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“That’s Not Art, It’s Just Consultation!”: Performing Innovation in Socially Responsive Creative Technologies Research

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Résumé de l'article

This article brings together two perspectives on the field of creative technologies and explores its place in practice-based research. Case studies are drawn from maker culture projects, pedagogical work in developing creative technologies programs in tertiary institutions, and socially engaged art projects taking up creative technologies methodologies. The article also contains an embedded research instructable, with prompts for engaging with communities, arts institutions, and industry. This article shares hopes for creative technologies as a form of practice-based research that can disrupt exclusive art and research cultures to make room for difference and value diverse kinds of innovation.

"That's Not Art, It's Just Consultation!": Performing Innovation in Socially Responsive Creative Technologies Research

Rebecca Caines and Brandon Watson

Introduction

This article, with an embedded research instructable, brings together two perspectives on the field of creative technologies and explores its place in practice-based research. Creative technologies is an eclectic field that somehow encompasses teenagers sharing instructional videos on YouTube, scholars seeking new digital methodologies for their research, and DIY crafters discovering electronics. Self-defined creative technologists might include artists creating in nonartistic spaces, computer scientists and engineers in creative roles, staff in military and policing research labs seeking technical solutions in unlikely places, and teachers in educational institutions building interdisciplinary programs to capitalize on the excitement of the new. As we demonstrate below, "innovation" is both a term denoting creative potential and a crass performative label, a tension that must be negotiated in the field. Creative technologies initiatives may be run by fine artists in galleries or other professional arts spaces. The artists may be working in intermedia, or in art/computing hybrids such as new media art, now sometimes referred to as digital art. Alternatively, there could be no artists involved at all. The field relies on innovation from engineering and computer science, but unlike those fields, it also has room for projects with aesthetic, emotional, quixotic, or experimental outcomes that could be nonrepeatable, unstable, or overtly localized. New Zealand–based scholars Andy Connor and Ricardo Medina Sosa have sketched out the edges of this expanding field. In "The A-Z of Creative Technologies," Connor and Sosa suggest that "as an emerging field, Creative Technologies covers different meanings including: the creative use of technology, the use of technology to enhance creativity, and also the creative inception of new technologies" (2018, 3; see also Connor 2020). We return to Connor and Sosa's useful frame throughout this paper. Creative technologies projects can also bring communities, artists, scientists, and academics together in new constellations to create socially responsive projects that use repurposed, ubiquitous, and/or emerging technologies, while also incorporating artistic techniques. It is the socially responsive possibilities of creative technologies that most interest us, as we are both involved in creative and technical research in collaboration with community partners.

For Rebecca Caines, a self-described interdisciplinary weirdo and early-career humanities professor, the porous, transdisciplinary framework of creative technologies has provided her with the excuse to explore new types of collaborations, codevelop unusual art/research/engagement hybrids, and

Rebecca Caines is an interdisciplinary artist and scholar, whose research crosses between creative technologies (including sound art, new media, and augmentation) and socially engaged art, with a special focus on improvisatory practices. She holds a PhD in performance studies from the University of New South Wales, in Sydney, Australia, and is an assistant professor in the Department of Theatre at York University. Her publications appear in journals such as *Performance Research*, *Contemporary Music Review*, *The Canadian Journal of Action Research*, *Critical Studies in Improvisation*, and *M/C: Journal of Media and* Culture. She is also co-editor (with Ajay Heble) of *Spontaneous Acts: The Improvisation Studies Reader* (Routledge, 2015). **Brandon Watson** holds a BA in creative technologies from the University of Regina, where he is also currently completing an MFA in interdisciplinary studies. His research interests focus on using maker culture and people-centered design to improve accessibility and promote design using the United Nations Sustainable Development Goals.

improvise across and between institutional, cultural, and economic divides (with varying degrees of success). A number of these projects are discussed here and can also be seen on her website (https://rebeccacaines.org). The openness of creative technologies has provided an academic and artistic home for Rebecca's particular mix of training and experience in multimedia theatre, performance studies scholarship, and socially engaged art. This nomenclature has become even more useful as she has collaborated with an increasing number of computer scientists and engineers in her research and teaching, including many collaborations with her partner John Campbell, who is a software designer and new media artist. Her community-facing projects have also become increasingly technology focused. Naming herself into this field, however, has required her to find new methodologies to work with others in the field who may have very different vocabularies, expectations, and backgrounds to her own. She has also had to find imaginative ways to share her hopes for the field with students, colleagues, families, and partner organizations over the past ten years, as she has been employed to build programs in creative technologies at two Canadian universities. As a cisgender, able-bodied, and economically privileged white settler scholar living in Canada, she constantly navigates the ethical complexities of centring technology in her research, while working with a wide range of collaborators who may have been systemically denied the same types of capital and/or access. This article is a chance to share some of the hopes she has for creative technologies as a form of practice-based research that can disrupt exclusive art and research cultures to make room for difference and value diverse kinds of innovation.

As a relative latecomer to creative technologies, however, Rebecca decided to invite her graduate student Brandon Watson to share his perspectives as he begins his career in the field. As an undergraduate, he transferred from an engineering program into a brand-new creative technologies degree, and he has continued to expand and explore what it means to be a creative technologist in a master of fine arts program in interdisciplinary media, art, and performance. With a limited art background, for Brandon, entering a world that bridges fields such as fine art, engineering, and computer science has posed a challenge at times. Of particular interest to him is how community-based creative technologies research can confront, replace, and redefine how we interact with commercially available products and expose the shortcomings that come with them. As a student keen on exploring many different technology-based fields, creative technologies has provided a firm grounding as he continues to locate himself within the academic landscape.

Brandon is currently working with an ageing community (his own lawn-bowling club, where he is one of a few younger members) to discuss and develop custom pieces of technology that can create and recharge social connections by increasing social and physical accessibility within the community. For example, he is exploring technological solutions that might allow members to avoid kneeling down to measure gaps between balls and lines, if this is physically difficult; or tools that could support holding or throwing balls differently, for those who struggle with gripping or moving in certain ways; or new, more accessible entertainment technologies or other creative projects that might better support the social goals of the club by bringing the members together. There has traditionally been some concern around adopting new commercially available technology within the club. It has been challenging at times to navigate a path that simultaneously increases the functionality of existing technology, while also reducing the anxiety that can come from change and complexity. Additionally, writing this article has enabled Brandon to better understand his identity within the realm of creative technologies and subsequently, in the realms of both engineering and art. He has found that there is not enough time to reflect on creative technologies and what it offers him while working on his interdisciplinary MFA. The concepts and ideas discussed here have

assisted him in getting to the meat and potatoes of what it means for him to be a creative technologist.

We share an interest in the possibilities that creative technologies offer us as researchers, artists, and community members who are committed to the communities in which we live and work. With a practical focus on making and the possibilities for producing new knowledge (artistic, scientific, *and* social), creative technologies projects can clearly contribute to ongoing discussions around practice-based research. We have, however, received pointed criticisms of our work from those who find that it contests their idea of appropriate research. We have been accused by artists of not making real art, "just doing community consultation," or of not building "technical enough" outcomes for engineers and computer scientists, or of being "too focused on art and creative experimentation" for research contexts. Yet we see working in-between as a strength of the work and believe that simultaneously being inside and outside a range of different fields can expose the exclusions that may limit other forms of research. As Natalie Loveless suggests, practice-based modalities "can actively challenge the many fields they intersect with" and "produce objects that work not only across discursive fields but challenge the norms of those fields, producing boundary objects that insist on being undutiful" (2019, 37).[1]

This article outlines some ways that socially responsive creative technologies research might contribute to new conceptions of innovation. Accordingly, we have produced our version of a research instructable on the topic. We created this instructable by interviewing each other about the pitch, supplies, examples, and steps that we would suggest to people who might wish to use creative technologies for practice-based research. Many instructables are designed to show users how to create a specific object. We are not instructing people on how to produce one particular outcome, so our research instructable reads more like a performance score than an instruction manual. Because user feedback is an important component of instructables, we also invited a couple of our long-term collaborators to add to a comments section at the end.

