

TRACES: HERE/NOT HERE

By

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ABSTRACT

Traces: Here/Not Here endeavors to put a positive spin on our mortality. We are here, and at some point we will no longer be here: by virtue of living, we will die - but what do we do with this time we have? This body of research creation is about life; about our time-limited lifetimes, our experience of it, and about the effects of our actions. It is about the affect of our interconnectivity with each other, human and non-human, animate and inanimate. By way of interactive artworks featuring playful and dynamic sculptures which must be activated by the physical effort of the artist, a collaborator or a visitor/participant, a durational performance is experienced leaving indexical marks, prompting mindful consideration of our interconnectedness, and injecting optimism that we can use this opportunity to act for what matters most to each one of us.

Through a reflexive practice-led methodology, augmented by literature reviews of theorists, critical thinkers, artists, and art historians, the research investigates the themes of time, Posthuman interconnectedness, as well as investigating participatory and ludic art, which activates the body and the special knowledge creation centered there.

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Except where noted in caption, all photos taken by Elizabeth M. Lopez

INTRODUCTION

We are here, and at some point we will no longer be here: by virtue of living, we know we will die, but what will we do with this time? *Traces: Here/Not Here* is a body of work about life; about our time-limited lifetimes, and our experience of it, and about the effects of our actions. It is about the affect of our interconnectivity with each other, human and non-human, animate and inanimate. There are effects from our actions, immediate and also those trailing behind, a trace of our life, reinforced or obliterated by the traces of others. By way of art installations involving playful and dynamic¹ sculptures pushed or pulled or twisted into motion by the artist, a collaborator or a visitor/participant, an experience is created, leaving an indexical mark. The artworks are the durational experiences, and not the objects, which I consider simply the artifacts of the artwork. This body of artwork strives to prompt mindful consideration of our inter-connectedness and inject some optimism that we have the opportunity to act for what matters most to each one of us.

Supporting my discourse on these concepts, I draw primarily upon critical thinkers Karen Barad² and Bruno Latour,³ with some threads from Henri Bergson⁴ via Gilles Deleuze.⁵

¹ I have chosen the word “dynamic” rather than “kinetic” to signal the difference between my sculptures and most of the works described as kinetic. Dynamic means that it is moving and changing, active and progressing.

² Karen Barad (1956 -) American feminist posthumanist theorist with a background as nuclear physicist.

³ French transdisciplinary theorist Bruno Latour (1947 -)

⁴ Henri Bergson, French philosopher and Nobel prize winner for literature, (1859 -1941) who famously also engaged in a debate on physical vs metaphysical time with physicist Albert Einstein in 1922 (Canales 2015).

⁵ French philosopher Gilles Deleuze (1925-1995).

Especially for an interweaving of play and art I draw from contemporary art historian Tom Stott.⁶ These ideas are explored in the Chapter THEORETICAL FRAME WORK.

Through my artwork, I seek to engage the body in forming or reinforcing meaning in our existence, for we are hard linked to our bodies; we can think only so long as we have the physical breathing, pumping vessel of our bodies. Knowledge made in the body runs deep, and understands what may be difficult to articulate through language. Using aspects of play, I am looking to both engage, and to draw out the joy of using the body, to use the memories of other play experiences, to explore by not only looking, but feeling; texture and temperature through touch, movement and positioning of our bodies, the heft of weight. This is often augmented by sound, a hum of vibration, or rasp of friction, and perhaps a subtle fragrance from the materials. I recognize that not all the installations will invite interaction by visitors, or involve some skill to initiate action (one work requires a two-person collaboration to launch) but they can also be actively engaged by sharing the same space while others, namely myself - the artist, perform the works. During the course of my research-creation, I have investigated ways to promote interaction. Research related to play and interactivity are shared under the chapters PLAYFUL ART/LIVING and PEOPLE MOVING ART MOVING .

These works use time as a material; taking time to experience such as in the time taken to walk through a curved Richard Serra corridor,⁷ taking time to make a mark to record a passage such as the indentations left on Gabriel Orozco's sand-pool table,⁸ taking time for

⁶ Tim Stott is an art historian and critic in the U.K. specializing in contemporary works that involve the audience in play situations. His book *Play and Participation in Contemporary Arts Practices* (2015) sets out a framework for critical analysis of artworks involving ludic participation.

⁷ For example: Richard Serra (1938 -) *A Matter of Time*, 1999, Bilbao Guggenheim museum.

⁸ Gabriel Orozco (1962 -) *Sand Table*, 2005, Santander Centro Botin

contemplation as in the meditative work of Lee Ufan,⁹ taking the time to elicit that embodied learning that occurs in play as in the large scale swing installation of Ann Hamilton.¹⁰ I have interwoven discussions of other artists' works throughout this document.

Except for a work whose significant component is a large driftwood log, my research creation works incorporate spinning tops cast from 3D prints made by digitally spinning the facial profile line of a particular individual – which is why I call them portraiture tops. In the case of this thesis work, I am using self-portraiture tops.

Following the lead of Lee, who has titled all his sculptures by the same name,¹¹ I have named top-based installations *Spinning through Life*. The suspended log work is named *timespacemattermotion*, in reference to Karen Barad's *timespacematter*.¹² Images of the series *Spinning through Life* are provided in Figure 1, Figure 2, Figure 3, and Figure 4, and images of *timespacemattermotion* are shown in Figure 5 and Figure 6. These are elaborated upon in the chapter THE TRACES OF MY WORK, where I share the conceptual work and the explorations that fed the results of my research-creation, as well as describing how I was able to reach out into a larger community of metal artists. Included is my foray into technical problem solving of a specific defect observed in the emerging area of using 3D digital prints for metal casting, the outcome of which I am sharing with the artist community.

⁹ Lee Ufan (1936 -) is a Korean-born interdisciplinary artist working in Japan and Paris. He is associated to the Japanese minimalist art movement Mono-ha (known as the "Object School" in English) from the late sixties, and is also described as poet, philosopher and critic (Lisson Gallery posted bio).

¹⁰ Anne Hamilton (1956 -) *event of a thread*, 2012, staged in Park Avenue Armory, New York.

¹¹ "In 1972 Lee changed all the titles of his extant three-dimensional works to *Relatum*. As he explained, 'a work of art, rather than being a self-complete, independent entity, has a resonant relationship with the outside. It exists simultaneously together with the world that is and is not, i.e. a *relatum*.'" (Dia: Beacon didactic)

¹² A term used in Karen Barad's 2015 article "Transmaterialities: Trans*/Matter/Realities and Queer Political Imaginings."

We have the ability to act - even in not actively acting, we are choosing not to act - and I maintain that with this opportunity, we can make the choices that align best with what we prefer to leave in our wake, both for the immediate and longer term effects. What is the affect/effect of Elizabeth Lopez having been alive, or even in the room?

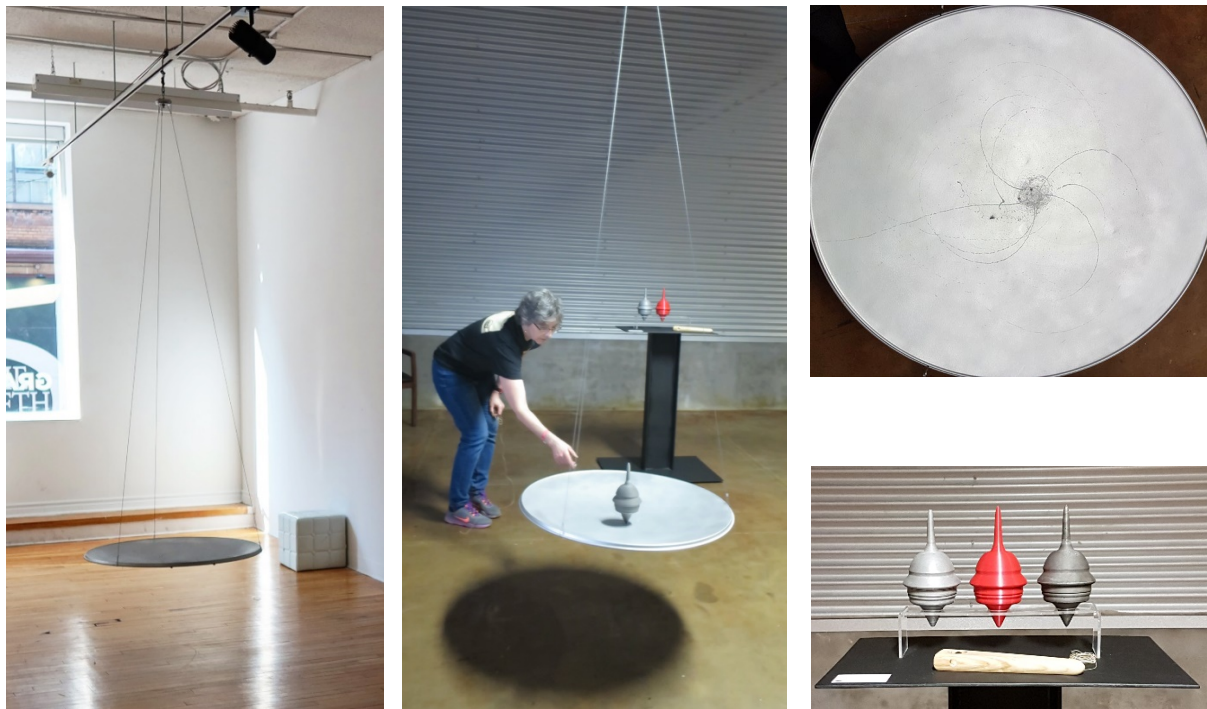


FIGURE 1 - *SPINNING THROUGH LIFE* AKA THE DISH
REPURPOSED SATELLITE DISH, STEEL CABLE, BEARING, ROPE;
(LEFT) INSTALLATION VIEW AT REST IN OCADU GRAD GALLERY, (CENTER) IN ACTION AT “A RARE FEW” EXHIBITION AT SLOSS FURNACES IN BIRMINGHAM, ALABAMA, APRIL 2019
(UPPER RIGHT) DETAIL: TRACES OF SPINS ON DISH, APRIL 5, 2019.
(LOWER RIGHT) ALUMINUM, PLA, AND IRON SELF PORTRAIT TOPS IN STAND, WITH WOODEN (ASH) LAUNCHER, AT “A RARE FEW”. TOPS ARE NINE INCHES TALL.



FIGURE 2 - *SPINNING THROUGH LIFE* AKA *ASHES*;
(LEFT) INSTALLATION VIEW OF TRACES OF SPINS IN FLOUR ON WOOD FLOOR,
(RIGHT) DETAIL WITH ALUMINUM CAST PORTRAITURE TOP AT REST.



FIGURE 3 - *SPINNING THROUGH LIFE* AKA *THE PLATE*;
(LEFT) EXAMPLE OF TRACE ON SAMPLE STEEL PLATE WITH PATINA, (RIGHT) TRIAL PLATE AWAITING TRACE MAKING.
NOTE THAT THE PLATE FOR THE THESIS SHOW IS 4' x 4' WITH PATINA, WHILE TRIAL PLATE SHOWN IS ABOUT 2.5 FEET SQUARE, WITHOUT PATINA.



FIGURE 4 - *SPINNING THROUGH LIFE* AKA Big Top;
(ABOVE) BRONZE CAST TWENTY-ONE-INCH PORTRAITURE TOP RESTING IN STAND WHERE IT CAN SPIN - STAND: WOOD, BEARINGS, OIL GLAZES. TOP WEIGHS TEN KILOS.
(BELOW LEFT) TWO PERSON EFFORT TO START THE TOP USING LAUNCHER AND LONG CORD.
(BELOW RIGHT) TOP IN MOTION. THE TOP SPINS FOR OVER SIX MINUTES ON A HARD SURFACE.
IN ITS FINAL FORM, THE TOP IS SPUN ON A LARGE METAL PLATE, LEAVING THE TRACE OF THE SPIN.



FIGURE 5 - *TIMESPACEMATTERMOTION* AKA THE LOG
DRIFTWOOD LOG, ALUMINUM LEAF, STEEL CABLE, RESCUE PIVOT AND CARABINERS, BEACH SAND; CIRCULAR SAND FOOTPRINT IS APPROXIMATELY 12 FEET IN DIAMETER.
(LEFT) INSTALLATION VIEW AT REST, (RIGHT) DETAIL OF METAL LEAF AND SUSPENSION HARDWARE.



FIGURE 6 - *TIMESPACEMATTERMOTION* (VIDEO STILL);
INITIATING MOTION DURING TRIAL (PRE-SAND ADDITION)

RESEARCH QUESTIONS AND METHODOLOGY

This chapter reviews the methods and methodologies used in my qualitative art based research, which have been directed toward the creation of artworks in conjunction with the critical frameworks supporting my research questions.

