art. This moved our research questions out of the formality of lab-driven (and thus university) research and into the community. We conceived and received a Social Sciences and Humanities Research Council of Canada (SSHRC) Connection Grant that had as its goal to connect with members of our local disability communities as we explored what the possibilities for the technology were. We held a hackathon with a humanities orientation whereby humanities, social science, and art students were teamed with software coders and individuals drawn from disability community groups. The core challenge of the hackathon was to give each team some base code and an eye tracker and to ask them to put together a functional art creation tool. From the researcher's perspective, we were interested in further understanding interdisciplinary research epistemologies: how would each member of a team contribute to how the developmental process unfolded, and to the end product? Work that had implications for people with disabilities, we realized, could be best done in coordination with non-academic partners and indeed relied on their knowledge and expertise to be effective, equitable, and meaningful.

Informed by what we learned from our Connection Grant, we applied for and received a larger multi-year research grant from SSHRC titled "'Disrupt/ability': Disability, Ableism, Eye-Tracking Technology and Art Creation." The purpose of the grant was to further develop eye tracking technology for art creation with the eyes only. As the title indicates, there are implications for individuals with limited mobility, generating questions about how we conceive of disability in relation to assistive technology and to considerations of health. Kivits et al. (2019) indicate common approaches to defining health-related research questions as being in search of "population health improvement" and "positive health actions," which

are relevant in many health contexts but that are problematical in the context of disability. As they remark:

> Public health constitutes a field of choice for developing interdisciplinary research. Targeting population health improvement necessarily entails embedding research and intervention within a variety of complementary disciplinary approaches. Medicine (and its scientific and professional domains), psychology, epidemiology, economics, social and political sciences, health services research, humanities, geography and legal science all involve research perspectives conducive to the observation, analysis, understanding and interpretation of health facts. When implementing and directing efficient and positive health actions for population, communities and people, the fact of working across disciplines—whether health be their main research focus and health improvement their aim—provides rich, innovative and relevant data for public health intervention. (1061)

In *Brilliant Imperfection: Grappling with Cure*, Eli Clare (2017) notes that health when related to people with disabilities is oriented towards healing and curing: "Overcoming bombards disabled people" (8); "Overcoming is a peculiar and puzzling concept. It means transcending, disavowing, rising above, conquering" (9).

Where Kivits et al. (2019) situate public health within an interdisciplinary frame that moves towards solving health problems, we situate our work within a transdisciplinary health humanities perspective that prioritizes the value of engaging in artistic creation for its own sake. The purpose of our eye movement art creation tools is to foster the enjoyment of creativity as a primary goal, thus avoiding ableist views of what technology's purposes might be in relation to people with disabilities. Eye tracking technology is not about overcoming any perceived bodily or mind deficiency but rather to recognize eye movements as one *ability* that can be used to create art. This is in keeping with Clare's mistrust of the goals of health interventions as being geared to improve the lives of people with disabilities. He writes:

> Sometimes disabled people overcome specific moments of ableism—we exceed low expectations, problem-solve lack of access, avoid nursing homes or long-term psych facilities, narrowly escape police brutality and prison. However, I'm not sure that overcoming *disability* itself is an actual possibility for most of us. Yet in a world that places extraordinary value in cure, the belief that we can defeat or transcend body-mind conditions through

> individual hard work is convenient. Overcoming is cure's backup plan. (2017, 10)

A transdisciplinary health humanities approach, then, serves as useful mode to avoid ableist perspectives on disability.