Instructables are a well-established way of sharing plans online for DIY creation. For example, the Autodesk Instructables website (https://www.instructables.com/) was launched in 2005 by Eric Wilhelm and Saul Griffith. It hosts user created and uploaded do-it-yourself projects. Each consists of a recipe that is attempted, and often then modified, by other online users. The Autodesk Instructables site, and many others like it, are a common feature of creative technologies practice. Such online hubs encourage DIY creativity, the use of cheap and accessible components, and the constant remixing of other projects in a public format. They focus on simple instructions, and on sharing tips, problems, and solutions with a wide online community. Autodesk Instructables might help users to create electronics projects, construct Halloween costumes, bake Nutella brownies, or even remodel shipping container houses for the homeless. An instructable, or any of its component instructions, libraries, or coding suggestions, might then be taken and used in an entirely different project. We hope the slightly tongue-in-cheek, manifesto-like instructions that we share from our experience in this field (and which we have mostly borrowed from our many incredible collaborators), might similarly be stolen, remixed, and recombined into new formations by other makers and researchers. Following each step in our research instructable, we offer an expanded reflection on the ways we have incorporated this instruction into our own practice-based research projects and discuss some possibilities and tensions that have emerged. We conclude with a consideration of current performances of innovation and outline our hopes for socially responsive creative technologies research-creation (the term used in Canada for artistic research or practice-based research in the arts).

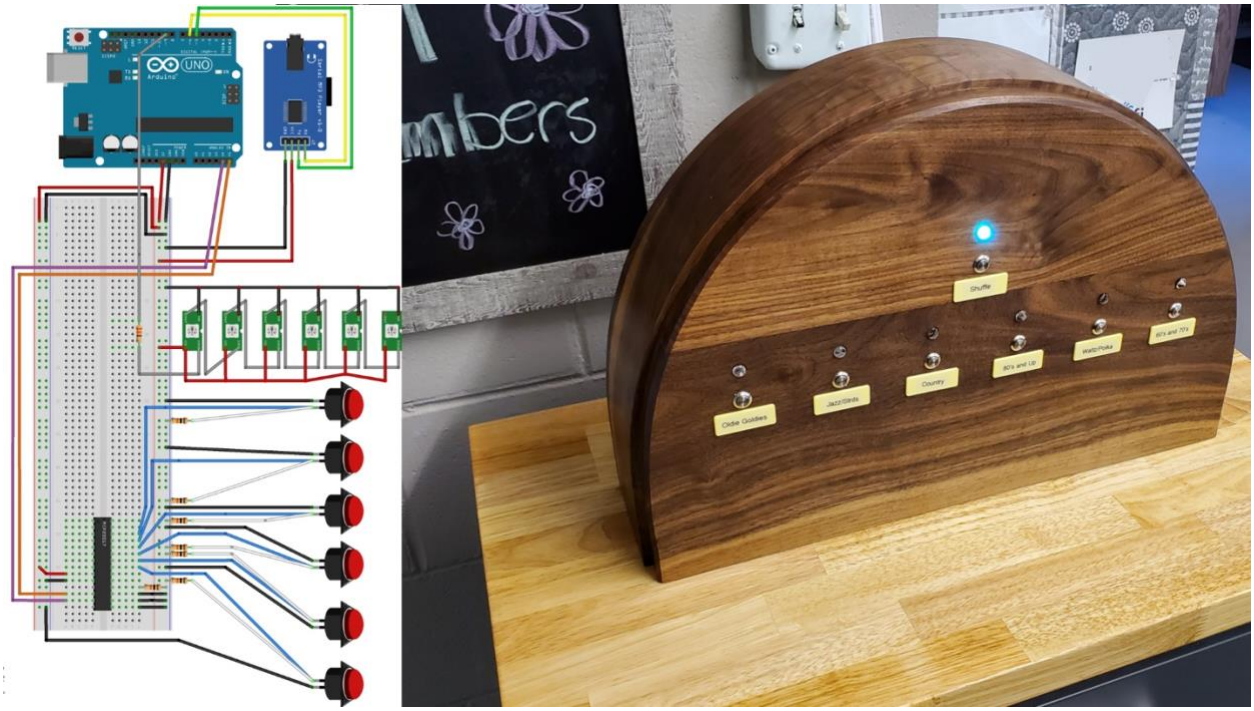
OUR RESEARCH INSTRUCTABLE

Instructable Title: "Performing New Kinds of Innovation with Creative Technologies"

Our Pitch

Innovation can look like very different things to different people, organizations, and disciplines. Creative technologies as a practice-based format allows for different ideas of innovation to coexist and challenge each other. Working across and between fields could also change what we think art, engineering, and research are.

Try our research instructable to build collaborative, socially responsive creative technologies projects that could challenge you, and the other fields you visit along the way.



The Maker Culture project "The User-Friendly Jukebox," bringing together DIY electronics and woodworking, was made with community partners as cocreators at a lawn-bowling club (2021). Credit: Brandon Watson.

List of Supplies You Will Need

A curious mind
A strong will
Deep reserves of imagination
Technologies, tools, and components that may not have been designed for the purpose you have in mind

Knowledge, techniques, methods, and approaches from the best place (wherever that may be; keep looking, you may be surprised)

Collaborators (human and nonhuman)

Fidget_Toy_3.1

```
/*
 Fidget Toy Version: 3.1
 Original Creation Date: 2020-03-17
 Updated: 2020-07-26

 Written by Brandon Watson

 This code maps a potentiometer to a range of frequencies (31Hz to 160Hz) to be output to a speaker via a 3.5mm headphone jack.
 Buttons, pressure sensors, rocker switches and joysticks have been programed to manipulate the frequency in different ways.
 The intended use is to be placed into a custom fidget toy which can output the manipulated frequency to speakers to give the
 user a high level of interaction with the fidget toy.
 */

void setup() {
  // set up a way of viewing what the frequency is doing on the serial monitor
  Serial.begin(9600); // initialize serial communication at 9600 bits per second
  pinMode(2, INPUT_PULLUP); // initialize pin 2
  pinMode(1, INPUT_PULLUP); // initialize pin 1
  pinMode(4, INPUT_PULLUP); // initialize pin 4
  pinMode(7, INPUT_PULLUP); // initialize pin 7
  pinMode(6, INPUT_PULLUP); // initialize pin 6
}

void loop() {
  int button1Val = digitalRead(2); // read input of a button on pin 2
  int button2Val = digitalRead(1); // read input of a button on pin 3
  int button3Val = digitalRead(4); // read input of a button on pin 4
  int button4Val = digitalRead(7); // read input of a button on pin 5
  int button5Val = digitalRead(6); // read input of a button on pin 6
  int sensorValue = analogRead(A0); // read the input on analog pin 0 and assign it to variable
  int mappedValue = map(sensorValue, 0, 1023, 31, 160); //map the pot values to frequency range and assign to variable
  const int X_pin = analogRead(A1);
  const int Y_pin = analogRead(A2);
  int mappedX = map(X_pin, 500, 1023, 0, 80); // map x-axis to a more useful value range
  int mappedY = map(Y_pin, 500, 1023, 0, 80); // map y-axis to a more useful value range
  int freq1Val = 200; // create variable for the frequency duration
  int delay1Val = 100; // create a variable for the delay duration
  int joyStick; // create a variable for the joystick value
  int freq1Button; // create variable for button press to manipulate freq1Val
  int delay1Button; // create variable for button press to manipulate delay1Val
  int delay2Button; // create variable for button press to manipulate delay1Val
  int delay3Button; // create variable for button press to manipulate delay1Val
  int delay4Button; // create variable for button press to manipulate delay1Val

  Serial.println(mappedValue); // print out the frequency that the pot is set to
  Serial.println(button1Val); // print out button 1
  Serial.println(button2Val); // print out button 2
```

Code for making projects with the Arduino microcontroller, inspired by many different libraries and sources (2020). Credit: Brandon Watson.