My art based research approach is largely self-reflexive, as defined by Graeme Sullivan (2010), and follows the descriptions of practice-led and practice-based research summarized by Linda Candy and Ernest Edmonds (2018). Candy and Edmonds distinguish between practice-based research, whose outcome is focused on the produced artifact, and practice-led research whose outcome is focussed around process insights (64). In the context of my research, the work around investigating and creating dynamic sculptures, for the purposes of provoking contemplation and enhancing affect through participatory installations are practice-based. In contrast, the foray into process investigations of defects encountered during metal casting using 3D printed models constitute practice-led research.

Research questions

My research homes in on three questions, approaching the potentially overwhelmingly bleak certainty of our impermanence as human beings in an positive, optimistic and affirmative way, through my creative practice:

- How do we acknowledge/recognize our finite lifespans within entangled networks of time and space?

- Through my artwork, how can I provoke consideration of how we, as individuals, use our agency in the time we have, and of the traces we will leave as the consequences of our actions?
- How can I promote physical interaction, ideally tactile and proprioceptive - touching, pushing and pulling, moving – as part of the artwork as a tool to trigger this conscious living?

Intertwining methods: literature reviews within reflexive practice

Fed by and feeding the making that anchors a reflexive practice-led methodology, I conducted literature reviews of theorists, critical thinkers, art historians and artists roaming around but eventually focussing on the ideas, works and expressions most pertinent to my concepts and research questions and used in my theoretical framework to inform my work (the theoretical framework is described in the following chapter). Many of these wide ranging routes of inquiry included enticing discourses which brush up against my research goals, but are best left for another project, for other research, another time.

Developing and making as part of research creation, I engaged in the iterative research process driven by the creative insights that arise through making. The process, products and accidental outcomes of making provoke further routes of inquiry or approach, which in turn impact further practice (Gray and Malin 2004).

The literature reviews and reflexive practice are entirely entangled, provoking each other, where making prompted new avenues for literature research which prompted new ideas regarding making, and so on. While early in my process it had seemed that I was making physical art objects, and in parallel, reading and thinking, as two distinct and separate processes, I've come to understand that there is a special mode of thinking facilitated by material making that is interwoven with the reading and looking. In making, my mind is focussed on the immediate task at hand: the materials, the hazards, the challenges presented by dimensions and shapes of objects and tools, the problem solving inherent in creative work. But behind that front-line cognitive processing, there is something more, quietly going on, with the process and the emerging object creating meaning. In contrast to reading, or watching videos or listening to live speakers, which are language based cognitive processes, the different inputs to the brain during making, tactile and proprioceptive, non-language sound, smell, and weight, trigger other connections. I often emerge from the self-imposed isolation of my protective gear (safety goggles, respirator, ear muffs, gloves...) with new thoughts and understandings swirling around in my head. This often pushed me off into new directions in my literature reviews and investigations of artist practices.

One important insight that emerged for me, is that the knowledge making through the body, an affect, can also occur for viewers, either by actively watching a performance (where we mentally echo the physical actions we see) or by physically engaging directly with the sculptural objects in my installations. The works have a greater chance to be affective if they

engage the physical body; a changing through moving, and sensing.¹³ All the more reason to promote the participatory aspect.

Direct observation and surveys

With this aim to promote participatory activation of the works, my research on interactivity has been a combination of direct observation, literature surveys and artist surveys. I observed people's reactions to installations, both works by others and my own work, in the different contexts of gallery, art school and public space; researched critical ideas on participatory artworks; and took note of how artists or art institutions actually promote physical interaction with signs or demonstrations. These are discussed further in the chapter PEOPLE MOVING ART MOVING PEOPLE.

Technical investigations into process anomaly

Making material artwork (or making ideas material), that is, something more than words spoken or written,¹⁴ involves some knowledge of processes and materials. These carry meaning for us which can strengthen or reinforce the concept; for instance, the heft of a bronze top immediately changes connotations from one cast in aluminum (much lighter!) or simply printed

¹³ I am writing these words, ironically, while Toronto enters a period of social distancing and self-quarantine, in an effort to slowdown and contain contagion rates of coronavirus (COVID-19).

¹⁴ Yoko Ono's instructional works are really only words: For instance, her 1963 *Beat Piece* is simply the words: "Listen to a heart beat."

in plastic (practically weightless!) and the use of a driftwood log evokes the history of the original tree.

Several times during the physical making, I have entered a problem solving mode that draws from my engineering and technical background.¹⁵ When combining processes such as digital modelling, printing and traditional lost wax casting, I seek to tap into the particular possibilities and strengths of each approach to achieve some new hybrid that emerges when new technologies or material become available (for instance, the almost ideal balance for a spinning top achievable through digital precision, combined with the weightiness of bronze). When unanticipated outcomes arise, I want to understand how it happened, to either repeat or prevent it; accidents can be unexpected pleasures, but they are also learning opportunities. This was the impetus for the research I did into unexpected determining probable causes for surface defects occurring during casting from 3D printed models, which is still a relatively new practice; in this case, I embarked on material and process tests and even data analysis to point towards the likely culprit. This is discussed in the Chapter THE TRACES OF MY WORK and documented in more detail in APPENDIX A.

¹⁵ I have an degree in Electrical Engineering, and have worked for many years in the electrical generation industry.

THEORETICAL FRAME WORK

Examining the ideas articulated in the research questions, I am interested in the ideas of Posthuman interconnectivity, recognising the time-limited experience of our lifetimes while our bodies - and therefore we - are alive, and in considering how we use this opportunity consciously. I am interested in creating experiences through my artwork that invites contemplation of our moment here and now, and how we move through these present moments, remembering that we all leave traces to some extent or another.

Finite lifespans within entangled networks

We are mortal; by being born we are condemned to die, not here/here/not here. But in that in-between place of existence, we are inserted and insert ourselves into that tremendous web of existence. And in this we are simply part of the universal process, as expressed by Karen Barad: "... birth and death are not the sole prerogative of the animate world, 'inanimate' beings also have finite lives. ..." (2017, 78).

We live on a planet that itself will end or at least radically change, as our sun, our own center-of-the solar-system star will eventually move through the next phases of red giant, glowing nebulae and finally (cold) white dwarf. But let us wind it back – much before the earth runs out of sun, we will run out of habitable planet for humanity in our present form, as well as

many other biological life forms.¹⁶ Whether we accelerate or decelerate the process, adapting along the way, is what the discussion regarding climate change and the Anthropocene is about.

The idea of *intra-action*,¹⁷ a term used by Barad, speaks to this interconnectedness, and the somewhat arbitrary separation of ourselves as distinct as humans from whatever we consider non-human. We are matter, we are affected by and affect what is around us, changing and becoming, and ultimately the matter we are made up of will reconfigure into something we will no longer recognize as human. “‘We’ are not outside observers of the world. Nor are we simply located at particular places in the world; rather, we are part of the world in its ongoing intra-activity” (Barad 2003, 828).

This concept resonates deeply with my perception of the interconnectedness and reciprocal affect of the physical world, which includes people in it as one element among many, connected in time and space, across many scales; there is no action/reaction that occurs in strict isolation.

There are concepts in Barad’s essay *Troubling Time* (2017) that align with the concerns of this thesis work: the discussion of “the nature of time and being, or rather: *time-being*” (62); the entanglements of the ultra-minute of quantum particles and the uber-macro world of planetary and galaxial scale, and the idea of the finiteness of not only the animate but also of the inanimate – that everything has a beginning and an end. The interconnectedness of

¹⁶ In the animated film *WALL-E* (2008), inhabitants of North American cities abandon the earth for their high consumeristic city-spaceship – not having to abandon the consumerism and waste generation that fed the crisis in the first place.

¹⁷ Term used in Barad’s article “Posthumanist Performativity” (2003).

everything, and the blurring or sliding of scales from subatomic to macro to cosmic are referenced in my artworks.

Intra-activity and change

Bruno Latour, in his book *Down to Earth* (2018), is deeply concerned with climate change and identifies the connections between socio economic polarizations, political marginalizations and the deteriorating habitability of our planet (2). Latour advocates a change in our way of approaching issues, proposing an abandonment of the old political Left/Right and Global/Local alignments and suggesting that new alignments are needed. In opposition to “trumpism” as identified by the exit of Britain from the European Union (Brexit) and American President Trump’s abandoning of the United Nations Paris Accord on Climate Change, or what Latour labels “Out of this World” where people who no longer “belong to the realities of this world point themselves ... the climate change deniers” (35), Latour sees that an alignment towards what he names the “Terrestrial” (40) is needed. In his discussion of the Terrestrial alignment, he describes a shift from approaching the earth as simply resources to be plundered freely for the benefit of humanity - “a system of production” (82), to a view that humanity as part of a distributed network that can instigate change, “a system of engendering” (82). In fact, acknowledging the Terrestrial is to recognize the geographical and physical world and its systems as an active player, an actor that will “participate in history, to fight back, in short, to concern itself with us (41).” This decentralization of the human connects Latour to other posthumanists, such as Barad, in emphasising the interconnectivity of issues and the provocation of change.

Latour criticises the iconic view of our planet from space – that somehow the beauty from afar makes us blind to the interrelationships of our physical and political and social ecosystems. But I think that there is a way to reconcile that view from orbiting satellites with an attention to what is happening on our local planet, in our neighbourhood; we can be sensitive to what happens here even while recognizing the “out there”; if anything, there is a fragility or finiteness implied when the earth is an object that can be captured within a camera lens.

Latour points out that life occurs on the skin of the planet, what he calls the “Critical Zone” (78), a term adopted from earth sciences, differentiating the layer from the space beyond earth’s atmosphere and from the deeper geology below us (123). This terminology seems apropos, because acknowledging this skin, this thin layer at the surface of the planet where we live, recognises it as a changing entity, something tenuous that has a beginning and an end, a “life” so to speak. This span of existence is what Barad alluded to in the quote earlier.

Time

In critical writing, it seems, discussions about time cannot go far without a mention of Henri Bergson and his explorations on perception of time and the concept of “Duration”, or lived/perceived time, which is relevant to my work about our lifetimes. I researched Bergson’s ideas primarily through the filter of Gilles Deleuze’s *Bergsonism* (1988) which extensively quotes Bergson’s writing. Bergson’s ruminations on our experience of time, the entanglement of memory and perception, the distinction between measured scientific time (where a minute

is always a minute long) and experienced subjective time (where a minute can be nothing or an eternity) directly speak to the moment we live in, for as long as we exist and are conscious.

Time is an intriguing concept – it flows on, around us and through us and whether we see it or not, we are changing. We are always changing; faster as infants and children and adolescents, slowing down in adulthood, and then markedly declining after middle (or later) age.¹⁸ We are always here now, until the moment we are not.

In *Bergsonism*, “*Durée*” or “Duration” refers not only to time passing, but change, impermanence: we are always changing/becoming, some faster than others, some on a different scale as others. Bergson makes a distinction between measured time or “clock” time and perceived time, the experience of time. In the context of a mountain range, a 125 years¹⁹ is almost meaningless, but for a human being it encompasses a whole existence. *Durée* is the perception of time lapsed, or but maybe even better described as the time we have lived.

Motion interests to me, since it is a fundamental marker of life, and is the movement through points of space in time. Motion, then, is space combined with duration. This leads to an interesting proposition where Deleuze quotes Bergson:

... in doubling the psychological experience of Duration with the physical experience of movement, one problem becomes pressing. ... [quoting Bergson] “What Duration is there existing outside us? The present only, or, if we prefer the expression, simultaneity.” (48)

¹⁸ When I made portraiture tops of my daughter at seventeen years old and then at nineteen, her profile had noticeably changed, as mine must have over the same time frame, just not so markedly. When choosing the profile posthumously for my parents, I had to pick between profiles of my mother at eighteen, at eighty-four, and at sixtyish. I settled for the middle one; it matches my memory of her better.

¹⁹ Based on the longest recorded human lifespan to date: French woman Jeanne Calment, as reported in Guinness World Records (2020), discounting Judeo-Christian Old Testament translated accounts of Methuselah.

Here then, the conclusion arises that the only true time we experience is the present moment, which is fleeting. All I have to work with in any given moment, is the moment (which is called simultaneity in the quote above). This gives the moment a tremendous power; how I choose to act in this moment becomes key. It is what Barad calls “the thick now of the present... (with) past and future condensed into each moment” (2015, 388). This is an intersection point between Barad and Bergson/Deleuze, where the present moment is a springboard or opportunity for change, and the possibility of a glimmer of optimism to slip in.