Developing technology that is of appeal to individuals with limited mobility needs to recognize the inherent biases of ableist thinking in health and medical research, and art creation as an enjoyable and fulfilling practice for its own sake proves to be an exceptional intersection of health and humanities. We have described our work as follows:

> Our current research project is interested in the concept of ability as it relates to how we consider the embodied nature of individuals: we are in particular interested in how art-making can be a disruptive process, signaling how we understand the relation of the body and its many functions to art making, and how certain kinds of digital technologies can be situated in relation to these considerations. (Riegel and Robinson, 2020)

The concept of ableism, defined in relation to the concept of disability, is central to our work. Bogart and Dunn (2019) define ableism "[a]s stereotyping, prejudice, discrimination, and social oppression toward people with disabilities … . People with disabilities are broadly defined as those who have conditions that are commonly perceived to be disabilities by the general public, including physical, sensory, and intellectual disabilities, in addition to invisible disabilities, chronic health conditions, psychiatric conditions, and others" (650). To be defined as being disabled is to be defined against a socially defined set of norms relating to bodies and minds.

Fiona Kumari Campbell (2001) influentially recognizes the normalizing nature of ableism when she defines ableism as "[a] network of beliefs, processes and practices that produces a particular kind of self and body (the corporeal standard) that is projected as the perfect, species-typical and therefore essential and fully human. Disability then is cast as a diminished state of being human" (44). To be disabled is to intrinsically be in deficit in relation to someone who is deemed able-bodied or able-minded. A disabled person is "an intrinsic bearer of a deficit. The dependency-relationship of a person is negatively valued: 'normal' means being an autonomous agent, where a centrally valued notion is that the autonomous agent is independent, not dependent upon others" (Carnevale 2015). Ableism others people with disabilities, becoming "ideas, practices,

institutions and social relations that presume ablebodiedness, and by so doing, construct persons with disabilities as marginalized … and largely invisible 'others'" (Chouinard 1997, 380, qtd. in Bogart and Dunn 2019, 651; see also Campbell 2008; Davis 1995; Friedman and Owen 2017; Kafer 2013; Keller and Galgay 2010; Ostrove and Crawford 2006; Overboe 1999; Palombi 2012; Rogers and Blue Swadener 2001; Snyder and Mitchell 2006; Thomas 2004).

Our research project is thus inherently interested in the relationship of art making to a series of concerns relating to ableism and disability, including how interacting with digital technology in a disability context is often matched with the concept of assistance via technology, as well as with overcoming disability that might be deemed a health concern from an ableist perspective. Rather than being "assistive" the technology we create is designed purely for creative purposes so individuals can express themselves and find enjoyment in creativity for its own sake.

Our research studies focus on the user experience of various art-making programs, on hardware and software interfaces, and on the development of eye training modules (eye control is taxing and difficult, especially initially), and the data we collect in these studies is geared to improving the experience of making art with the eyes only rather than to *improve* the individuals who engage in the art making. Indeed, focus group exercises we have conducted demonstrate that apart from the need to be able to move a single eye, no other physical movement is required to use our art-making programs, and that as such largely the matter of embodiment is removed. Participants with only the ability to move their eyes have found the experience of participating in focus groups to be interesting from a social perspective as every user of the eye trackers finds eye control challenging and, essentially, all users are in equally weak positions. Once users gain experience, the level of achievement in terms of controlling what is created with the eyes only is disconnected from bodily function (apart from the need to be able to move one eye), erasing ableist notions of physical superiority. Chris Hayes notes that technology "has the potential to destabilise the ableist assumptions at the heart of the art world, supporting artists and audiences with disabilities in radical new ways" (Hayes 2018 qtd. in Riegel and Robinson 2020). Art making through eye tracking technology thus has the potential to "serve as such a radical disruptive tool" (Riegel and Robinson 2020).

What, then, does a transdisciplinary health humanities project look like in our context? It develops in a community-oriented manner, involving

focus groups, individual sessions, and public events that draw on the experiences of users as they interact with our technology to help inform further research questions, outcomes, and understanding. Such research draws on what disabled artist Kristina Veasey deems as necessary to develop technology used by people with disabilities: "It's important to involve disabled people in the development of that if you want to be relevant and impactful" (Hayes 2018). Thus, it works to resist ableist approaches to technology development, working to ensure the art-making experience is divorced from any notions of being assistive and/or curative. From a technology perspective, we seek to minimize cost in recognition that expense is a barrier to accessibility with much technology developed in relation to people with disabilities (Uslan 1992; Kaye et al. 2008; Borg and Östergren 2015; Dobransky and Hargittai 2016; Soong et al. 2018; Ward-Sutton et al. 2020). We have harnessed the power of low-cost gaming eye trackers by creating custom software programs that allow participants to use line drawing to create figures, to create abstract art by using colour dots and a colour picker, and to create colour-by-number art, including embedding multiple such figures on a broader digital canvas (for examples, see mind-artlab.com). The entire experience is designed to be touch-free so that no assistance is needed to start a program, to navigate a program, to save or print a created work of art, and to close the program.