STEP 1

Creating in a hackathon at Sonic Arts Research Centre, 2016. Credit: Matilde Meireles.

1. Just create . . .

For this step, we recommend that you see your research as ongoing artistic and technical experimentation that may not ever have a result, may be partial, or may have endless variations. Follow the lead of your collaborators, your materials, and your ideas. Let the creative experiment be the point (but remember this is NOT a scientific experiment on other people).

Note 1: This does not preclude things being started or finished, when appropriate.

Note 2: Make plans; but they can become like a musician's graphic score, made up of prompts with multiple interpretations and iterations.

Examples: Collaboration and Experimentation

Between 2018 and 2022, both authors were involved in the development of a piece of wearable technology that is a good example of open-ended creative experimentation with multiple versions. This creative technologies endeavour emerged from a previous research project entitled ImprovEnabled led by Rebecca and her collaborator Michelle Stewart, a researcher who addresses systemic injustices facing those with Fetal Alcohol Spectrum Disorder (FASD). The ImprovEnabled project (2015–2018) investigated the possibilities for using improvised theatre and music games to learn more about the lived experiences of the disability and aimed to provide individuals and their families as well as frontline community organizations with toolkits and resources to use improvisation-based projects to combat social isolation. It also included suggestions on how to adapt games and exercises to support their own needs and goals. See http://improvenabled.ca.

In 2017, in collaboration with Paul Stapleton, we held a hackathon event with partners from Australia and Northern Ireland as an extension of the ImprovEnabled project. The hackathon was held at the Sonic Arts Research Centre (SARC), in Belfast, Northern Ireland, where Rebecca held a visiting research scholar position. The impetus for the hackathon was a question by Michelle as to whether immersive sound experiences might provide a therapeutic sensation of pressure for individuals, similar to a weighted blanket. The hackathon explored different ways to use creative technologies, particularly audio technologies, to support strengths-based responses to FASD. Groups of SARC and visiting researchers, community leaders, artists, and graduate students collaborated with families and occupational therapists in Canada (who participated via prerecorded videos and live messages) to plan out and prototype possible sonic tools that might take advantage of the specific strengths of neurodivergent individuals (particularly around exploring different sensory profiles), and/or help design tools that might support social justice outcomes. The resulting hackathon prototypes addressed methods for advocacy in loud, overwhelming public spaces, tools to address sensory overload by helping with self-regulation, and new options for encouraging sound-based creativity.

In 2018, Rebecca successfully applied for a Canada Council for the Arts grant for a national project exploring strategies for improvised arts and community engagement, entitled multiPLAY (https://multiplay.ca). This was not a research project but part of the council's attempt to fund new ways to improve citizen engagement and access to the arts while increasing digital capacity (Canada Council for the Arts 2018). Rebecca and Michelle, joined by composer and improviser James Harley, led a sub project of multiPLAY under the title "Sonic Blankets." We invited some of the youth and families who were involved in the Belfast hackathon to further explore sound through open-ended studio play sessions. Several graduate students and postdoctoral research fellows also visited during the workshops and shared their own research with the team. This included sharing resonant gong sounds with postdoctoral research fellow Stacey Bliss, a workshop on therapeutic use of the voice with PhD student Carey West, and several sessions exploring fidgets (devices used for self-regulation of anxiety and improving focus). It also included improvisation with PhD student Erin Felepchuk, who then worked further with Harley at his audio lab at the University of Guelph. Felepchuk's own graduate research explores improvisation and autism spectrum disorder, so there were some common interests.

The play sessions included several different activities. There were sessions on making instruments from fidget devices and using them to create multichannel music; explorations of public spaces with

digital audio recorders, and opportunities to learn audio editing software to find and combine environmental sounds that the youth artists enjoyed or disliked. The team tested out a range of speakers to see if they produced sensations in the body; and they also experimented with live immersive multichannel sonic improvisation. The outcome was to codesign a piece of wearable technology to introduce sonic pressure to the body, that would eventually be called the Therapeutic Fidget Sweater. At this point, Brandon joined the team to help construct the wearable. Making the wearable was a collaborative, creative exploration, not a medical study (although we recruited an occupational therapist to test the sweater to ensure that there are no damaging or unwanted effects), but the team agreed that if something seemed to feel good, it might become the focus for further research. The youth artists, according to the terms of the research ethics board certificate, were not considered research participants as they were simply being trained in art workshops and consulted in the development of potential products, and no data or personal information was collected. One future hope is to design low-cost alternatives to expensive therapeutic aids for individuals and families. While the project was not part of an extended research study, Rebecca does see that similar work *could* be part of research-creation, as it engages multiple forms of practice-based knowledge which took form through art workshops, and then continued via collaborative maker culture design and development.

Brandon joined the multiPLAY project as an undergraduate student completing an independent study. What seemed like the tail end of an already established project was for him the beginning of an exciting exploration into wearable technology, sound, and fidgets. One of the main goals was to create an audio/vibration-based sensory wearable that would envelop the user in the sounds and vibrations originating from their special prerecorded audio tracks as well as their own music collection. By collaborating with the group to develop a basic concept of the wearable, Brandon contributed a new device to the project—an audio-based fidget toy that outputs a tone through a basic AUX interface. The tone can be manipulated in real time using the different switches, buttons, sliders, and joysticks commonly found on fidget toys. The combination of devices allowed for another level of interaction with vibration and audio as the user can fidget with the toy and receive both direct vibrational and tactile feedback.

Brandon's process further illustrates the evolving nature of research-creation. Prototype 1 included a series of small transducer speakers powered by a 5V DC amplifier. Keeping the wearable small, safe, and easy to use was important to the design. It was built into a hoodie and used four headphone cables to deliver power to the left and right speakers as well as power to the digitally controlled LEDs located in the hood of the sweater. It included a modular design to allow the user to wear the garment in a multitude of ways. During the initial testing of the wearable, it was determined that although modularity was a good concept, it made the device too complicated to use. It was also found that the speakers were not powerful enough to produce the desired sensation. Brandon started working on the second prototype at the start of his MFA program. He scrapped the 5V system for a much more powerful 12V system and larger transducer speakers. The complicated headphone cable system was replaced by a custom cable using 9 pin aviation connectors. Prototype 2 was a well-received improvement by the participants both in power and simplicity and was still in the testing phase in 2023.

Reflections on Step 1

Research in creative technologies takes many forms, and there is no consensus on what creative technologies scholarship or practice might be. Our research instructable is written from our own specific context and experience. Could it be useful for those with a very different understanding of what research should be? "Scholarly activity is about the discovery, exchange, interpretation, and presentation of knowledge. As such it is inquiry-driven, and the outcome of that inquiry can potentially take many forms. The challenge for Creative Technologies is to define what scholarship in this field is, the criteria of quality, and to promote the acceptance of the outcomes achieved" (Connor and Sosa 2018, 7).