Traces – a chance to act

That we can change, disrupt or trouble the established ways of thinking to create different outcomes is a lifeline of sorts; that our material actions matter, and will one way or another carry forward. This is the urgency and optimism that I read in Barad’s work – that we can – must - choose to change what appear sometimes to be inevitable outcomes:

In these troubling times, the urgency to trouble time, to shake it to its core, and to produce collective imaginaries that undo pervasive conceptions of temporality that take progress as inevitable and the past as something that has passed and is no longer with us is so tangible, so visceral, that it can be felt in our individual and collective bodies. (2017, 57)

We can create change - this is what Barad and Latour are advocating, and what I have found to be true²⁰ - and every moment is the opportunity for change. As Barad has written: “The world and its possibilities for becoming are remade in each meeting” (2007, x).

Each of us make choices everyday, whether we deliberately, consciously choose or not. Regarding whether to invest effort in the micro or the macro is an individual choice. But certainly it feels like more than ever, we are confronted with the need to make choices; as a society (which is always made up of individuals), or even as a species, we are on a track that appears to need attention.

As well as Barad and Latour, feminist and posthuman scholar Rosi Braidotti also speaks to climate issues, and to the need to act in a Posthuman non-anthropocentric manner. (Braidotti adds in the issue of technological acceleration, which John Schellnhuber²¹ identifies as an even more urgent threat to humanity than climate change.) Braidotti weaves several of these ideas together in the introduction to her book *Posthuman Knowledge* (2019):

The posthuman condition implies that ‘we’ - the human and non human inhabitants of this particular planet - are currently positioned between the Fourth Industrial Revolution and the Sixth Extinction. Yes, **we are in this together**: between the algorithmic devil and the acidified deep blue sea. The 4th industrial revolution involves the convergence of advanced technologies, such as robotics, artificial intelligence, nanotechnology, biotechnology, and the Internet of Things. This means that digital, physical and biological boundaries get blurred. The Sixth Extinction refers to the dying out of species during the present geological era as the result of human activity. More specifically, this conjecture positions us between two parallel and to a certain extent specular forms of acceleration: the systemic accelerations of advanced capitalism and

²⁰ As a key example, over my working life, I have witnessed the introduction of workplace anti-harassment legislation, where destructive behaviours which were previously tolerated became illegal. Normalization to a new standard requires reinforcement at every opportunity, to effect significant change quickly.

²¹ In the “Discussion with Bruno Latour, Hans Joachim Schellnhuber” (2018), John Schellnhuber, in Q and A period closing the session, almost in voce sotto, says that technical digitization - digitization and artificial intelligence by unsupervised programmers - is a bigger threat than climate change, the subject of the discussion.)

the great acceleration of climate change. Striking a balance between these conflicting forces, so as to keep the broader picture in mind, is the current posthuman challenge. (2019, 2) [bolding mine]

This paints a dire picture, but it is a challenge, not necessarily a final sentence. There is a way available, should we choose to act, and it is that optimism which I embrace. Braidotti highlights “the positive potential of the posthuman convergence”, offering “tools for coping with it affirmatively” and continues: “Despair is not a project; affirmation is” (3). Braidotti argues for interdisciplinary or “transdisciplinary” (39) approaches to find solutions differently, with the required urgency. While Braidotti has been criticized for advocating more positive approaches in the past,²² I interpret this affirmation as a clear-eyed recognition of an issue, combined with an optimism that we have the ability to deal with it, and a call to move to do just that; to live in a conscious manner for preferable outcomes. This is consistent with the call by Barad (quoted earlier) to “trouble”, to disrupt, and to change the course of the status quo.

While I will not delve further in this paper into the large-scale impending threats discussed above, or those entangled with them, I offer them up to make this point: as human beings, we have plenty of areas which need attentive care, large and small, where we can choose to make an impact, according to our desires and concerns. There is certainly enough to be done in the circles that start close to the home and widen out. This is about the mark we can choose to make, the trace that we leave.

²² Sara Ahmed in her essay “Happy Objects” (2010, 50) argues that Braidotti’s call for positive or affirmatory approach to the future has the potential to obscure historical injustices that have lead to present issues.

PLAYFUL ART/LIVING

The concept of play emerges repeatedly in my research-creation: play is part of what makes or keeps us human, it feeds a joy which translates into the optimism which keeps us going through the hard parts, it uses our bodies and minds in different ways of thinking. As an artist I can use it to capture your attention, create a space in time – an experience of time, where I might provoke some change – the affect of art. This aspect of play is deliberately woven into my work– I am looking for a positive spin on mortality, and for engagement of the body in activating the artwork. Learning through playing, embraced for children, is related to thinking through making, in that we use our bodies to trigger ways of knowing, and knowledge creation.

Playing is a vital activity, often neglected in life as we accrue responsibilities. I am not counting the commuters playing solitaire on their smartphones, which constitute more of a nervous tick. I am referring to playing that makes you laugh out loud, tires you out while recharging you. Invoking play in the performance of the artworks, referencing a playground roundabout,²³ or using a universally recognised toy – the spinning top,²⁴ works on several fronts: when we play, we are enjoying the moment; when we play, we are subject to elements of chance and of unpredicted outcomes – as in life. The top is an apt metaphor for us, battered by forces outside its control, wearing down and “alive” for as long as it is moving – for human death is pronounced once we stop moving, once the heave of the lungs, the pulse of our

²³ Playground child-powered roundabouts, or merry-go-rounds, seem to be disappearing due to the injuries that may arise from spinning too fast and not hanging on; how many of us learnt the strength of centrifugal force.

²⁴ There is an excellent 1969 film by the Eames brothers celebrating tops across cultures, “Tops”.

bloodstream and the flutter of our eyelids stops. And by inviting play, I am tricking you into giving your time and attention, I am taking up your time by stealth.

Tom Stott in his book *Play and Participation in Contemporary Arts Practices* (2015)

intriguingly refers to toys as “time machines”. He explains:

When we play with them we play with time ... In fact, perhaps it is only the singular relationship that it has to time that distinguishes the toy from other objects. Picked up and put down again, travelling back and forth across the margin between “once upon a time” and “no longer” the toy makes the passage of human temporality intelligible in its most basic form, and most importantly, it puts that temporality quite literally into our hands. (84)

I interpret this two ways: in one way, we are giving up our time, dedicating our time to the play activity, and in other way, we are tapping into all the other times we have played this game, pulling up those feelings and memories from previous, often emotionally rich, experiences.

Play in contemporary art.

Stott is an art historian specializing in contemporary works that involve the audience in play situations, for instance, Carsten Höller’s large scale slide tubes, or the games of Orozco. In the aforementioned book, Stott sets out a framework for critical analysis of artworks involving ludic participation, driven by the growing prominence of playful and participatory artworks in contemporary art. Stott provides useful concepts in the discussion of these works, such as their aleatory nature (embracing of chance and non-linearity) and how participants can and will

change the work over time, as possibilities are realized, as well as how participants themselves are changed.

There is a posthumanist argument, for which the player is as much a plaything as master of her play. In this case, to be in play is to be played. Or more precisely, it is to be mutually entangled and conditional upon other players, play objects, and dynamic, sometimes emergent processes. (16)

The artist incorporating play also becomes entangled with others and with chance, with the success of the work hinging on others, which is another point Stott makes: “work of ludic participation...is incomplete without participants who play” (45).

Stott describes three aspects to consider in ludic participatory artwork: that there is a temporal aspect or dimension to the work (it is durational), that the artist must relinquish some level of control (the participant will contribute), and that there is always the possibility of failure, or at least unexpected outcomes. Certainly these are aspects aligned with human lifetimes: they are durational, we cannot have total control, and there is always the possibility of failure or loss.

Stott, as art historian in the use of play and participation in art, starts with the irreverent Dadaists, but moves on to recognise the pivotal role of the “Fluxus” artists:

The use of play and games among Fluxus artists has received critical attention. ... Play was central to Fluxus as an ‘postcognitive’²⁵ activity that denied the conventional distinction of producer and receiver and prompted active participation. (29)

²⁵ Stott further explains: ‘*Postcognitive*’ is a term used especially by the artist Dick Higgins [a Fluxus artist] to describe a type of artistic production and performance that is now longer descriptive and no longer focused on the intention, expression ... of either the author of a work or the one who engages with it. Instead, the emphasis is upon a ‘fusing of horizons’ in the enactment of works.” (27)

I have found many affinities in the work by the Fluxus group of artists to my work: bringing an awareness of the quotidian to the forefront, making room for playfulness, or acknowledging the art inherent in living. However, often their methods for inducing action or interaction are in stark contrast to mine; where I ideally would eliminate explicit direction, many of the Fluxus “Happenings, Events and Activities”²⁶ works are simply directions and not much else.²⁷

In acknowledgement that there will always be people who watch, rather than actively interact with a work, the spectator can be engaged nonetheless. Stott quotes Orozco, whose artworks often are built on varying or recombining existing games:

‘The participant is not just the one who is playing, but also the spectator. ... If you are not playing but watching, I think you are still participating by looking and you similarly start to think about this new game and about geometry, physics, landscape nature, politics and the history of games.’ (63)

This idea that watching a performance can equate to participation, if there is an affect, justifies the artist performing /activating the work, with others observing. This is a position also advanced by Catherine Homan, in her essay about the “playful spectator” (2013). Her salient point here is the idea that even a passive (not interactive) spectator is engaged with a work of art. Homan stresses that in this context, a spectator is not a critic, but someone who approaches the work prepared and open to being changed by it.

²⁶ Some examples of Happenings, Events and Activities of the Fluxus Artists are discussed by American Performance artist Allan Kaprow in his essay “Nontheatrical Performance (1993)” in *Critical Theory and Interaction Design* (2018).

²⁷ Yoko Ono’s 1963 *Beat Piece*, which is about stopping for a moment and being mindful of life is simply the instruction: Listen to a heart beat.

Adults at play

Play, then, becomes a marker of life, one that perhaps legitimizes our existence beyond reproduction – the ability and the desire to have fun, to play, which does not end with childhood, although often abandoned during the necessary travails of adulthood.

In the critical essay *The Amenable Object* (1983), Dr. Jeanne Randolph discusses artwork through a psychoanalytic lens, and includes in it an aspect of play. I was captivated by her description of British psychoanalyst D.W. Winnicott’s interpretation of play (he theorized about the developing child): “it is as though to play were one of the first adult modes that a child acquires” (30). Here play is an early independent /autonomous activity of the young human being, separate from the parent. I had the opportunity to show Randolph some of my work in late 2019²⁸, and our discussion about playfulness reinforced how it aligns with and aids my thematic concerns. In fact, the installations are sized and arranged to encourage adults, rather than children – who will overcome obstacles more readily if given the permission to play, something I observed directly with my installations.²⁹

The other Posthumanism

The term “Posthumanism” sometimes refers to humanity progressing beyond the natural organic physical body towards cyborgs or hybrids (Smart and Smart 2017), or even just

²⁸ Studio visit, November 20, 2019, OCAD University.

²⁹ This is discussed further in the next chapter.

machines with artificial intelligence which humans either “evolve into” or are replaced by (like the threats that form the basis of the classic science fiction films such as the *Terminator*³⁰ movies, or *Bladerunner*³¹).

In Katherine Hayles’ 1999 book, *How We Became Posthuman*, Hayles quotes Warren McCulloch,³² neurophysiologist associated to cybernetics, who presents playful enjoyment as the possible justification for machines with artificial intelligence supplanting humans.

“I don’t see any reason, if he [*humankind*] can evolve machines that can have more fun than he himself can, why they shouldn’t take over, enslave us, quite happily. They might have a lot more fun, invent better games than we ever did.” (283)

I agree that if humans lose the capacity for joy and playfulness, we have missed a significant point of life; it is an important task to cultivate it, even in the light of tackling serious issues at a personal and societal level. Maybe without the ability to play and to find joy and pleasure in simple things, life becomes just unbearable.

As an example of an artist using playfulness to approach disturbing subjects, digitization and aggressively advancing technology feature prominently in Hito Steyerl’s political and critical work, yet she slips in humorous disruption. In her video installation at the Art Gallery of Ontario exhibition, there was a work showing military robots with human-like limbs being tested for

³⁰ The first film in the series was *Terminator* (1984) starring Arnold Schwartzegger as an android assassin from the near future, sent to preclude the birth of a human leader rising up against machines.

³¹ *Bladerunner* (1982) stars Harrison Ford as a tracker who eliminates renegade androids who have come to earth from extra-terrestrial colonies where they are used by humans as workers.