Our project functions in a transdisciplinary manner in that its epistemology, methods, and disciplinarity exceed the specificity of our individual disciplinary grounding. It is informed fully neither by cognitive developmental psychology, nor by literary studies and the digital humanities, even when these disciplines provide insights into the project's conception. We cannot, after all, sidestep our disciplines entirely, nor is that the aim of transdisciplinary work. Rather, such work is geared to address a challenge, which in our case relates to the potential for eye movements to be used for art creation. Leafing out of this challenge are considerations of disability and ableism, as well as creativity and aesthetics. Digital technology plays a central role in how we approach the challenge given that eye movements must of necessity be captured by digital technology.

Conclusion

Connected to any use of technology in a disability context are concerns of accessibility and the uses of technology, which should always be understood through the lens of ableism to avoid discriminatory practices

relating to technology development. The health humanities provide a useful field to situate our work given their transdisciplinary potential, as we discuss above. They allow researchers such as us to address research challenges through other disciplines outside our areas of expertise, combining them with our specific knowledge. Neither of us is an expert in hardware or software development, yet these are key elements of the project. This move to integrate expertise outside our disciplines meshes with what Andrea Charise (2020) sees as an important challenge facing health humanities work, which is to break down the "theory-application divide" as it is not "a productive driver for health humanities, nor does it make much sense to maintain such [a] partition when mapping the future directions of the field." Our community participants come to our endeavours with eye trackers *not* as subjects of our research to be studied, nor with any specific theoretical disciplinary grounding. Rather, their participation in our project involves experiencing the technology, and as they interact with it, they provide us with their insights on how it functions and how it could be further developed. Such research fits uncomfortably within research conceptions that require solutions to problems, or as Eli Clare (2017) terms it in relation to disability "cure". As researchers, transdisciplinarity affords a way to conceive a project that relies on community participation to address the broader social challenge of how we perceive disability and how ableism pervades health research rather than of disability as a problem to be solved. Creating art with one's eyes is not a solution to a definable problem, but at its simplest an opportunity to be engaged in art making as a valuable experience in and of itself. Charise (2020) challenges the contours of the health humanities by noting that they "will only realize … [their] promise be recognizing, and being legible to, the multiplicity of sites and communities where such work is needed, shaped, and experienced." Such work then needs to embrace transdisciplinarity, erasing the conventional boundaries of the disciplines, and the divisions between academic researchers, practitioners, and broader communities. As Robert J. Lawrence (2010) remarks, transdisciplinary approaches offer practical solutions that require "the capacity of teams of researchers and representatives of civil society to join their research objectives by building dialogue" (129).

Acknowledgements The authors acknowledge funding from the Canada Foundation for Innovation (CFI) and the Social Sciences and Humanities Research Council of Canada (SSHRC) that supported this research. Open Access funds

provided by the Office of the Vice President (Research), University of Regina, the Office of the Dean, Campion College, and the Social Sciences and Humanities Research Council of Canada.

References

Albert, Mathieu, Farah Friesen, Paula Rowland, and Suzanne Laberge. 2020. *Advances in Health Sciences Education*. Vol. 25, 755–767. Springer.

Aldrich, John H., ed. 2014. *Interdisciplinarity: Its Role in a Discipline-based Academy*. Oxford: Oxford University Press.

Balsiger, Philip W. 2004. Supradisciplinary Research Practices: History, Objectives and Rationale. *Futures* 36 (4): 407–421.