The instruction above for researchers to "just create," and to use creative exploration as a method, places creative technologies alongside other forms of professional art practice that take the form of open-ended processes. These include Fluxus-style performance events, free-improvised music, and generative or interactive new media art. Naming this kind of open-ended artistic experimentation as a legitimate research activity, however, brings this vision of creative technologies squarely into the centre of fiercely argued debates about the place of fine arts in research practice. Should art be considered an entirely separate activity from research, as it has different histories, professional standards, vocabularies, and audiences? Will legitimizing academic interpretations of art as a type of research activity interfere with artistic integrity and control? Are artists avoiding key questions that face researchers around accountability, ethics, and generalizable knowledge production by arguing for special status as artists? These questions are being increasingly posed as artists are asked to justify their work in academic settings, and as scholars ponder the possibilities of artistic research as a modality just as legitimate as scientific research, humanities research, or research in the social sciences (Biggs and Karlsson 2010).

These debates are not central to how we understand our practice, because we see our creative technologies work as a kind of research-creation that involves both artistic and scholarly activity. As Owen Chapman and Kim Sawchuk suggest, there are many ways of incorporating a "creative process, experimental aesthetic component, or an artistic work as an integral part of a study" (2012, 5). Their often-cited list of subcategories of research-creation includes (1) gathering research for the purposes of creation ("research-for-creation"); (2) analyzing creative objects for knowledge ("research-from-creation"); (3) presenting research outcomes using creative means ("creative presentations of research"); and (4) using creation to allow research to emerge ("creation-as-research") (15). While creative technologists could engage in any of these practice-based modalities, the last subcategory best describes our research. As the authors define it:

> "Creation-as-research" involves the elaboration of projects where creation is required in order for research to emerge. It is about investigating the relationship between technology, gathering and revealing through creation (following Franklin, 1992, and Heidegger, 1977, where "technology" connotes a mindset and practice of crafting as much as it does "equipment"), while also seeking to extract knowledge from the process. Research is more or less the end goal in this instance, although the "results" produced also include the creative production that is entailed, as both a tracing-out and culminating expression of the research process. It is about understanding the technologies/media/practices that we discuss . . . by actually deploying these phenomena, and pushing them into creative directions. It is a form

> of directed exploration through creative processes that includes experimentation, but also analysis, critique, and a profound engagement with theory and questions of method (Chapman and Sawchuk 2012, 19).

We find Chapman and Sawchuk's definition of creation-as-research to be very useful as we imagine and build projects with our collaborators.

The socially responsive creative technologies projects that we make are often artistic, scientific, *and* scholarly, and their methodologies might draw from both academic and artistic ideas of successful outcomes. Our projects produce peer reviewed writing and engineering designs as well as juried festival and gallery work. We facilitate fine arts graduate studios and curate or lead workshops as professional artists. We often produce tools developed with and by the community. These community-based creative technologies outcomes sometimes slip out of established frameworks. They might be free online toolkits that are not peer reviewed (such as the toolkits that emerged from the ImprovEnabled project) or experimental products that may never be commercially released (such as the Sonic Blankets wearable). The work may appear in community research-creation showcases in non-juried spaces, such as community centres and support groups, or in health settings, gallery spaces dedicated to community work, or as part of outreach programming/curation by universities or arts institutions. New codesigned software might be used just for one group. Work may be self-published, or self-presented in open sharing sessions taking place online or in person. These projects may also have many versions, remain partial, or be ephemeral, appearing at a moment for a purpose that is never designed to be sustained. Creative technologies practice thus challenges ideas of research as always planned, controlled, and leading to specific outcomes with measurable applications in other contexts. This lack of generalizability might be problematic, after all, does creating one wearable technology sweater, for one family, matter in the wider scheme of research? But it might also open new ideas of success. For example, a playful workshop may have unintended positive effects on participants. Youth artist Keisha Mohr, working with her mother, FASD advocate Shana Mohr, created the following bio for the multiPLAY website in 2020:

> Hi
> My name is Keisha Rayne Mohr. I live with something called FASD. Nobody can change that. To be honest, I love living with FASD. It makes me special and different. I still do ordinary things anyone would do. I play hockey, go to school and even get in a little mischief once in a while. That is who I am 🙂 My favourite part about this project is the way my body felt during the project was amazing. I felt like I was in my happy place and actually being understood. It was an incredible experience. I love it.

STEP 2

Caines and participants performing improvised music on iPads in a public concert for the project "Improvising with iPads: A Partnered Inquiry into Technology-Based Music Therapy, Improvisation and Cultural Expression in Health Settings," Wascana Rehabilitation Hospital, Regina, Saskatchewan, 2015. Credit: John Campbell.

2. Just keep creating . . .
Cross into places you are not sure you belong. Let artistic methods, ideas, and outcomes infect engineering constructs, and functionality encroach on artistic freedom. Let collaborators remind you that you are not in control.

Note: Be ready for critique (you need it).

Example: Facing Critique

As mentioned, Brandon is currently working on an MFA project to increase the social and physical accessibility of a community group. He is an avid athlete and long-standing member of the lawn bowls club and is collaborating with his fellow (much older) members to explore creative technologies for use by the club. The first component of the project was the creation of the User-Friendly Jukebox, designed to allow members easily to listen to music with the press of a single button. In the eyes of Brandon, the User-Friendly Jukebox branched the areas of engineering and art through the inclusion of a people-centred design process (Norman 2013) and through an artistic critique of modern commercially available technology. He felt he was artistically engaging aesthetics in his exploration of nostalgia, familiarity, and emotion. The design of the jukebox was based on Brandon's mental picture of a classic jukebox and sculpted from wood and DIY electronics with great care to be friendly, inviting, and nostalgic. He wanted to separate it from overcomplicated, anxiety-producing commercial designs, which include intimidating panels of buttons, knobs, switches, and wires that seem extremely difficult to operate. He was also inspired by graduate classes exploring interactive sound art installations constructed from wood and electronics and was informed by his own ongoing exploration of sound art as a marker of memory and a tool for community making, which was a theme of several other sound art projects he made during this time. The electronics were drawn from maker culture projects he discovered online.

During his end-of-semester critique, Brandon almost received a failing grade from both art and engineering faculty members who were tasked with deciding if he had successfully completed the semester and could move forward in his program. From the perspective of the artists, the project was void of all artistic value, and "nothing more than the work of an engineer consulting with people." In turn, the engineers felt that, while there were definitely engineering components, there were anomalous key artistic elements that would not normally be seen in engineering, including his focus on concept and care over functionality, and the time spent on wood carving and sculptural techniques. An engineer, he was told, would be more likely to prototype "with just a shoebox and some wires." This was his first experience as a creative technologist in such a hostile debate, and his initial response was a loss of confidence. He began looking for ways to incorporate both art and engineering more clearly within his work. Eventually, he came to the conclusion that art has never *not* been present in his process. He decided that as a creative technologist, much of the art he incorporates within his work comes in the form of practice-based critique of the failure of commercially available technology. While the attack felt fierce at the time, he was eventually supported by other creative technologists in the room and did finally pass the review. He was also heartened by the positive reception from the lawn bowling community, and this support has helped him to further cement his idea of creative technologies and be in a better position to defend his work.