³² Warren McCulloch, 1898 – 1969, neurophysiologist associated to cybernetics, and known for his work with Walter Pills regarding neurological networks. (Arbib 2000)

hostile conditions³³ in a way which would be outright torture if inflicted on a person (actually quite disconcerting). In the same exhibition, Steyerl's immersive 3 channel video installation *ExtraSpaceCraft* (2016), featured a bombed out Iranian astronomy lab, and a drone adapting to different roles; sheep herder, surveillance & reconnaissance, space engineer, and autonomous weapons system - almost. The drone shares: "I was supposed to be an autonomous weapons system. But since I became autonomous I prefer to play".

While Steyerl's work draws attention to very ugly social facts, artifacts, and acts, this playfulness suggests the possibility of optimistic endings. It holds our attention for the duration of the video performance, and uses a bit of a laugh to help us along when things get bleak. Play and playfulness also form part of the positive message in my work, and are used to attract and draw in both the viewer's attention, body and time. I will explore this further in the next chapter which elaborates on my research on promoting interactivity and participation as a mechanism to prompt consideration of how we chose to live out the time we have.

³³ *HELL YEAH WE FUCK DIE* (2016), three-channel video installation at Art Gallery of Ontario exhibition *Hito Steyerl: This is the Future*. October 24 2019 to February 23 2020.

PEOPLE MOVING ART MOVING PEOPLE

Related to my third research question, I have investigated how to provoke participatory interaction, changing the audience into participants and activators of the work, inducing knowledge created through the positioning, moving and use of the physical body, beyond language, and optimally to trigger considerations. Certainly playfulness, discussed in the previous chapter, is intertwined with this; play activates the body and mind, creating an optimism that feeds the message in my work that in our life our actions leave a wake of effects. In this chapter I expand on the promotion of interactivity integral to participatory artworks. In the introduction to their anthology, editors Samuel Bianchini and Erik Verhagen, discuss the increasing presence of contemporary artworks which seek to engage the audience in an active way that creates meaning, and go so far as to classify them as “practicable”:

We describe them as “practicable” because their distinguishing feature is their capacity to accommodate the concrete involvement of their viewers and to generate an activity that may transform the works themselves as well as their audience. (2016, 1)

This is an apt description of my work: I am seeking to use action to provoke contemplation by engaging the body to think through doing – two things often held as being “consistently opposed” (14), but linked in “practicable” contemporary art.

Encouraging interaction requires overcoming the historical art gallery paradigm to not touch artworks, strong even when not overtly dictated. In truth, this rule is being eroded in contemporary art, notably in those electronic installations that are move between gaming and

art or tap into social media,³⁴ and by explicit instructions to interact with works. But I am interested in provoking a low-tech non-electronic non-electrical participatory experience using more than the eyes and hand controllers. Large scale examples of this are Robert Morris *bodyspacemotionthings*, staged in 1971 and 2009, which is very useful for examining changing norms over time, and Ann Hamilton's *event of a thread*, staged in 2012, which embraces a fully immersive experience with multiple elements, but centered around a audience-driven performance.

To research this aspect, I have combined direct observations, and literature surveys and artist surveys. In public galleries, I looked for the ways in which interactions were promoted (where permitted) and how successful they appeared to be in doing so, and in the case of one show, I was able to discuss interactivity with the artist. I used opportunities to exhibit my own work in the different contexts of gallery spaces and art school critiques to observe people's reactions, to better understand how I might elicit participation, and I also researched critical ideas on participatory artworks.

Morris' *bodyspacemotionthings* – the changing rules of engagement

In my literature review, I encountered a well documented case where ostensibly the same participatory installation was staged thirty-six years apart, demonstrating how norms can shift over time. Robert Morris's *bodyspacemotionthings*, a participatory installation widely

³⁴ For example, the *>HUM(AI)N* exhibition in Phi Centre in Montreal (May 28 to Sept 29 2019) had several artworks which involved virtual reality or artificial intelligence technologies.

discussed in participatory art literature,³⁵ involves plywood ramps and climbing structures and was originally installed at the Tate Gallery (now Tate Britain) in 1971. Basically, it could be characterized as a playground sized for adults. It was shutdown after four days of what had been planned to be a five week run due to becoming hazardous from excessive use. It was restaged in 2009 at the Tate Modern and in that case, the opposite happened: it ran for three weeks instead of the planned four days. The differences are described, and considered by Jonah Westerman, on a *Performance at Tate* webpage:

The temporal divide that separated the first truncated exhibition from its extended doppelganger affords an opportunity to compare the two versions of the artwork and to see just how much museums, audiences and ideas about art have changed in the intervening period in response to the provocations of performance. (2016)

As pointed out in this quote, in the intervening years visitors' expectations and norms changed, and the art institution had learned from the first experience. In 1971 staging, there had been artist-posted photographs and film³⁶ demonstrating intended interactions close by; however, the suggestions were sometimes ignored in unanticipated ways, resulting in a number of injuries (notably wood splinters). In the 2009 restaging, more attendants were provided to guide visitors and to prevent misuse, abuse and injury. Also, the materials and construction were both more durable and more benign. Regarding the visitors and their relationship to art installations the Tate article makes the following observation:

... the museum and art audiences had become accustomed to the notion that an artwork would make immediate demands on a viewer's body and that it would require

³⁵ For instance, Tim Stott discusses it extensively in the "Playgrounds II" chapter of his book *Play and Participation in Contemporary Arts Practices*.

³⁶ Inexplicably, from today's context, is the fact that a nude woman and two clothed men demonstrated use in the accompanying film *Neo Classic* (Stott 126).

action as prerequisite to reception – or, quite simply, that these are not antithetical operations.

Namely, in this case, we can see that the art community, including gallery visitors, has acclimatized to new possibilities for physical engagement in art works.

Enlisting the audience – Hamilton's *event of a thread*

While Morris' work was a key event in introducing playfulness to the art gallery and in observing shifting norms, there is a more recent work by Ann Hamilton which is an excellent example of how a work is created, or transformed by the participatory element: Hamilton's large scale multi element participatory work *event of a thread* (2012), installed in New York City's Park Avenue Armory,³⁷ which I have only experienced through others' words (the artist's, curators, and reviewers') and video documentation.³⁸ The work included long large swings accommodating two or three adults, pigeons flying and roosting in the space, performers reading and writing onto surfaces connected to microphones, and paper bagged radios carrying those sounds to those who borrowed the radios. All these activities filled up the entire space of a huge hall. Dominating the space, a large suspended diaphanous curtain hung, connected through pulleys to the swings. What draws me to this work is how the spectator is enlisted as a participant to activate the work by getting on swings – large versions of the playground classic – and using their whole body to move the cables suspending the large parachute-like fabric, which billows in response.

³⁷ *Event of a thread*, Park Avenue Armory, December 5 2012 to January 6 2013.

³⁸ Extensive documentation is available through the artist's website: www.annhamiltonstudio.com

The curtain moves only so long as people climb onto the swings and exert themselves to get the swings going. Through the long and tangible chains, the relationships are visible, the effect and affect felt (who hasn't felt the butterflies in their stomach when swinging?). That the swings are associated to child's play³⁹ takes us to a place back in time, perhaps of joy, but the sweat of effort also brings us into our skins, and the present moment, and converts the visitor into a collaborator in the creation of the experience.

In the *Art 21* video (2013) on this work,⁴⁰ Hamilton speaks of how people responded in ways that she had not anticipated: they would lie down on the floor below the billowing curtain and watch it for "long, long periods of time". Of course, this was a reward for her – participants had opened up another contemplative possibility of the work that she had not planned, resulting in an even stronger outcome.⁴¹ This unexpected behaviour is inherently part of participatory art – the artistic creator relinquishes some control over the artwork and work is changed by the new collaborator – the participant.

Touching required

The works by Morris and Hamilton discussed above are cases where the gallery embraces the participatory nature of the work, and touching and interaction are encouraged; in

³⁹ I myself rarely turn down the opportunity to swing at the park.

⁴⁰ "Ann Hamilton: 'the event of a thread' | Art21 Extended Play." YouTube video, 4:47. "Art21," April 2013. <https://www.youtube.com/watch?v=1fJ4umqXGjM>

⁴¹ Stott talks about this introduction of unexpected behaviours when reviewing Carston Höller's *Frisbee House*: "Through the solicitation of play, *Frisbee House* tests out how players might organise themselves under constraints modified by the artist but not fully reducible to his intention." (53) [underling mine.]

fact, without the activity the works would be failures. In less active works, though, even when the artist's intention is physical interaction with the work, either expectations (implicit or explicit) or gallery rules (likely liability driven) alter the final form. For instance, this occurs in sculpture museum Dia: Beacon, where the words "please do not touch the artwork", (Figure 7), are painted onto a wall in every room. In the case of Michael Heizer's work *North, East, South,*



**FIGURE 7 - SIGNAGE AT DIA: BEACON GALLERY, NEW YORK
IN VARIOUS ROOMS, PHOTOS TAKEN DEC 2019.**

West (1967/2002), Heizer must have intended that it be experienced by approaching the edges of the twenty feet deep pits and peering over. However, glass fencing keeps the visitor at a safe distance – unless you book an early morning walk-through, as I did, where a small group of adults are shepherded into the enclosure. I can attest that the vertiginous draw experienced peering into the dark holes is an entirely higher order of physical response than viewing the pits obliquely from behind the barrier; imagine the difference of being inside the tiger's enclosure at the zoo, or looking in from the outside. The enforced distancing from the work clearly impairs the impact. In another case, Lee Ufan's mischievous collection of large rocks on

cushions (*Relatum* - formerly *Language*, 1971/2011), in a studied scattering⁴² across the gallery floor is accompanied by the ubiquitous call to keep all hands off. However, in the gallery promotional video,⁴³ the artist is shown seated squarely on one of the rocks – which are perfectly seat sized – in what is presumably a meditation like the ones he wants to provoke. By impeding physical touch, either to protect the public or protect the work, the affect is attenuated considerably.

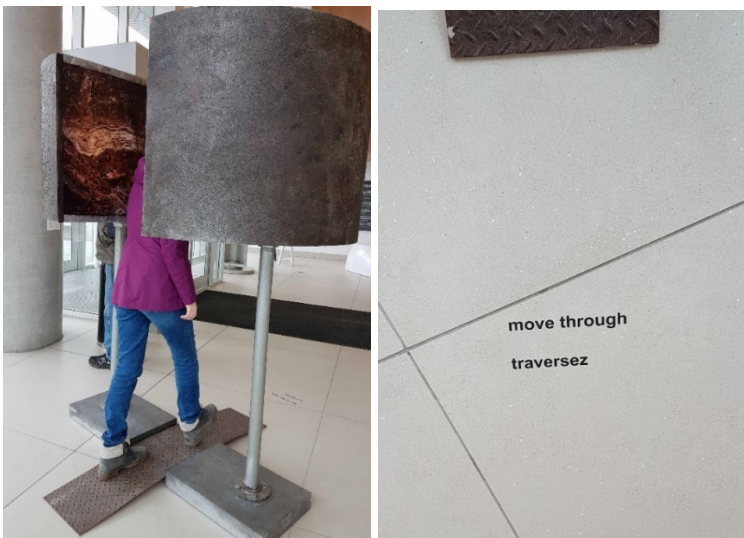


FIGURE 8 - INSTALLATION SHOTS OF JUAN GEUER WORK *ROCK HEIST* AT THE OTTAWA ART GALLERY, APRIL 2019.

Moving towards acceptance of physical contact, an example of overt direction to interact or approach works was the Juan Geuer (1917 – 2008) show *Carbon + Light*⁴⁴ at the Art

⁴² In a Dia promotional video, curator Alexis Lowry speaks of “both the thoughtfulness and casualness with which he (Lee Ufan) places the rocks”. (COS x Dia, 2019)

⁴³ Ibid.

⁴⁴ CARBON + LIGHT; JUAN GEUER’S LUMINOUS PRECISION. Exhibition from March 9 to August 18, 2019, Ottawa Art Gallery. Curated by Caroline Seck Langill.

Gallery of Ottawa. One particular piece, *Rock Heist* (2000), required the visitor to walk over metal plates between through two facing light boxes; instructional directions were provided on the floor: “move through; *traversez*” (Figure 8). I observed that many people still fell back, and that until someone else engages with the work, without being tackled by an attendant, they did not try it out themselves.

The experience of *Dying*.