Banner, Olivia. 2019. Introduction: For Impossible Demands. In *Teaching Health Humanities*, ed. Olivia Banner, Nathan Carlin, and Thomas R. Cole, 1–15. New York: Oxford University Press.

Bogart, Kathleen R., and Dana S. Dunn. 2019. Ableism Special Issue Introduction. *Journal of Social Issues* 75 (3): 650–664.

Borg, J., and P.O. Östergren. 2015. Users' Perspectives on the Provision of Assistive Technologies in Bangladesh: Awareness, Providers, Costs and Barriers. *Disability and Rehabilitation: Assistive Technology* 10 (4): 301–308. https://doi.org/10.3109/17483107.2014.974221. Epub 2014 Oct 27.

Campbell, Fiona Kumari. 2001. Inciting Legal Fictions: Disability's Date with Ontology and the Ableist Body of the Law. *Griffith Law Review* 10: 42–62.

———. 2008. Exploring Internalized Ableism Using Critical Race Theory. *Disability & Society* 23 (2): 151–162.

Carnevale, Antonio. 2015. Robots, Disability, and Good Human Life. *Disability Studies Quarterly* 35 (1): 201.

Charise, Andrea. 2017. Site, Sector, Scope: Mapping the Epistemological Landscape of Health Humanities. *Journal of Medical Humanities* 38 (4): 431–444. https://doi.org/10.1007/s10912-017-9445-5.

———. 2020. On Applying the Arts and Humanities in Austere Times. In *The Routledge Companion to Health Humanities*, ed. Paul Crawford, Brian Brown, and Andrea Charise. Abingdon and New York: Routledge.

Clare, Eli. 2017. *Brilliant Imperfection: Grappling with Cure*. Durham and London: Duke University Press.

Couser, G.T. 1991. Autopathopgraphy: Women, Illness, and Life Writing. *A/B: Auto/Biography Studies* 6: 65–75.

Crawford, Paul. 2020. Introduction: Global Health Humanities and the Rise of Creative Public Health. In *The Routledge Companion to Health Humanities*, ed. Paul Crawford, Brian Brown, and Andrea Charise. Abingdon and New York: Routledge.

Crawford, Paul, Brian Brown, Victoria Tischler, and Charley Baker. 2010. Health Humanities: the Future of Medical Humanities? *Community Mental Health Review* 15 (3): 4–10. https://doi.org/10.5042/mhrj.2010.0654.

Crawford, Paul, Brian Brown, Charley Baker, Victoria Tischler, and Brian Abrams, eds. 2015. *Health Humanities*. Basingstoke: Palgrave Macmillan.

Davis, L.J. 1995. *Enforcing Normalcy: Disability, Deafness and the Body*. Ann Arbor: Verso Press.

Dobransky, Kerry, and Eszter Hargittai. 2016. Unrealized Potential: Exploring the Digital Disability Divide. *Poetics* 58: 18–28.

Frank, Arthur. 1995. *The Wounded Storyteller*. Chicago: University of Chicago Press.

Friedman, Carli, and Aleksa L. Owen. 2017. Defining Disability: Understandings of and Attitudes Towards Ableism and Disability. *Disability Studies Quarterly* 37 (1). https://doi.org/10.18061/dsq.v37i1.5061.

Frodeman, Robert. 2010. Introduction. In *The Oxford Handbook of Interdisciplinarity*, ed. Robert Frodeman, xxix–xxxix. Oxford: Oxford University Press.

Frodeman, Robert, Julie Thompson Klein, and Carli Mitcham. 2010. Preface. In *The Oxford Handbook of Interdisciplinarity*, ed. Robert Frodeman, vii–ix. Oxford: Oxford University Press.

Gibbons, Michael, ed. 1994. *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. London: Sage.

Hadorn, Gertrude Hirsch, Christopher Pohl, and Gabriele Bammer. 2010. Solving Problems Through Transdisciplinary Research. In *The Oxford Handbook of Interdisciplinarity*, ed. Robert Frodeman, 431–433. Oxford: Oxford University Press.