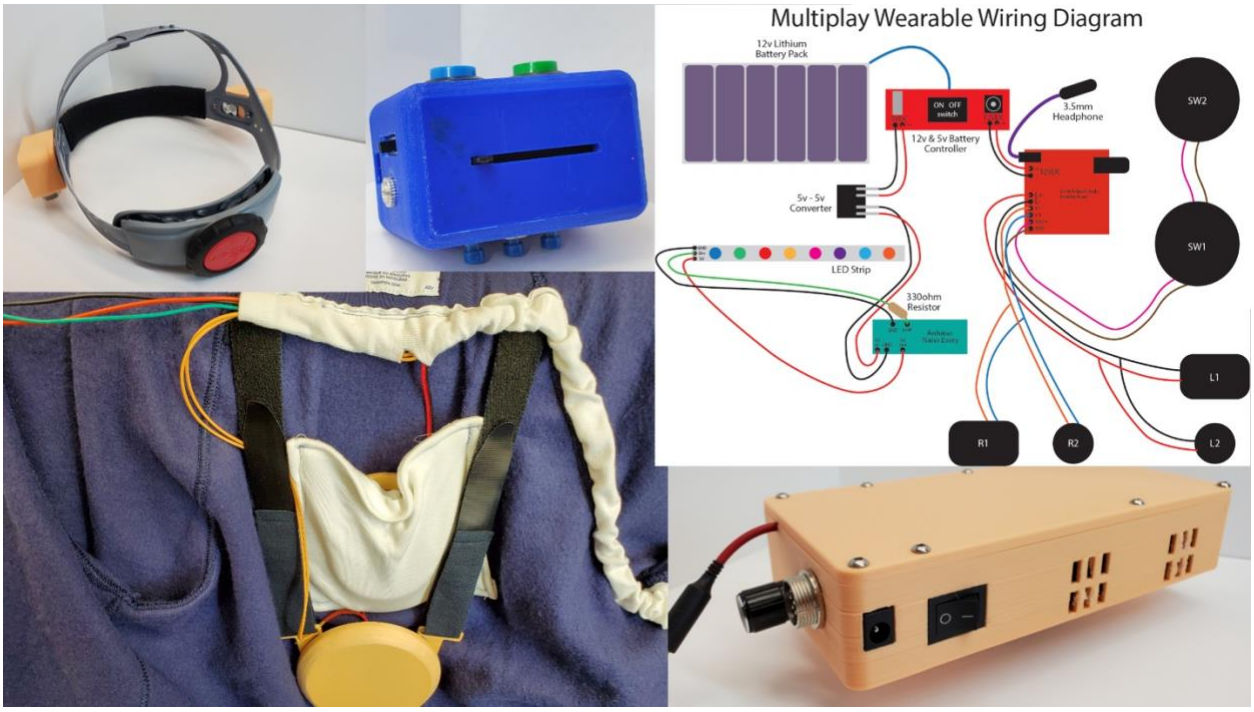
In the following semester, to connect more to his own artistic processes such as storytelling and emotional response, Brandon focused on creating a solo creative technologies work that spoke about his conflicted feelings as a human in contact with technology. One experiment was an ambisonic audio art piece exploring his personal relationship to his home aquarium and considering how technology may both save and destroy our natural environments (https://brandochiliportfolio.weebly.com/projects.html). This project helped Brandon to gain confidence in his own artistic and technical capabilities and see the two sides of his work as inherently connected.

Reflections on Step 2

Connor and Sosa contend that "whilst Creative Technologists may specialize, they need to not fall into a silo of thought and practice. Collaboration with others is key to understanding and addressing complex problems and the key to successful collaboration is a shared understanding and a sense of safety to take risks and learn from each other" (Connor and Sosa 2018, 3). As a socially engaged artist whose projects are always codesigned with community members, Rebecca reflects often on the impact and ethics of cocreation. She engages with a number of other collaborative practice-based methodologies across her projects including social practice (Jackson 2011; Thompson 2012), improvisation (Caines and Heble 2015), community-based performance (Kuppers and Robertson 2007), participatory and relational art (Bishop 2006), and modified versions of participatory action research (Pant 2014). She also uses ethnographic methods from performance studies (Phelan and Lane 1998) and different forms of creative project evaluation (ASC 2022). She tends to simultaneously explore in multiple directions at once. Yung (2015) describes the work of creative "multidisciplinarians" as one of simultaneous response: "The framework is artistic *and* ecological, artistic *and* communal, artistic *and* scientific, *and* profitable, educational, academic, technological, sociological, cultural, feminist, activist, etc. Within the artistic mode, the thinking is theatre *and* folk concert *and* social practice, or sculpture *and* media arts *and* community discourse, etc." (5).

Sharing control with others is central to these approaches, based on careful negotiation, communication, and acknowledgement of the different levels of power operating across these spaces. It is perhaps no wonder that Rebecca is drawn to creative technologies, with its core principle of collaboration. There is also something seductive about the idea of disciplines infecting other disciplines, or being in an (inter)disciplinary home that transgresses often, and about watching creative technologies expand, in the Kraussian sense, somehow moving between art and non-art, engineering and non-engineering (Krauss 1979, 31–44). Rebecca does recognize that there is something disturbingly arrogant at the heart of an approach in which researchers truly believe they can go anywhere, and try anything without the proper training, history, and context. This is where both ethics and a certain amount of gatekeeping might be needed for safety, to ensure depth of research, and avoid the harm to communities that may come when researchers assume access to all areas. Yet there is no avoiding critique when the work crosses disciplinary lines, especially when the practice sits at the crossroads of so many different opinions about what art, engineering, and research should aim to be. At the centre of our instruction to "just keep creating" is the awareness that publicly exposing your weaknesses in creative technologies projects, admitting that training is vital but could be partial or inadequate, letting others lead, or knowing that you will need to completely change direction when you get it all wrong might engender a useful kind of vulnerability and transparency (if one can only avoid defensiveness).

STEP 3



Developing a wearable technology project in playful creative workshops (2019—ongoing). Credit: Brandon Watson.

3. Make connections you are not sure will hold and give up control.

Note 1: Connections could be working with other collaborators who may have very different ideas of success. (Connections could also be dodgy soldering points, because we are still learning how to work with electronic components.) Connections might be with experts, amateurs, anonymous online tech support, community leaders, or your boyfriend.

Note 2: Be ready for someone to turn your community tool into a Halloween costume and then into a training method for the police.

Example: Creating Collaborative Class Projects for Dancers

In 2020, Brandon collaborated with another graduate student with a background in theatre design and production on a project advised by Rebecca. For Brandon, this area was miles away from the coding, woodworking, electronic, device-based work that he had been focusing on. Their idea was to create a wearable wireless device from inexpensive or recycled components. The device would read a dancer's heart rate and send the information to a computer backstage where it could directly impact many elements of the performance. For example, in this instance, the goal was to have the information change the speed and colour of the lighting as well as possibly change the tempo of the music. They thought that it could lead to some interesting elements within live performances in which a cumulative, run-off effect might take place. As the performer's heart rate increased, affecting the tempo of music and lighting effects, the cue to dance faster would further affect the performer's heart rate in a cyclical process. The students hoped the tool might become part of a theatre graduate performance project examining the possibility for engendering parasympathetic responses in audiences via bodily functions such as coughs and heart beats.

There were many challenges to the project, including obtaining an accurate and stable heart rate, transferring the information into the MIDI (Musical Instrument Digital Interface) file format that was needed for the theatrical software used, and transferring the information wirelessly through a Bluetooth connection. While each of these can be straightforward concepts and coding challenges by themselves, combining them into one package proved to be a nightmare. Brandon's collaborator, while technically trained in theatre production, was very far out of his comfort zone researching products and attempting code. The code and libraries came from a range of sources, including medical websites. The project was also hindered by COVID-19 protocols that banned the two students meeting face-to-face. The available heart rate sensors were quite erratic in their readings which required workarounds. Changing the readings into MIDI required alterations that were not ideal for the Bluetooth connection and when they thought they had all areas of the code working together, they were greatly limited by the available software on Windows and Mac PCs, which would receive the Bluetooth information in such a way that it could be imported live into theatrical software to alter scenes. Every step that they took led them two steps back and, in the end, the success or failure of the project was completely in the hands of the corporations that designed the software that they had to use. The project failed to connect properly, and they only saw flashes of possibility. While this was extremely frustrating, the progress they had made along the way proved that there could be an exciting future for the technology.