During the opening reception of the Design TO 2020 *Dying.exhibits*⁴⁵ I met Mia Cinelli, the artist-designer behind *The Weight*, a heavy shawl-like textile work promoted as a “grieving aid”,⁴⁶ that envelops the wearer is the approximation of an intimate familial hug. This work is only meaningful as intended if worn, otherwise it is oddly shaped quilted cloth. Cinelli approached me after I, following the instructions on the didactic, sat down on the empty proffered bench, wrapped the cloth embrace around myself and then let out a deep sigh. After I surrendered the bench to another (someone emboldened by my action), Cinelli and I spoke about how difficult it is to entice people to actually interact with art objects, to activate a work. She later addressed those gathered and spoke about how her work had arisen from process of mourning a family member, and about discovering the therapeutic proprioceptive nature of weighted blankets. (Grief is felt deep in the body, and needs a sort of “body processing” to acknowledge and process it. Of course, loss through death is a facing with mortality.) So far, she

⁴⁵ *Dying*.: An event series exploring death through the lens of art and design. January 15 to January 31, 2020, with an art exhibition component, *Dying.exhibits* on end-of-life aimed at encouraging conversations about death.

⁴⁶ Cinelli, Mia. “The Weight,” *Mia Cinelli*. December 2014. <https://www.miacinelli.com/The-Weight>

said, she had had to only make a few repairs, and people are generally gentle with the shawl object. I did note that the shawl – which look like angel wings to me – had a cable on it, tethering it to the bench and preventing theft. A practical solution, but one that undercuts the work to some extent, creating a bit of an obstacle to its full affect.

Playing with my works

Over the course of the last year I had the opportunity to observe people interacting with my works installed in the relatively safe space of the art studies program and in public gallery spaces. What I gleamed from these experiences follow.

Critique insights – the untouchability of preciousness.

When displaying my own work, *timespacemattermotion*, in critique spaces, colleagues in graduate studies mostly approached tentatively, even knowing that I intend interaction. One person did immediately jump in to spin the log, and I was compelled to quickly ask that they first make sure not to smack someone else in the sweep space. But generally, I observed a reluctance to touch someone else’s work. One colleague offered up that the gilded log looked “too precious” to invite touch. I am interested in aesthetically pleasing objects as part of the works, and feel that this tension – between plaything and artwork – introduces a disruption that can prompt contemplation and a search for meaning. Two different individuals commented on a different potential impediment to touching and interaction, what they called the “monumental” quality of my work. This included Dr. Jeanne Randolph commenting on the

large bronze top in its display stand, and a colleague commenting on the log piece. These qualities, associated most often to artworks make work that is meant to be touched seem untouchable.

Gallery experiences

Over December 2019 and January of this year, one of my smaller sized suspended works from the *Spinning through Life* series was prominently displayed in the Station Gallery in Whitby Ontario during a juried group exhibition.⁴⁷ This piece comprises of a forty centimeter diameter concave mirror as part of a suspended support surface that can be spun and swung. Three small resin printed portrait tops of my family complete the physical components of the work. The work is activated by spinning the tops on the mirror while the whole assembly spins and swings. Despite a small didactic posted nearby, it was my observation that none of the public – many of them artists or part of the art community – would actually do more than closely examine the work. It was only when I approached and spoke to them, or better yet, demonstrated, (Figure 9), and then invited them to engage in the work that people would give it a try. Notably, once I granted “permission”, younger persons were the first to overcome any reluctance and give the tops a spin. One particular boy used a technique I hadn’t seen, siding his two thumbs in opposite directions to spin the tops, which was a delightful surprise.

⁴⁷ *Encounters*, juried by Leila Timmins - Curator & Manager, Exhibitions & Collections, The Robert McLaughlin Gallery, Fynn Leitch - Curator, Art Gallery of Peterborough, and Greg Murphy - Executive Dean, School of Media Art & Design, Durham College. Show curated by Olexander Wlasenko.



**FIGURE 9 - *SPINNING THROUGH LIFE* AKA SUSPENDED MIRROR;
DEMONSTRATING THE SPINNING OF THE TOPS, DURING STATION GALLERY EXHIBITION *ENCOUNTERS*.
PHOTO TAKEN BY C.J. DORN (2019)**

I was able to contrast this experience with that of exhibiting *Spinning through Life (aka The Dish)* in the juried exhibition, *The Rare Few*,⁴⁸ curated by Carrie Johnson of the Rockford Museum of Art in Illinois, in April 2019. The opening reception and following day afforded me opportunities to observe visitors' reluctance or compulsion to interact with a dynamic work. Since this work involved starting the tops using a hand-held launcher with a string, as opposed to simply spinning using your fingers, no one offered to try starting them while there were

⁴⁸ This exhibition was held in conjunction with the National Conference of Contemporary Cast Iron Arts and Practices (NCCCIAP) at the National Landmark Sloss Furnaces in Birmingham, Alabama, USA. My participation in the NCCCIAP is discussed further in chapter THE TRACES OF MY WORK.

observers. However, I could tell by the traces on the dish the next day that at least one other person gave it a shot. What I took away from this experience is that if I expect people to interact with the work, it should be easy to do so, or I should be willing to provide some guidance on how to use something like a launcher, which can be intimidating.

At Station Gallery I experienced one of the risks in interactive art – that the work does not survive intact. One top went missing, either lost or possibly pocketed, or perhaps broken and thrown away. Due to the nature of the work, I cannot lock down or secure moving parts, nor would I want to, as it detracts from the experience. I have since reprinted a new set of tops, but it was a risk that I had accepted prior to submitting the work, and for me, the benefit outweighed the risk.

Art in public spaces - taking it outside

It has become clear that a way to shake the do-not-touch-the-artwork paradigm is to change the context in which it is encountered, which is the case of public art. Of course, with art in a public space there is much less control by the artist – the work is exposed to the elements, and to many more people, a much larger cross section of society than the pre-filtered conditioned audience of the art gallery. Erling Björgvinsson and Anders Høg Hansen, in their article “Mediating Memory: Strategies of Interaction in Public Art and Memorials” (2012) also discuss the risk of unintended and potentially counterproductive outcomes, which is present in any artwork, but necessarily much more probable in the public domain. However, the benefit of exposure (literally) and influence, and chance of affect is also much larger.

Björgvinsson and Hansen also advise creators of the extra conceptual effort needed in work that invites or needs interaction:

When engaging with participatory projects, who is to be involved at what time becomes a central question ... we need to pay attention to those involved, when they are involved, what power they given to participate and how this affects the work. (19)

While Björgvinsson and Hansen are referring to public art, this consideration of the participation of people other than the artist is an important one for anything that can be touched or interacted with.⁴⁹ Who should interact with the work? Visitors (any) versus volunteers versus assistants (paid or otherwise, but familiar with the intent of the work) versus the artist; each bring with them a different reference and potentially wildly varying outcomes, which may contribute or detract from the conceptual basis of the work. However, the potential positive affective outcomes can be worth the extra creative effort.

There is an interesting double standard applied to works that are outside or in (more or less) public spaces, even when they are related works by the same artist. Richard Serra's *Tilted Spheres* (2002) is installed at Terminal One of Pearson Airport in Toronto, inside the secure gate area. While his similarly scaled works staged at the Guggenheim Bilbao in Spain and at the Dia: Beacon in New York are accompanied by "do not touch" admonitions, in Pearson there is no such injunction nor any attendants to enforce it. Placed where it is, it is almost an invitational playground to while away time at a departure gate. Is the work at Pearson anchored differently (to withstand potential abuse or hazard)? In my photos, there is no discernable gap between

⁴⁹ This echoes thoughts in Stott's discussion of the degree of creative control participants are granted in ludic artworks. (2015, 119)

the floor and the steel plates, unlike what I saw in Bilbao or Beacon (which makes it obvious that they are simply resting on the floor). When artworks afford the opportunity of interaction, clearly there must also be sufficient protections against harm to persons.

Louise Bourgeois' spider sculptures also provide examples of responses in different contexts: a do-not-touch context inside Dia: Beacon, and open-to-hugs (or kicks) context in the much larger nine-meter-high street installations outside both the Guggenheim Bilbao and the National Art Gallery in Ottawa. The smaller almost three-meter-high Dia sculpture, indoors, *Crouching Spider* (2003). sports shiny points from rubbing in the days when visitors could touch/caress the sculpture, but that is no longer permitted. Clearly Bourgeois' large scale outdoor spiders, *Maman* (1999)⁵⁰ are open to being touched, embraced and instagamed; perhaps they are robust and large enough to defend themselves.

Context, permission, demonstration

While I had originally investigated how to incite participation without instruction, I have arrived at the conclusion that some direction is needed, some context provided, some parameters set. As the artist, I prefer inviting interaction by demonstration, rather than using signs. However, in the case where it is not feasible to have a person familiar with the work close by, a short video can suggest the possible interaction – always remembering that people may interact in unexpected ways, possibly changing, adding to or negating the intended effect. My

⁵⁰ The *Maman* sculptures at Bilbao and Ottawa, are two from an edition of six, created in 1999 but cast/fabricated in 2001 and 2003 respectively.

works are complex enough that they cannot be completely unattended, since I am seeking a sort of “gentle use”, or at least a non-malicious use in the interaction with the pieces. However I do need to be ready for physical wear and tear or damage, which may require restoration or maintenance work,⁵¹ or just complete loss. As well, there is a need to consider how unanticipated use or overuse might present risk to others.

Clearly the artist must be open to new meanings arising from a different use or interaction, but the risk is inherent in all art of interpretations which are different than intended, and it is part of the experimentation and exchange where growth occurs. For my work, which is about lifetimes and existing in our bodies, albeit for a limited time, the interactivity is an important dimension of internalizing that body-centered knowledge.

Working in my favour is that the admonishment to not touch sculptural artworks may eventually erode away; remember that the former gallery censure of “no photography” has all but crumbled almost to the point of oblivion. However, in the case of a photography ban, it is practically unenforceable due to mobile phones with cameras.⁵² I am hopeful that a new intermediate ground between no touching and destructive touch will become a real option.

⁵¹ Rafael Lozano-Hemmer offered up at a University of Toronto artists’ talk (January 2019) that he offers maintenance contracts, which provides his studio with an extra source of income. His work has a “warranty of zero years”, and the maintenance provides funding for experimentation for new works.

⁵² There are still significant holdouts - the Prado Museum in Madrid still enforces a photography ban even with mobile phones.

THE TRACES OF MY WORK

This chapter elaborates on the research creation works of the thesis show, including the explorations and challenges along the journey to the final installations, and the critical elements to my work. Interspersed, I interweave some artists' works which deal with similar forms or concepts.

Impermanence and the moment

I entered graduate studies fascinated with impermanence and the moment – the philosophical fodder of time, with a practice grounded in painting, albeit sculptural paintings - encaustic painted and gilded works on routed plywood. Think of a Patterson Ewan or Yechel Gagnon plywood work, but with encaustic layered on, and silvery metal leaf reflective surfaces, depicting water or mountain-scapes; the huge expansive spaces on the edge of infinity (Figure 10).



FIGURE 10 - *STOCKDALE GLACIER AUGUST 19, (2016)*

METAL LEAF, OIL, ACRYLIC, WAX ON ROUTERED PLYWOOD. 40" X 48" X 3/4"

But already I had been drawn to metal casting and the idea of creating sculptures in the round, where you move in relation to the work, where you handle the work and the weight lends meaning (Figure 11), or maybe the work rearranges periodically in changing relationships (Figure 12).

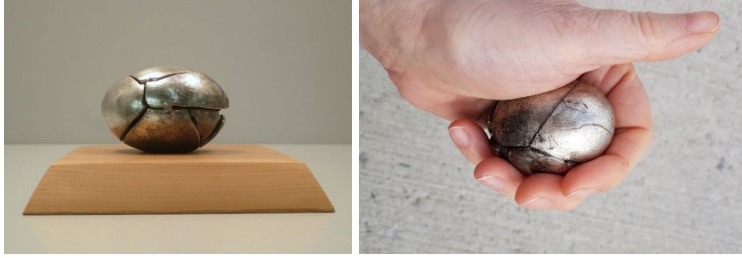


FIGURE 11 - WORK TO HANDLE - *FRACTURES II*;
 BRONZE SCULPTURE WITH SILVER AND BLACK PATINA ON WALNUT REST. EGG SIZED.
 BASED ON HEN'S EGGS THAT HAD BEEN CAST IN WAX, BROKEN AND REASSEMBLED, THEN CAST, CONCEPTUALLY SPEAKING TO THE FRAGILITY AND PRECIOUSNESS OF LIFE.