Hawkins, Anne Hunsaker. 1999a. Pathography: Patient Narratives of Illness. *Western Journal of Medicine* 171 (2): 127–129.

———. 1999b. *Reconstructing Illness: Studies in Pathology*. Purdue: Purdue University Press.

Hayes, Chris. 2018. How AI Increases Art World Accessibility for Disabled Artists. *Dazed*, Sept. 2018. https://tinyurl.com/yxw3lg6n

Huutoniemi, Katri, Julie Thompson Klein, Henrik Bruun, and Janne Hukkinen. 2010. Analyzing Interdisciplinarity: Typology and Indicators. *Research Policy* 39: 79–88. https://doi.org/10.1016/j.respol.2009.09.011.

Jones, Therese, Delese Wear, and Lester D. Friedman, eds. 2014. *Health Humanities Reader*. New Brunswick and London: Rutgers University Press.

Kafer, Alison. 2013. *Feminist, Queer*. Crip: Indiana University Press.

Kaye, H. Stephen, Patricia Yeager, and Myisha Reed. 2008. Disparities in Usage of Assistive Technology Among People with Disabilities. *Assistive Technology* 20 (4): 194–203.

Keller, R.M., and C.E. Galgay. 2010. Microaggressive Experiences of People with Disabilities. In *Microaggression and Marginality: Manifestation, Dynamics, and Impact*, ed. D.W. Sue, 241–268. New York: Wiley and Sons.

Kim, H.K., S. Park, and M.A. Srinivasan. 2009. Developments in Brain-machine Interfaces from the Perspective of Robotics. *Human Movement Science* 28 (2): 191–203.

Kivits, Joelle, Laetitia Ricci, and Laetitia Minary. 2019. Interdisciplinary Research in Public Health: The 'Why' and the 'How.'. *Journal of Epidemiological Community Health* 73 (12): 1061–1062.

Klein, Julie Thompson. 2010. A Taxonomy of Interdisciplinarity. In *The Oxford Handbook of Interdisciplinarity*, ed. Robert Frodeman, 15–30. Oxford: Oxford University Press.

Klugman, Craig M., and Erin Gentry Lamb. 2019. Introduction: Raising Health Humanities. In *Research Methods in Health Humanities*, ed. Craig M. Klugman and Erin Gentry Lamb, 1–14. New York: Oxford University Press.

Lawrence, Roderick J. 2010. Deciphering Interdisciplinary and Transdisciplinary Contributions. *Transdisciplinary Journal of Engineering & Science* 1 (1): 125–130.

Ledford, Heidi. 2015. Team Science: Interdisciplinarity has Become all the Rage as Scientists Tackle Society's Biggest Problems. But there is Still Strong Resistance to Crossing Borders. *Nature* 525 (7569): 308–311. https://doi.org/10.1038/525308a.

Marrone, Mauricio, and Martina K. Linnenluecke. 2020. Interdisciplinary Research Maps: A Mew Technique for Visualizing Research Topics. *PloS One* 15 (11): e0242283.

Nicolescu, Basarab. 2014. Multidisciplinarity, Interdisciplinarity, Interdisciplinarity, and Transdisciplinarity: Similarities and Differences. *RCC Perspectives* 2: 19–26.

Okamura, Keisuke. 2019. Interdisciplinarity Revisited: Evidence for Research Impact and Dynamism. *Palgrave Communications* 5 (1): 1–9.

Ostrove, J.M., and D. Crawford. 2006. One Lady Was So Busy Staring at Me She Walked into a Wall. *Disability Studies Quarterly* 26 (3). https://doi.org/10.18061/dsq.v26i3.717.

Overboe, J. 1999. 'Difference in Itself': Validating Disabled People's Lived Experience. *Body & Society* 5 (4): 17–29.

Palombi, B. 2012. Women with Disabilities: The Cultural Context of Disability, Feminism, Able-bodied Privilege, and Microaggressions. In *The Oxford Handbook of Feminist Counseling Psychology*, 199. Oxford: Oxford University Press.