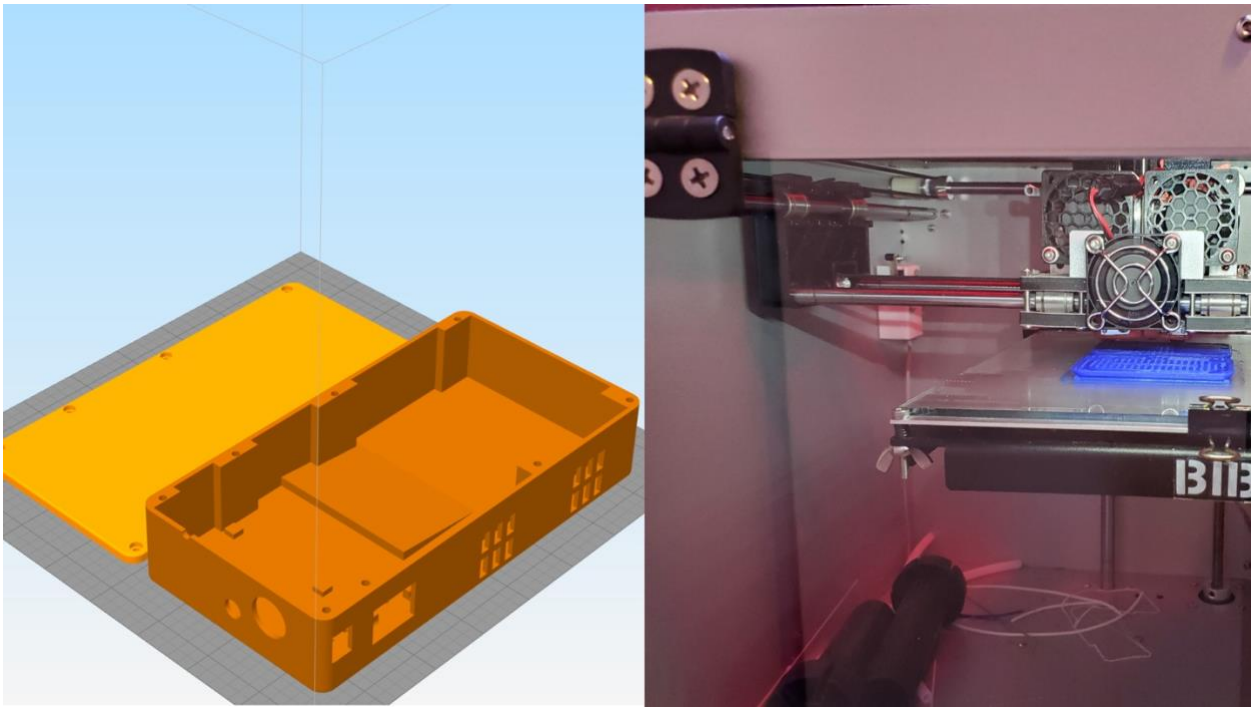
Reflections on Step 3

Creative technologies builds on practice-based methods taken from computer science and engineering. These include people-centred design (Norman 2013), agile software development (a highly influential method calling for early and continuous software development that is constantly responsive to client needs; Beck et al. 2001), amateur DIY maker culture (Dougherty 2016), and hackathons, tech/game jams including serious games (computer games with a social purpose; Engage Research Labs 2020). Creative technologies practitioners are also interdisciplinary scavengers and can learn from histories of interdisciplinarity as it appears in other contexts. In a much-quoted definition, Julie Klein (1990) states, "Interdisciplinarity is a means of solving problems and answering questions that cannot be satisfactorily addressed using single methods or approaches" (196). Maura Borrego and Lynita Newswander, however, remind us that interdisciplinarity can be

differently conceived in the sciences and humanities (2010, 64). In their view, the sciences are more likely to use the term to refer to multidisciplinary teams working on a problem together, while the humanities are more likely to refer to new processes and forms that emerge from hybridizing and combining different approaches. Connor and Sosa suggest creative technologies engages in a kind of methodological bricolage as it works pragmatically, using resourcefulness and improvisation. They state: "The notion of 'available things' is core to the idea of effectual thinking of entrepreneurial activity. Similarly, the ability to find and use such available things across traditional disciplinary boundaries also aligns with the undisciplined nature of the field" (Connor and Sosa 2018, 3).

This pragmatism is not always focused on social justice or creative outcomes. Some of our colleagues in creative technologies, for example, are borrowing creative projects, ideas, and tools from maker culture and new media art, and using them to help defence organizations build new forms of immersive police and military training in Canada and the US (Hanson 2021). Creative technologies RND labs are also common in military contexts and the source of many new inventions. This is a tension for those opposed to the secrecy and inherent violence of paramilitary research, yet it is natural in a field where cross-disciplinary agility is standard. Our instruction to "make connections that may not hold (and be ready to let go of ownership)" is not easy, nor is it innocent, but it can produce or share new knowledges that cross between worlds, blurring who is a researcher or a participant, a teacher, or a learner, an amateur or an expert.

STEP 4



Learning how to 3D print. Credit: Brandon Watson.

4. Start and End by Learning

Note: Do not be an expert. You better bring what you know, but you also need to learn before you start. You need to not be safe, comfortable, or know what is best.

Example 1: The Collaborative CNC Music and Drawing Project

Connor and Sosa suggest that "curiosity naturally leads to discovery" and maintain that creative technologies is "a mechanism that facilitates discovery and self-directed learning" (2018, 5). During an undergraduate class with Rebecca, for his creative technologies program, Brandon began working on a project to explore the connections between art, engineering, technology, audio, collaboration, and improvisation. If that sounds like a lot, it is because initially it was probably too much. He was also inspired by reading Morehshin Allahyari and Daniel Rourke's "The 3D Additivist Manifesto" (2015), which explores creative and radical 3D printing and maker culture possibilities. His vision for the project was to build a CNC machine (any machine where software and code control the movement of the production equipment, in this case a plotter machine for drawing), with a custom tool head designed to hold three marker pens. The machine would also be used to simultaneously create music. He aimed to translate music notes into the g-code instructions needed to control the motors, which would then produce the different tones, qualities, and durations he wanted as they moved. While the CNC machine was making music, three users could then stand around the machine and, using a hydraulic system, individually raise and lower the marker pens onto a piece of blank paper to create collaborative drawings over which no one person had complete control.

This accomplished a few things. First, it transferred music onto paper as a kind of drawing. Second, it allowed users to listen to the sound and change the drawing through improvisation and collaboration. Nearly every component of the project required extensive research to complete as Brandon had never built a CNC machine, programmed one, transferred music from MIDI notes to g-code, or worked with hydraulics. In fact, the only component of the project that he was familiar with was working with a 3D printer to build some custom parts for a CNC machine. He had to research if there was a way to translate music notes into g-code. This research included watching many YouTube instruction videos and scanning forums. His initial research led him to the MIDI file format, which seemed like the most efficient way of converting music. As he continued to research, he found that someone had already built a clever MIDI to g-code converter (https://www.ultimatesolver.com/en/midi2gcode). This resolved one of the most technical components of the project. Building the actual CNC machine involved numerous design decisions that had to be made before he could test them. One of these design choices was whether to use belts or lead screws to move the tool head. He also experimented with different music scores to convert to g-code, eventually choosing the theme song to the game *Original Super Mario Bros* as it converted well and was suited to the audience (university students in a creative technologies course). This project resulted in some interesting questions about collaboration and improvisation across disciplines that Brandon would like to explore in the future.