FIGURE 12 - WORK THAT TRAVELS - *THE THREE OF US*;
 SET OF 3 CYLINDRICAL PIECES, PORTRAITS OF MY FAMILY, LARGEST BEING 2.6 INCHES TALL WITH DIAMETER OF 2.5 INCHES.
 BRONZE CAST FROM DIGITALLY MILLED MODELS, VARIED PATINAS. CONCEPTUALLY ABOUT RELATIONSHIPS.

During graduate studies I experimented with photography, videos and projections, light-sensitive works tracking the sun's trajectory, time lapse videos tracking stars, and mirrored balls bobbing on waves, eventually homing in on musings on our time-limited existence using spinning sculptural objects in dynamic installations.

I use the spinning top as a metaphor for our lifetimes, portrait tops based on facial profiles which are spun on varied platforms, leaving the marks of the movements, evoking the crazy motion of life, and the residual effects of our actions, interactions, and Baradian intra-

actions. The installations involve activating dynamic sculptures, such as the tops, or in one case, a large driftwood log suspended from a pivot bearing. In all these works, movement is initiated by a person directly (artist, attendant, or visitor), and has a durational time element; a beginning, a “life” and an end. The movements leave an index of the occurrence; sometimes the marks are more durable but potentially obliterated by subsequent marks, and sometimes they are made in sand or flour and swept up at the end of the day, remaining only in memory or photo documentation.

The installations of the thesis exhibition, to be activated in performance are:

- *Spinning through Life – aka The Dish*: The suspended concave steel dish on a swingable pivot point – which captures the trails of the tops spun on it (Figure 1).
- *timespacemattermotion – aka The Log*: The suspended log on a swingable pivot point with sand below – capturing the traces of people’s movements around the log (Figure 5 and Figure 6). A video montage of this work is available as Appendix B to this document.
- *Spinning through Life – aka Ashes*: The flour/ash mixture spread on the floor – capturing the trails of the tops spun on it, to be swept up at the end of each day (Figure 2).
- *Spinning through Life – aka Plate & Big Top*: Two metal plates on the floor – capturing the trails of the larger top spun on it, during the course of the show (Figure 3 and Figure 4).

In a gallery setting, these are supplemented by:

- Wall hung metal plate with traces from previous spins.
- Photographs of previous traces on the steel dish or flour floor traces.

- *Spinning through Life – Earth to Sky Big Top*, a large portraiture top resting in its display stand (the top can be spun at low speeds in the stand).

Portraiture tops

I am circling around the motif of person as top – I call them portraiture tops – to depict something of the nature of our existence. I use them, as well as other rotating elements (such as in the log work) to reference how we move through time and space while we are alive. We arise from the reconfiguration of atoms, we grow, we move through space and time, constantly changing, adding and dropping, and we leave traces of our actions, thoughts and words. Then, we will once again reconfigure into the constituent atoms or even subatomic particles, dispersed.

The traces of our actions will trail behind us, residue of our existence, until they too are obliterated by the overlaid traces of others, of events, of time. We are here for a while, and then we are not, but along the way we make connections, we take detours, we invest effort in what and those we care for, and we respond to expected and unexpected events that may turn us off what we thought was our trajectory onto a new path.

There are others before me who have taken the profile of a person and spun it around in a portrait; notably Renato Bertelli in 1933, and Greg Payce since the 1990's (and still doing it), both in ceramic. Bertelli's *Profilo Continuo* or "continuous profile" of Benito Mussolini⁵³ is about authority and power, the "all-seeing"⁵⁴ Italian fascist leader. Greg Payce creates vases

⁵³ I was first referred to Bertelli's work after I presented my work in a studio critique.

⁵⁴ As described on the website of the British Imperial War Museum describing *Profilo Continuo*.

and columns which are positioned adjacently to produce the outline of an archetypical head or body in the negative space (Figure 13).

The collaborative artist duo of Sue Webster and Tim Noble have built a practice around their double portraits in many different media, and include double portraits using negative and positive profile lines. One work, *Untitled (Spinning Heads)* (2005)⁵⁵ clearly evokes (or perhaps emulates) Bertelli's work, and another combined profile piece, *Double Negative* (2010)⁵⁶ relies on a particular fixed vantage point to see their facial profiles – which is the case in several of their assemblages of found objects, whose cast shadow becomes the pair's portrait⁵⁷.

Besides being conceptually pointed in different directions from my work, these are all static pieces; what is important in my portraiture tops is that they move, they spin, they have erratic motions, then self correct, they hit a speck and change direction, they settle in and then they lose their way and eventually topple. Their spin is a duration of time, and in the *Traces* series, that duration of time is documented in the trail in the dust, on the paper, or in the scratch-line of the surface.

The portraiture tops first emerged when through learning 3D modeling software (Rhino); I was inspired by Payce's work to digitally create models for *The Three of Us*, a set of bronze cast sculptures depicting the negative space profiles of my family. Once in the virtual digital modeling space, I played with positive profiles as well. At the time, feeling pulled in all directions by work, school and familial obligations, the Elizabeth-as-top emerged,⁵⁸ a top based

⁵⁵ *Untitled (Spinning Heads)*, 2005, Painted bronze.

⁵⁶ *Double Negative*, 2010, Painted bronze.

⁵⁷ *Kiss of Death*, 2003, Thirty-four taxidermy animals, animal bones, light projector, metal stand

⁵⁸ My early self-portraiture tops are called *EML as toupie*, a nod to my Montreal origins and the fact that the French "toupie" is much more fun and specific than the English "top" which gets confused with the upper part of things. EML are my initials.

on my own facial profile. I carried a small 3D printed top with me everywhere for over a year, almost a talisman. Over time, the metaphor emerged as a recognition of life and of the interconnectedness of the many forces at play; a positive spin, an affirmation of the movement of life. When people watch the tops spin, there is often a gleeful response, sometimes even giggles, and then many become mesmerized in the movement, caught up in the anticipation of the moment of toppling, of failure, of “death”.



FIGURE 13 – NEGATIVE SPACE SILHOUETTES

LEFT: *BRÜDER (BROTHERS)* BY GREG PAYCE, 2019, CERAMIC, 18 INCHES TALL. INSTALLATION SHOT AT ART MUR GALLERY IN MONTREAL, JANUARY 2020.

RIGHT: *THE THREE OF US*, BY ELIZABETH LOPEZ, 2016. TALLEST PIECE IS 2.6 INCHES TALL.

Despite the sculptural examples of spun profiles referenced, I feel that the closest work to mine, using an analogy of a spinning top for a person’s experience, is one I came across after I had started making portraiture tops. Interestingly it is from a literary source, Nick Sousanis’s doctoral dissertation in the form of a graphic novel.⁵⁹ In this melding of words and drawing, Sousanis depicts people as spinning tops, moving around each other, perhaps bumping into each other, and ultimately falling over and stopping, closely approaching how I use the portraiture top (Figure 14).

⁵⁹ Sousanis, Nick. 2015. *Unflattening*. Cambridge, Massachusetts: Harvard University Press.

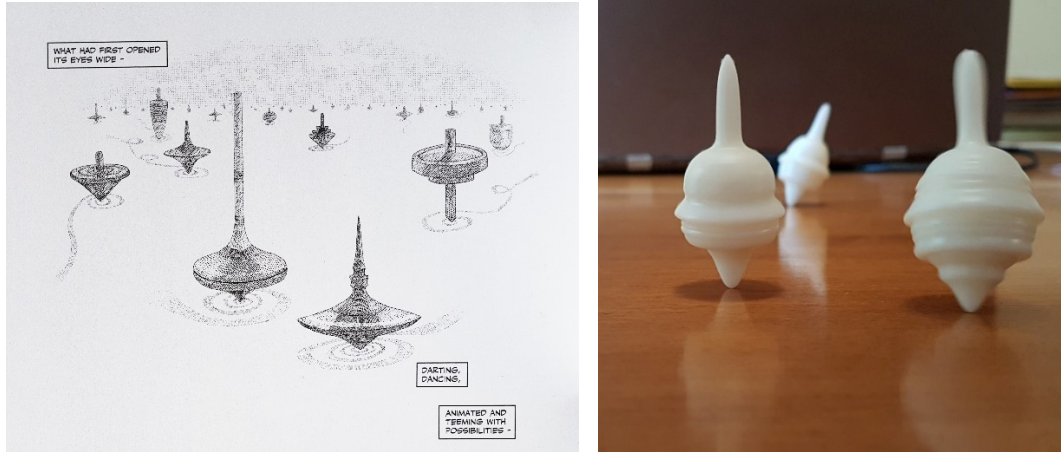


FIGURE 14 - COMPARISON OF TOP IMAGERY AND SPINNING PORTRAITURE TOPS.

(LEFT) SPINNING TOP IMAGERY FROM GRAPHIC BOOK, *UNFLATTENING*.

NICK SOUSANIS, HARVARD UNIVERSITY PRESS, CAMBRIDGE, MASSACHUSETTS, 2015. PAGE 18.

PERMISSION TO USE IMAGE GENEROUSLY GIVEN BY N. SOUSANIS.

(RIGHT) SET OF FAMILY PORTRAITURE TOPS (2018), RESIN PRINTED. TALLEST TOP IS 2.2 INCHES TALL.

I often place smaller tops on swinging, spinning platforms, suspended pendulum-like from the ceiling, such as the case in *Spinning through Life aka the Dish*. These spinning platforms reference the space we exist within, nested and interconnected points of time and space; we stand on planet that is spinning (producing night and day), which has a trajectory around the sun (producing the seasons, and marking the years), captured in orbit around a star that is bright and unimaginably hot today, but not forever.

R/evolving symbolisms

Taking a break from tops, in the summer of 2019 I explored alternate symbolisms of people as spheres.⁶⁰ I started with soft toy balls (dog toy balls, and large beach balls), then

⁶⁰ Later I came across Gabriel Oronzco's *Yielding Stone* (1992) plasticine ball - his own weight in material rolled through city streets - and Quebec artist Sarah A. Tremblay's clay ball "portraits" of impactful people in her life, *Stone Portrait* (*Bertrand, Charléli, Maryse, Neil, Celia, Simon and Maxyme*) (2012).

migrated to stainless steel mirror balls, throwing them on the waters of Lake Ontario, documenting them being blown by breezes and carried by waves. What interested me here was existence at the interface, similar to our short lives, where we are not here/here/not here.⁶¹ Or how we exist somewhere between the water we rise up out of, and the sky where we look out onto the cosmos. This interstitial space is akin to Latour's "thin biofilm of Critical Zone",⁶² on which he focuses his attention.

Roaming as I often do, along the same shoreline of Lake Ontario where I waded into the water to throw balls and document their movements, brought me to a compelling driftwood log, half submerged in the water. I pulled it higher onto the beach, took it in, let it dry out over weeks, and then carefully attended to it. In some ways the cleaning, shellacking, gilding of the tree echoed the washing and preparation of a corpse that used to be carried out by close relatives in generations past.

This tree-that-was references time and mortality. The tree grew – there are the rings of seasons experienced and the knots of many branches - and then stopped. Somehow the trunk of this tree found itself in water, Lake Ontario eventually, acted upon by waves and sand, deep grooves forming radially. Surely it floated, sank and rose again to the beach where I found it.

Experimenting with different hardware for the slinging of the log, I settled on the smooth beauty of climbing gear. Rappel anchor ring, hauling swivel, carabiners, webbing and

⁶¹ I produced two videos, *Spheres on Waves I & II, explorations of existing at the interfaces; Here for a Short Time*.

⁶² Bruno Latour (2018, 92) discussed earlier in this paper in the Theoretical Framework chapter.

ropes – equipment designed to protect life. As a climber, I routinely trust myself to such equipment, under the use of an attentive belayer – a partnership of human and technology.

The log spinning in space, with silvery sides and cables, references the satellites and exploratory extensions we send to space, or even that satellite of the sun we call home. It is about how there is a beyond, beyond us, beyond our planet, beyond our time. The metal leaf along its sides emphasizes the sinuous grain lines brought out by the log's time underwater. It reflects light, and while spinning, is shiny one instant and subdued in the next, marking a durational experience, *timespacemattermotion*.

The log will spin for over nine minutes, depending on the initializing impetus, starting fairly fast, maybe a bit wobbly, but quickly stabilizing and slowing to a languid sweep. Then it slows to an almost-still movement. It is in those moments that contemplation grows.

The sand spread below the log, and below our feet, records our presence and our trajectory around the log. When we walk away, we track some of the sand with us into our lives.

Another log

I feel compelled to share the surprise discovery of another log work; in December 2019, I visited the Dia: Beacon sculpture museum in New York State, specifically to see Lee Ufan's work. I was astounded to come across a piece (Figure 15) which I had never seen documented, sharply echoing my log piece *timespacemattermotion*, created during the summer of 2019.