Riegel, Christian. 2017. Mourning, Memorial, and the Yizkor Books in Eli Mandel's *Out of Place*. *Mosaic: An Interdisciplinary Critical Journal* 50 (2): 187–204.

———. 2020. Writing Grief: The Fraught Work of Mourning in Fiction. In *Exploring Grief: Towards a Sociology of Sorrow*, ed. Michael Hviid Jacobsen and Anders Petersen, 104–123. Routledge.

Riegel, Christian, and Katherine M. Robinson. 2020. Disability, Ableism, Eye Tracking, and Art Creation and Disruption. In *Radical Immersions: Navigating Between Virtual/ Physical Environments and Information Bubbles*, ed. Elena Papadaki, 138–145. London: DRHA.

Riegel, Christian, Katherine M. Robinson, and Ashley Herman. 2017. Harnessing Quantitative Eye Tracking Data to Create Art: Interdisciplinary Collaboration and Data Visualization. *Body, Space & Technology* 16: 101.

Rogers, L.J., and B. Blue Swadener, eds. 2001. *Semiotics & Disability: Interrogating Categories of Difference*. SUNY Press.

Siedlok, Frank, and Paul Hibbert. 2014. The Organization of Interdisciplinary Research: Modes, Drivers and Barriers: Organization of Interdisciplinary Research. *International Journal of Management Reviews* 16 (2): 194–210. https://doi.org/10.1111/ijmr.12016.

Snyder, S.L., and D. Mitchell. 2006. *Cultural Locations of Disability*. University of Chicago Press, Chicago, IL.

Soong, Ronald, Kyle Agmata, Tina Doyle, Amy Jenne, Tony Adamo, and Andre Simpson. 2018. Combining the Maker Movement with Accessibility Needs in an Undergraduate Laboratory: A Cost-Effective Text-to-Speech Multipurpose, Universal Chemistry Sensor Hub (MUCSH) for Students with Disabilities. *Journal of Chemical Education* 95 (12): 2268–2272. https://doi.org/10.1021/acs.jchemed.8b00638.

Thomas, C. 2004. Rescuing a Social Relational Understanding of Disability. *Scandinavian Journal of Disability Research* 6 (1): 22–36.

Trussell, Dawn E., Stephanie Paterson, Shannon Hebblethwaite, Trisha M.K. Xing, and Meredith Evans. 2017. Negotiating the Complexities and Risks of Interdisciplinary Qualitative Research. *International Journal of Qualitative Research* 16: 1–10.

Uslan, M.M. 1992. Barriers to Acquiring Assistive Technology: Cost and Lack of Information. *Journal of Visual Impairment & Blindness* 86 (9): 402–407. https://doi.org/10.1177/0145482X9208600907.

Ward-Sutton, C., N.F. Williams, C.L. Moore, and E.O. Manyibe. 2020. Assistive Technology Access and Usage Barriers Among African Americans with Disabilities: A Review of the Literature and Policy. *Journal of Applied Rehabilitation Counseling* 51 (2): 115–133.

Christian Riegel is Professor of Health Humanities and English at Campion College, University of Regina, Saskatchewan, Canada. He is a Fellow of the Royal Society for the Arts (FRSA) in the United Kingdom. Amongst his books are

Writing Grief: Margaret Laurence and the Work of Mourning, *Response to Death: The Literary Work of Mourning*, and *Twenty-First Century Canadian Writers*. He is coordinator of the Certificate programme in Health and Medical Humanities at the University of Regina.

Katherine M. Robinson is Professor of Psychology at Campion College, University of Regina, Saskatchewan, Canada. She is a Fellow of the Royal Society for the Arts (FRSA) in the United Kingdom. She specializes in mathematical cognition, the psychology of evil, and eye tracker computer game design for data collection. She recently published *Mathematical Learning and Cognition in Early Childhood Education: Integrating Interdisciplinary Research into Practice*.