In Brandon's experience, when you step outside of your comfort zone and begin a project with many unknowns, the process of learning as you go can lead to amazing and exciting works that create new possibilities for the creator. Brandon is not an expert in any of the fields that were combined in this project, but through learning, discovery, and experimentation, the project led him on new pathways. Stepping out of one's comfort zone as a creator can help to challenge the importance of being an expert in a particular field. While Brandon was taking classes in his original engineering program, he was taught that engineers are problem solvers. In creative technologies, the more common idea is that creative technologists are not the experts, and we may not be the ones to solve any problems at all, but instead may always be involved in continual play, creativity, and experimentation.

Example 2: Building Creative Technology Programs

Rebecca has significant experience building creative technologies programs in Canadian universities. She was employed at the University of Regina in 2011 to help build a new program in the Faculty of Media, Art, and Performance that would allow students to move between courses in each of the faculty's departments (Visual Art, Music, Theatre, Film, and Interdisciplinary Programs) *and* take courses in the Department of Computer Science in the Faculty of Science. This was a complex pedagogical initiative, and in her first semester she was asked to teach a 100-level course, open to all students at the university, entitled Introduction to Creative Technologies, before the program had even begun. This was a speculative endeavour, in which she invited lecturers from both partnering faculties, as well as from the Software Systems Engineering program in the Faculty of Engineering and Applied Sciences, to speak about their art and research. In part, her goal was simply to observe, and then build connections between, the new Creative Technologies program and research and teaching that were already taking place. At the same time, she worked with several multidisciplinary committees to learn how the university understood the field, and what it was possible to build, given the university and faculty resources and the local communities of practice around art and technology. It was difficult to build a coherent core of required learning to the program, and to connect the diversity of electives and options that were all approaching the idea of creative technologies in different ways.

The new degree options were a BA, entered via the Faculty of Media, Art, and Performance; and a BSc entered via the Computer Science Department. The team also built a minor that was open to anyone in the university. There were many moments of disconnection while attempting to balance so many different perspectives of the field. Creative technologies also needs investments in technology, technological support, and new kinds of spaces, and there was very little will to make these kinds of staffing and infrastructure investments in an uncertain funding climate, especially where existing programs were being asked to cut their budgets. This funding pressure is not unique to academia but is a feature of many new creative technologies contexts. This work can be tricky to resource as it requires both artistic and technological assets, and constant updating as conditions in the field change. There is also a fascinating conundrum for tertiary institutions, especially in the fine arts. The initial appeal of attracting both institutional buy-in and potentially increased student enrolment through naming a program something sexy like "Creative Technologies" can run into harsher realities when management are asked to actually support new kinds of pedagogy, manage interdisciplinary and cross-faculty teams with different priorities, and prioritize resource-heavy practice-based programming despite budget cuts in the humanities.

For some, a new program called Creative Technologies should just be an instrumental device to connect and feed existing fine arts classes/practice, while allowing student artists additional access to technological supports. This idea is also reflected in research, where some creative technologies artists do not learn the technology themselves and instead seek technologists as staff rather than as cocreators. For others, a creative technologies program should be an intensely technical extension of multimedia computing that requires students to take large amounts of training in coding, mathematics, and electronics (although in Rebecca's experience, no professor wants the task of teaching these at the beginner level to artists). Students and families (and the wider university administration) seemed most interested in courses that would train students in software for professional careers such as graphic design, web design, and commercial creative content. To Rebecca, those felt like technical college goals. She and her colleagues in the Interdisciplinary

Programs department felt that Creative Technologies should not simply be a service program but should be allowed to flourish as its own distinct field, taking up a commitment to critical thinking and to interdisciplinary theory and practice.

The learning for Rebecca during this period was constant. In her years at the University of Regina, she designed new classes in interactive media, wearable art and technology, sound art, locative media, mobile devices for music, and technologies for theatre, yet none of these were part of her original postgraduate or postdoctoral degrees, and all required plunging at times into unknown territories and new fields of research. Some of these attempts were unsuccessful, for example when the skillsets she attempted were too difficult to acquire or teach, or when the correct administrative, technological equipment and supports were not made available. Other courses became successful features of the new program. The university was very small, with limited available faculty to teach the classes, pressure to constantly show increasing student numbers, and a tiny regional new media art scene and limited tech industry to draw on. She did not have the luxury of helping to build a program that chose just one creative technologies specialty. Instead, she had to create something that could hold together a range of significantly different ideas of what creative technologies was and what it could achieve—and do this as a junior scholar, in shifting administrative environments with differing levels of buy-in and support. This multifaceted approach produced many tensions, arguments, and complications for faculty and students (and may have contributed to a high faculty turnover), but it also led to a very open structure where new classes were developed regularly and students were introduced to the radically diverse nature of the field.

Reflections on Step 4

It is often very difficult to determine the lines between planning, learning, and research in creative technologies. When is a project just pedagogical, or just research, or just administrative work? For example, one pedagogical method Rebecca utilized was coteaching, which emerged from her own interest in interdisciplinarity and from her experience working in multidisciplinary research teams. She experimented with several models for working with colleagues from other departments, including coteaching sound art with a professor in Software Systems Engineering (where half the class were fourth-year engineering students, and half fine arts and open elective students). She also built a collaboratively taught iPad Orchestra class, working with musicians (initially clarinetist and musicologist Pauline Minevich, and later improvising vocalist Helen Pridmore, and with computer scientist David Gerhard). This class became a music techniques elective for music majors, and a core project class for creative technologies majors, as well as an elective for computer science majors interested in app development and interface design. It also had a connected research component, exploring the pedagogical possibilities for utilizing iPads in music teaching and learning. Rebecca also brought her undergraduate and graduate students from these classes into her socially responsive creative technologies research. Her co-teaching experiments directly led to new practice-based research projects which then became fuel to drive even more new class production.

The iPad Orchestra class, for example, led directly to the development of a community-based research project in health settings with Indigenous residents entitled Improvising with iPads: A Partnered Inquiry into Technology-Based Music Therapy, Improvisation and Cultural Expression in Health Settings. It also led to the incorporation of iPad improvisation techniques into the ImprovEnabled project discussed above. Students from creative technologies became involved in both these projects as parts of their classes, or during special independent studies, and/or as paid

undergraduate and graduate research assistants. When they had specialized technical skills, they were often teaching the researchers or sharing their knowledge with other students. These research projects in turn fuelled the development of new classes. One example was a new course for fourth-year students entitled Interdisciplinary Improvisation where students examined current socially engaged research in improvised art and technology and then built their own projects (Brandon's CNC machine discussed above is one example). This approach was directly inspired by the practice-based case studies that Rebecca was intersecting with via her own CSI research, such as Ramshaw and Stapleton's Translating Improvisation project in Northern Ireland (2017), or Pauline Oliveros's Adaptive Use Musical Instrument project that began in the United States and continued with partners across Canada (Oliveros et al. 2011). Practice-based learning is always both the beginning and end of Rebecca's engagement with creative technologies. She now hopes to bring her intertwined learning and her practice-based research from the University of Regina context to her new position helping to build a new socially responsive creative technologies program at York University's new Markham campus that opens in 2024.