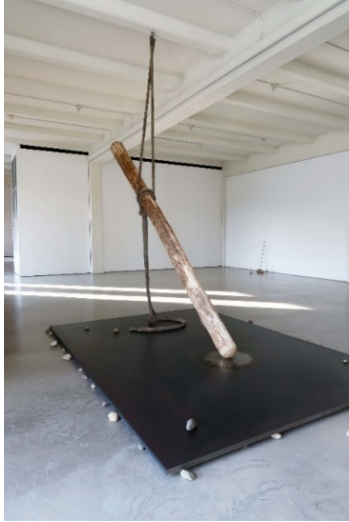
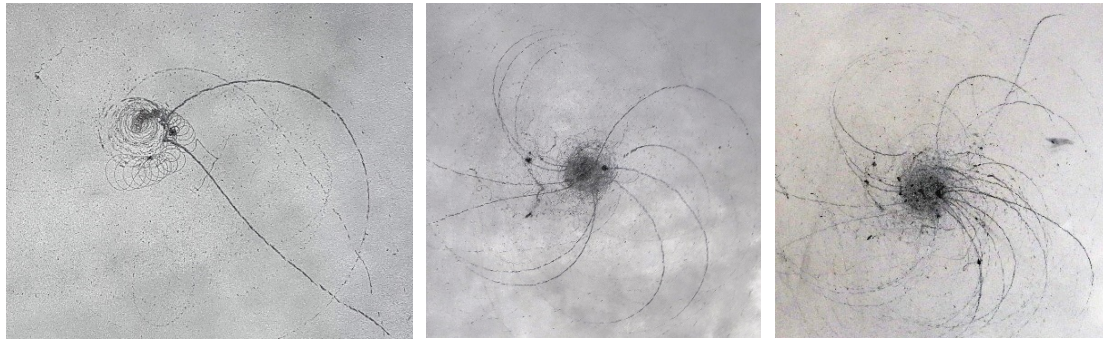


FIGURE 15 - INSTALLATION SHOT OF LEE UFAN *RELATUM* WORK
AT DIA: BEACON GALLERY, NEW YORK. DECEMBER 2019.
PHOTO BY AUTHOR.

Called *Relatum* (of course) this particular piece is static, but speaks to balance: a wooden pole, milled like an old telephone pole, is partially suspended, resting on a steel plate, which in turn rests on rounded stones, on the concrete floor. Although this *Relatum*-pole work and *timespacemattermotion* incorporate similar materials (suspended or semi-suspended pieces of wood), the element of motion and interaction and change in my work is significantly different to Lee's: I use motion, and bodily activation and bodily (proprioceptive) perception as part of the work, while Lee's work is always static, and often show the body through the index of the artist's movement or presence. However, the goal of inspiring contemplative consideration of our relationships in time and space— for a time — are, I feel, aligned. Lee focusses on relationships in physical space, between the self and the other, while I consider relationships in time. Temporal factors are minimized in his work, other than perhaps erosion, however many of his outdoor installations are temporary, so the effect of time is minimal.

Leaving a trace



**FIGURE 16 - *SPINNING THROUGH LIFE* - DETAILS OF TRACES OF SPINS ON METAL SURFACES;
SATELLITE DISH TRACES— LEFT: NOVEMBER 2018, CENTER: APRIL 2019, RIGHT: NOVEMBER 2019.**



**FIGURE 17 - *SPINNING THROUGH LIFE* - DETAILS OF TRACES OF SPINS ON METAL SURFACES;
BLACK HOLE TUNNEL EFFECT ON FLAT STEEL PLATE, NOVEMBER 2019,**

The shift beyond the experience of movement and duration towards the additional element of traces first emerged when I spun an iron cast top on the surface of the repurposed satellite dish⁶³ and I was enthralled by the trails gouged in the dish (Figure 16). These spirographic marks recorded the curls within curls, the wobbles, the recoveries, and topples, as

⁶³ There had been very faint trails made in the shipment dust settled on the concave mirrors when I first spun digitally printed tops on them – a delicious suggestion of the spins.

well as errant stabilization phases of the spins (Figure 3). For each spin is different, strengthening the analogy of the spin as a lifetime – the emerging pattern depends on position, pull strength, length of cord, or hand position, the bumps or pits of the surface, perhaps a piece of grit and what appears as chance.

The metal dish carries a layering record of its history in plain view, like a haphazard arrangement of tree rings, and with enough spins, the earlier record is obliterated by the accumulating palimpsest. In a showcase of iron works,⁶⁴ I displayed not only the digitally modelled cast tops, but the scratched surface which testified to their spins.

In experimentation with traces, especially for larger tops, I started considering steel plates, another material that is basic – processed, yet almost raw material arising from the earth. Laying them on the floor provides a smooth hard surface that improves the duration of the spins, and captures the record of the journeys. By experimenting with patinas or coating, the markings could be further enhanced. The marks on these flat stationary plates seem to reference cosmic configurations and mathematical models of black holes and deep space (Figure 17).

After the recent deaths of my parents, I was exposed to human cremated remains, or cremains, for the first time. The surprisingly fine powder of my parents' incinerated corpses made a deep impression on me. I originally thought to use wood ash below the spinning log to reference the cremains, but in a trial threw down sand instead. This seems appropriate since

⁶⁴ During the OCADU GradEX 2019 exhibition, the Foundry Club showcased our participation in the NCCCIAP conference in Alabama, where *Spinning through Life aka The Dish* had been part of a juried exhibition *A Rare Few*.

the driftwood itself had come out of the sandy beach, and also because of the colloquial references to the sands of time.⁶⁵ And footsteps in the sand – until obliterated by more footsteps or the clearing sweep of the waves and wind, are powerful indices of those there before us. Having spread most of my parents’ cremated remains in the waters of Lake Ontario a week before, I collected beach sand from a nearby spot for use in the log installation. Every experience is folded into who we are in the present moment; I couldn’t help but wonder whose remains might be in the sand I was collecting - as surely as molecules that had been my parents’ bones make their way to the ocean via the Great Lakes and the Saint Lawrence River, some must redeposit out onto nearby shores.

For the smaller installation, I experimented with a variety of flours, to mimic the fine powder of cremains. These ended up effectively capturing the curls of the tops spins on the wooden floor (Figure 2). Perhaps some of the sand or flour from my installations will adhere to people’s shoes and in that manner, track out of the gallery and into the street, leaving traces in the wider venue of the city.

There are some words by Barad that speak to traces, which may be overwritten, but never completely obliterated, even when we seek to eliminate them: “Attempts at erasure always leave material traces: what is erased is preserved in the entanglements.” (2017, 76). Which is a way of thinking of how a lifetime that scores a mark on the surface of what Barad calls *timespacematter*⁶⁶ becomes our ever diminishing legacy.

⁶⁵ Byung-Chul Han in his book *The Scent of Time*, refers to wonderfully evocative incense burners which mark time, since they are created to burn down in a defined time – an olfactory hourglass. (2017, 55)

⁶⁶ A term used in Karen Barad’s 2015 article “Transmaterialities: Trans*/Matter/Realities and Queer Political Imaginings.”

For the purposes of encouraging interaction with the installations, seeing the evidence of others, footsteps in the sand may further suggest that interaction with the work is welcome.

Movement is a sign of life

As stressed, the installations in *Traces* are dynamic, and it is the durational experience and movement⁶⁷ that is captured in traces. Life is motion, and the moment of stillness is the moment of death. We are alive so long our bodies are alive, moving. The body that is a corpse is no longer a person.

I am not interested in using motors for movement, which can go on for as long there is no power interruption or the battery is charged; the motion must be driven by a person, or perhaps by an errant breeze. The works requires an initiation (a birth), a duration with a wind down (a life), and an end (a death).

Moving between technologies and spaces

In the process of making, I move easily between digital and traditional processes, using what seems most appropriate for my purposes, picking up one tool and combining it with others, seeking the strengths of the different approaches to fulfill the creative concept. The possible⁶⁸ is opened up by different materials and techniques, moving between virtual and

⁶⁷ In movement, the works are different than at rest; this is most overt in the *Earth to Sky* top, where the green and black patinas in a colour-blocked pattern transform during spinning into a colour gradient effect.

⁶⁸ The possible is one of the “Four P’s” described in *Speculative Everything: Design, Fiction, and Social Dreaming* (2014) by Anthony Dunne and Fiona Raby. I found that exploring “The Plausible, the Possible, the Probable, the Preferable” opened up creative imagining.

physical realities. For instance, the bronze work in *This is Life* (Figure 18) would be very difficult, if not outright impossible to make without virtual space design and 3D printing the model.



FIGURE 18 - *THIS IS LIFE*, DIPTYCH (2017)

CAST BRONZE SCULPTURE AND 3D PRINT, BOTH WITH FREELY ROTATING BUT CAPTURED SPHERICAL FORMS, ON ACRYLIC SHEET. BRONZE HAS 5.3" DIAMETER, PRINT HAS 3.1" DIAMETER.

Using digital modeling and printing presents possibilities for realizing my ideas that would be very difficult otherwise; for the purposes of making functional tops, while referencing specific individuals, digital modelling allows me to trace a line from a photo, providing fidelity to photographed profiles, and spinning it in virtual space, creating a perfect symmetry of form.⁶⁹ In that space, I can create uniform wall thickness for well-balanced (and long lasting) top spins. With the next steps of the making process in mind, I could design in the minimum wall

⁶⁹ I have created portraiture tops on wood and metal lathes, where it is more difficult to produce profile fidelity, and certainly, as a subtractive process, always has the risk of removing too much material, which cannot be undone.

thickness for the hollow cast metal object. And after much deliberation, in order to avoid welding at the joints - which would have been very difficult to do well, I digitally designed threaded joints with smooth clearances (Figure 19). Of course, the processes must be accommodated; in order to make a larger top, I was constrained by the build volume of the 3D printers I had access to (maximum height of 9 inches), and had to print them in three pieces.

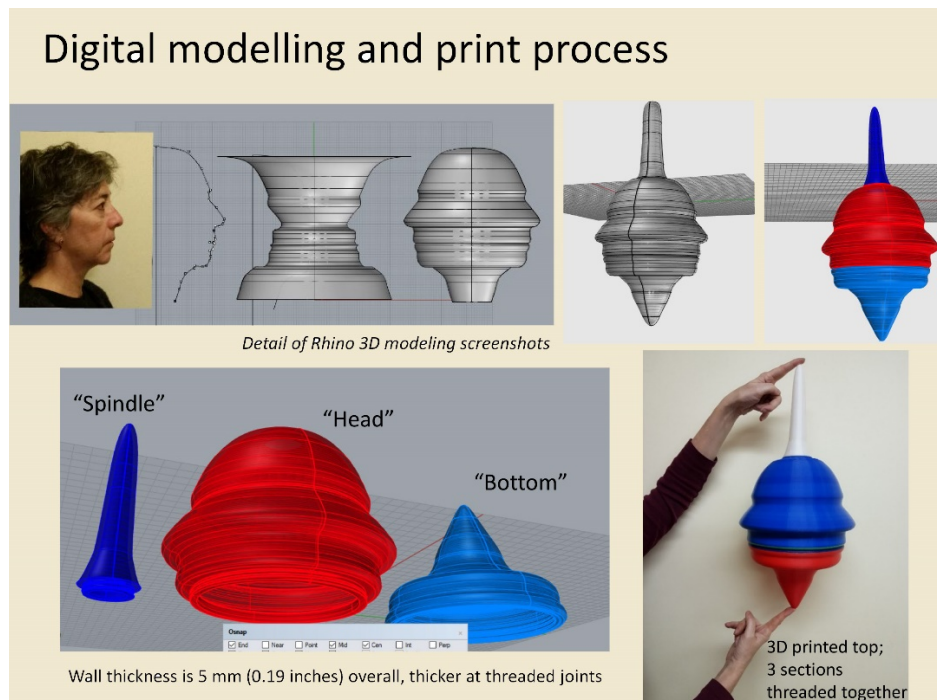


FIGURE 19 - DIGITAL MODELING TO 3D PRINT PROCESS FOR PORTRAITURE TOP MODEL TO BE CAST

During this movement between the spatial environments of photography, virtual modeling and physical printing and casting, there is another dimension that I must negotiate: time. While this process is multi-stepped and long, making the cast sculpture itself a record of time, I am referring to the work of deciding what my source portrait will be. In the case of creating portraiture tops I may take a set of profile photographs – the snapshot of now – or in

some cases, I have gone through the family records to find an accidental profile, consequently reaching back in time.