STEP 5

Supporting First Nations teenagers to explore audio technologies and interview Elders about the changing sound in their community in the "Community Sound[e]Scapes: Northern Ontario" project (Caines 2012). Credit: Rosa Loess.

5. Be Mistaken

Mistakes come because you are not infallible or independent and rely on things and people (including yourself) that can fail. (P.S. nobody is ever really independent anyway—where does your tap water come from?) Your technologies might be designed by someone else (and don't necessarily work with other technologies). Also, mistakes are material and you must be accountable for them. You will make mistakes with partners (human and nonhuman). You need to own these, live inside these, build from these.

Note: Try not to be afraid.

Example: Jukebox Disasters

There were many near project-ending mistakes that took place during the creation of the User-Friendly Jukebox discussed above. During the woodworking phase of the project, Brandon had a very specific technique he wanted to incorporate. This technique is called kerf-bending and is used to create smooth curves in straight panels of wood by creating a series of repeated parallel cuts across the bend. The spacing and depth of these cuts differ depending on the radius of the bend and the species of wood. Due to a small miscalculation, when he attempted to bend the wood into place for gluing, the piece cracked in multiple locations and split apart. This mistake made the entire piece completely useless and set him back many days while he determined whether to try again or attempt to work with the broken piece. He settled on continuing each cut entirely through the wood yielding about 40 small pieces. By adding a slight angle to each piece, he was able to glue them all together and form a large curve. While he wanted a clean, jointless curve, he ended up with a curve that had to embrace the massive mistake by accentuating the joints between each of the forty pieces. Later, a piece of equipment failed, completely destroying the jukebox. It gouged out large sections of wood, splintered others, and burned and scorched marks deep into the wood.

Rolling with mistakes is something that creative technologists, along with everyone else, must learn to do, but it can be overwhelming at times, especially when mistakes are completely out of your control. Quitting was very much an option in Brandon's mind because he didn't have a solution to salvage the project at that point. It took the collaborative effort of another woodworker to find a path through the failure and salvage the woodworking. While the finished User-Friendly Jukebox doesn't exactly resemble his original plan, Brandon believes it is significantly better because it showcases how collaborative experimentation strengthened the project and his conception of mistakes and failure.

Reflections on Step 5

Rebecca has spent many years exploring ideas of improvisation through the framework of Critical Studies in Improvisation (CSI). This included completing a postdoctoral fellowship with the research network Improvisation, Community, and Social Practice based at the University of Guelph, and subsequent involvement in the management of the connected research initiative, the International Institute for Critical Studies in Improvisation (IICSI). In 2013, she started the Regina Improvisation Studies Centre, which acted as a partner site in IICSI, and in that role supported a range of improvisation-based research projects. Improvisation has become both a method and an outcome in much of her research and her teaching, and unpacking improvisation as a methodology has also been a recent focus of her scholarly writing (Caines 2019, 2020; Caines and Heble 2015). For her, improvisation is made up of categories that should be central to both art and research: real-time decision-making with others, surprise, supported and accountable risk taking, deep listening, and, perhaps most importantly, the reconfiguration of mistake. Improvisation requires that we engage in activities that may not be successful, or could, despite our best efforts, result in failure. While some improvisers might blithely suggest that "there is no such thing as failure," this is a simplistic summary of a more complex idea. CSI suggests instead that failure must be looked at as material. This does not mean there are no issues, errors, or things to avoid; on the contrary, we must face and own our mistakes, become wholly visible, accountable and responsible for them, and must continue to explore them in conversation with others.

There is more research to be done exploring the intersection of improvisation and creative technologies as connected practice-based research modes. Creative technologies' use of people-centred and responsive design approaches, rapid prototyping methodologies, maker collaboration, jams, and gamification all seem to connect to CSI via a shared interest in qualities of playful collaboration, responsiveness, and risk. For both Rebecca and Brandon, it has certainly felt natural to combine research-creation in creative technologies with improvised approaches drawn from theatre, music, and visual arts.

Both socially responsive creative technologies and CSI seem to offer a similar challenge to risk adverse research cultures that are focused on the anxious avoidance of possible dangers and liabilities, and ready to see a mistake as just a learning opportunity. We are encouraged to mark mistakes, and then to try desperately hard to avoid them next time, rather than see them as the genesis of work. This is intensified in creative technologies work, which is so fraught with the likelihood of technological failure at any point of a project, however expert the practitioners. If it becomes possible to admit that failure is inherent, as technologists do, perhaps it is also possible to walk the careful line between owning mistakes and learning from them, using them to make new things possible, and becoming less fearful of imperfection.[2]

Conclusions: Performing Innovation

Innovation is a term that may produce scepticism in artists and scholars. It is a concept often wielded by bureaucrats and technocrats too ready to dump the old in favour of trends, or fads, or selling new directions that may in fact be the wrong way to go. In business, it is used to refer to both the invention of something new (sometimes called idea generation or simply creativity) and the bringing of that new product or service into "successful use" (Cumming 1998, 21–29). However, fields like social entrepreneurship acknowledge innovations that might come from outside profit-driven contexts. Geoff Mulgan suggests that "the results of social innovation—new ideas that meet unmet needs—are all around us. They include fair trade and restorative justice, hospices and kindergartens, distance learning and traffic calming" (Mulgan 2007).

Innovation in socially responsive creative technologies work is difficult to evaluate. The project may be an innovation artistically, but boring technically (or vice versa). It may be received as a failure to the disciplines it touches on and borrows from, but a success to the communities involved. It may be a technical success and a social and creative failure. How do we measure if the research has moved from idea generation or "just consultation" to successful knowledge creation? Creative technologies by its nature is performing ideas of innovation that are riskily attractive, always promising something exciting that it may not be able to deliver on. And when does innovation actually begin or end? Some creative technologies projects are short lived by necessity. Rebecca has worked on many projects that have had to nimbly find a space inside community contexts where staff are overworked, spaces are limited, people are leaving or unable to keep attending, or participants or co-creators are passing away. These projects can be momentary and ephemeral, but they can also be marked by joy. For example, when cocreating with people forced to live in a rehabilitation hospital whose lives are totally prescribed and deformed by systemic barriers to inclusion, breathing in as a group, to create a silent moment for someone who is nonverbal and unresponsive to have the time and permission to reach with shaky, slow moving hands to create their own sound on an iPad and thus be heard for the first time, that could feel like an innovation.

It could also feel like a revelation.

What kinds of performances of innovation might come into view when communities and researchers improvise their own terms for practice-based research, and take up the invitation to explore the creative potential of art and technology together with vulnerability and transparency, always ready to succeed, always ready to fail?

INSTRUCTABLE COMMENTS FIELD

User: John Campbell
Comment: My first job was a software developer for a small industrial automation company where I wrote computer vision software. We had to get the most out of every element of the system. So reworking the hardware and software was a frequent occurrence. Sometimes completely scrapping the original solution for the hope that the new solution would be better performing. (Faster, more accurate, etc.) For me this was innovation, trying to push past what seemed to be the boundary of what was possible with the current system.

User:
Comment:

Mistakes in a project. Credit: Brandon Watson.

Notes

1. A visual artist and theorist, Loveless also draws on a wider history of exploration of boundary objects and undutiful behaviour from feminist as well as science and technology scholars in her work.

2. For further examples see Caines, Seibel, and Kenny (2014). For reflections on the unique types of mistakes, and possibilities for acknowledging and attempting harm repair in settler-colonial contexts see Jimmy,

Andriotti, and Stein (2019), available as a free download at https://musagetes.ca/wp-content/uploads/2019/07/Braiding_ReaderWeb.pdf.

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