I have chosen to leave the impressions of the digital printing in the cast objects, artifacts of the digital device used, as an overt sign of this melding of processes, where the imperfect mark of the machine replaces the hand of the artist. Conceptually, this melding of high and low tech processes and materials feels right; after all, our bodies and lives are increasingly artificially enhanced and extended, and we are electronically connected continually, immersed as we are in communication technology (e.g.: smartphones); we seem to exist in a virtual world, a technical world and the natural world simultaneously.

Iron arts - connections

One of the important forays during my research was into iron casting and connecting with a wider North American community of metal artists. In November of both 2018 and 2019, I participated in the State University of New York (SUNY) annual “Turkey Pour” iron casting events hosted by SUNY Professor Kenneth Payne at the Buffalo campus. Every year, the weekend before American Thanksgiving, several universities bring molds, metal, people and protective gear (and some food – it’s a pot luck) to participate in multiple pours from the outdoor cupola furnace. The metal cast is recycled iron from obsolete iron cast objects, such as old hot water radiators. As the evening falls, flames spewing out of the open cupola with occasion eruptions of sparks from contaminated scrap metal create a dramatic scene of fire and

brimstone. It was at these events that the iron tops from molds made at OCADU were cast, and new connections forged.

In April 2019, I was able to actively participate in the biennial National Conference for Contemporary Cast Iron Arts and Practices (NCCCIAP), held at the National Historical Landmark Sloss Furnaces in Birmingham Alabama, USA, presenting on my research into surface defects in lost PLA⁷⁰ casting, taking a workshop on “direct carve” technique in resinated sand molds (artwork created in Figure 20), and exhibiting work in the juried, curated iron arts show, *A Rare Few*.⁷¹ The conference afforded a tremendous opportunity to network and for experiential learning from others’ artistic practices.

I presented the results of my research carried out over the Winter 2019 semester regarding unexpected surface defects which emerged on bronze works cast in December 2018, from 3D prints printed using PLA filament. Arising from this research, I offered recommended practices for use of 3D PLA prints in ceramic shell metal casting, as PLA filament offers an economical alternative to casting-specific filament for creative practices. The surface defects had occurred on two key pieces I cast for an artwork, manifesting as deep pitting or crevasses in the metal, and which did not appear to be consistent with venting, inclusion or residue issues familiar to experienced metal casters and documented in foundry literature.⁷² In previous digital casting, and in all the other casts at OCADU that semester, no similar defects were seen,

⁷⁰ PLA or Polylactic Acid, is a thermoplastic polymer derived from renewable resources, usually from corn starch or sugar cane, and which is biodegradable (All3DP). It is used to make 3D printer filament.

⁷¹ *The Rare Few*, 2019 April 5-6 Contemporary Cast Iron Arts Exhibition, curated by Carrie Johnson of the Rockford Museum of Art, IL.USA.

⁷² Notably, Ronald Young and Robert Fennell’s 1980 text, *Methods for Modern Sculptors*.

and I wanted to understand why. Like many accidental results in art making, the effect had a certain allure of its own, evoking a narrative of long times spent at the bottom of an ocean, but I want to be able to create works with more predictable results, at least for some intentions. The research presentation included photos of the effects and of extensive testing carried out, as well as the conclusion and the recommendations going forward, based on my research and accumulated best practices. At the talk, and in other conversations at the conference, many shared some of their practices regarding casting 3D printed models, a process which will only be used more as artists become more comfortable with digital modeling. I subsequently summarized and shared this learning for use by OCADU students and staff at both the foundry and the Rapid Prototyping Center, where digital models are printed. In APPENDIX A a summary of this process research, as well as the briefing note, is provided. The single biggest advice I can offer as a result of this work is to use unpigmented PLA in printed models for metal casting, but more fulsome advice is listed in the briefing note.

At the conference I also took a four day “direct carve”⁷³ workshop with Gerald Masse⁷⁴ using resinated sand to create a mold which was cast in iron. While this was my first experience with sandcasting, it involved an advanced technique which creates casts with cores and interior forms. I have not included the work produced there in the thesis exhibition (Figure 20), as it is not a dynamic work, however it is a satisfying and intriguing introduction to this

⁷³ Rather than packing sand around an object, this technique carves directly into the sand to create the voids of the mold.

⁷⁴ Gerald Masse is a founder of Sculpture Trails Park, in Indiana. Sculpture Trails Park, in Indiana. <https://www.sculpturetrails.com/>

technique. I intend to investigate sandcasting further, as it is often used for larger scale work than ceramic shell.



FIGURE 20 - IRON CASTING WITH TWO CORES AND INTERIOR SCULPTURAL ELEMENTS
17.5 INCHES HIGH, APPROX. 7 INCHES AT WIDEST POINT. BASE IS CURLY MAPLE, 11 INCH SQUARE.
PHOTO BY AUTHOR.

Spinning through Life (aka The Dish) was included in the juried exhibition, *The Rare Few*, curated by Carrie Johnson of the Rockford Museum of Art, in Illinois, USA. As mentioned earlier, this show also provided the opportunity for me to observe visitors' reluctance or compulsion to interact with a dynamic work. Since this work involved starting the tops using a hand-held launcher with a string⁷⁵, as opposed to simply spinning using your fingers, no one offered to try starting them while there were observers. However, appropriately, the traces on the dish indicated that others had spun the tops when I was not there.

⁷⁵ It does not escape my notice that when I am preparing a string for a top, unravelling it off a spool, measuring a length off and then snipping a clean cut end, I am Clotho, Lachesis and Atropos (Britannica 2019), the Greek mythological three fates all in one, in this metaphor of top-spin as life.

These iron arts events not only connected me with a large community working in metal, some of whom are also using 3D printed modelling, but exposed me to different variants and possibilities within mold making and metal casting.

CONCLUSION

Research involves seeking knowledge where it did not exist before ... For something to be perceived as public research, as distinct from gathering information of personal value, we expect it to produce something insightful, useful or, indeed, ground-breaking. (Linda Candy and Ernest Edmonds 2018, 64)

Through my research, I have endeavoured to add to the conversation, through dynamic art installations, providing insights; using people powered durational works to enable knowledge making that is embedded in the physical engagement with dynamic sculptures, and prompting consideration of our place as humans in the interconnected networks of time and space. These works involve a marking of the experience, leaving residual traces. And as a residual side effect of my journey, the investigations into probable causes of surface defects in metal casting from printed PLA models provide useful information for that creative and increasingly accessible process, information which I have already shared. “Ground-breaking”, of course, sets a high bar, but I feel that in creating dynamic interactive sculptures⁷⁶ in traditionally static materials, I am introducing something new to the art arena.

I have provided contextualization of my work by referring to others not only in the chapter directly discussing *TRACES: Here/Not Here* research creation, but in the interweaving of others’ works in the conceptual discussions of time, interconnectivity, play and interactivity. The *Spinning through Life* portraiture top series of works are distinct and significantly different from others’ works in that they are dynamic and durational – physically spun so that angular momentum and moment of inertia keep the sculptural objects upright, until slowed down by

⁷⁶ Of course, a work such as Bernini’s *Daphne and Apollo* may be physically static, but the viewer (or at least me) is compelled to circle it repeatedly to take in its movement and splendor.

friction and pulled down by gravity – until they fall, and allegorically in my work, stop moving and “die”, leaving a residual trace of the “lifetime”. The experience and the marking of the durational performance is in fact the artwork, not the top-objects, which are simply artefacts. In the work featuring the log piece, *timespacemattermotion*, I use person initiated durational movement again, this time to arrive at the slow almost-still movement that is the mechanism to induce contemplation. In this work, it is the initiatory propulsion that leaves the footprints in the sand, the indexical trace of the participant, and a suggestion to the next. These works enlist play elements and playfulness, to engage the body, to interrupt time, and to suggest our mortality can be broached in an optimistic manner.

Addressing my first two research questions on interconnectivity, the human experience of life within much larger frameworks of time and space, and our part in them, I have anchored my conceptual discourse on words from Barad, and Bergson-through-Deleuze. Their ideas reverberate in my work, the intersecting result being that the moment we have is the moment we can consciously act in, for we are intertwined and entangled and our existence does make a mark. Researching interactivity, participation and play in contemporary artwork, I have found Stott’s critical framework useful, and largely consistent with my own observations and experience.

Addressing the last research question on interactivity and participatory art, I have arrived at the conclusion that I cannot expect people to approach the work without any direction; some suggestion is required, some parameters must be set, and context is everything. In lieu of written instructions, I (or an attendant) can demonstrate the interaction in

person or in video, and invite. Furthermore, participation should be relatively simple, or else I must provide some guidance on using something like a launcher.

It has become clear that a way to overcome the internalized strictures against touching artwork, which preclude interaction, is to change the context in which it is encountered, and take it out of the gallery and out to where people move about already.

Moving along this trajectory of the research, I am interested in inserting dynamic participatory works into the public spaces. Perhaps it might be something like prayer wheels spun on walls as you walk by in Katmandu; the idea of artworks being touched and moved by people in their daily life, and touching and moving them back strikes me as an important element to insert in our lives. To place art in people's path creates an opportunity for a mutual touching that can be powerful.

Given that in practice-led research, the thesis paper is intended to support or shed insightful light on the thesis body of artwork rather than the reverse (Candy and Edmonds, 2018 65), it is unfortunate that the onset of the COVID-19 pandemic⁷⁷ precluded the opportunity to stage a thesis exhibition. Of course, this is merely inconvenience in the face of the threat to human life and to our medical health systems, threats which must be dealt with decisively by government and individual actions to minimize the toll. The spread of the virus from one city in China to Europe and North America is a testament to how interconnected we are on this planet; furthermore, it is the electronic network of communications, news and social media that allows us to maintain physical isolation without human isolation, connecting to friends and

⁷⁷ On March 11, 2020, The World Health Organization assessed the COVID-19 situation as a pandemic. COVID-19 refers to Coronavirus Disease, a highly infectious disease caused by a newly discovered, or novel, coronavirus. (Coronavirus 2020)

family across the planet – in our household we talk daily to people across nine time zones. I worry about bringing the virus into the home each time I return from getting fresh supplies, this new threat making it seem like the world could unravel; its like we are entering one of Margaret Atwood’s near-future dystopias⁷⁸ – somehow the present has overtaken the few-steps-ahead future. But we are living an example of how we can individually act to change radically – each person’s actions are important, precisely the premise of this thesis research. While governments move from suggesting to enforcing new rules of social distancing and self-isolation, it is still individuals’ ability to adjust our behaviours and habits that will mitigate the death rate of this new virus. But maybe this is a new norm; we hide in our homes or our cars, we step back if someone from outside our household approaches us, we studiously avoid touching not only another person but especially any common surfaces. Suddenly we are afraid of what each of us may be harbouring.

The thought arises: is this Earth rising up in opposition to humanity’s practices; Latour’s Terrestrial - an active entity resisting people’s voracious activities? A virus that puts seniors – of which there are now so many – at risk of death because the medical care systems and supplies may be overwhelmed. Is this a wake-up call to the risk of our overextended network of humanity and the effects of our needs?

As an aftereffect, the trace of this pandemic, what happens to my vision of interactive playful participatory art? Will I disinfect the log or the tops every time someone touches them? Do I provide gloves, and sacrifice texture? If people no longer gather in galleries, or parks, or

⁷⁸ The *Madd Addam* trilogy (concluding 2013), for instance comes to mind, or the less extreme but still alarming scenarios described in the short story collection *Stone Mattress* (2014).

events, will all art become digital? Virtual? Unlike the historical demand to not touch the art – in an effort to preserve it - will we now not touch the art to protect ourselves?

Driving through the community streets, in what is hint-of-spring in Toronto, the traffic is much lighter, far fewer people walking around than what was so recently normal.

Optimistically, maybe this exercise will teach us better ways of working remotely, reducing congestion and long commutes, reducing carbon emissions and stress levels. Maybe we emerge with better models for working and communicating, and managing health care. Maybe we emerge with consideration of what is important to each of us; considering how I have been investigating how to induce people to interact with works that prompt consideration of consequences of being here, albeit briefly, it is appropriate that this phase of my work ends with me considering my actions going forward, in what ever time I yet have to act.

EPILOGUE: Post Mortem

The portraiture top as funerary urn; portrait urns for my parents.

Supporting my parents through their last years, as increasingly debilitating conditions of prolonged life eroded their capabilities, I was constantly reminded that to be alive means that one day I will not be able to do what I am able to do today, and that sooner or later, inevitably, I will be dead. But there are more positive ways of looking at a lifetime that is ended by death, and when we assemble after someone has died, we are bearing witness to and celebrating the connections made, the give and take that occurred during that life.

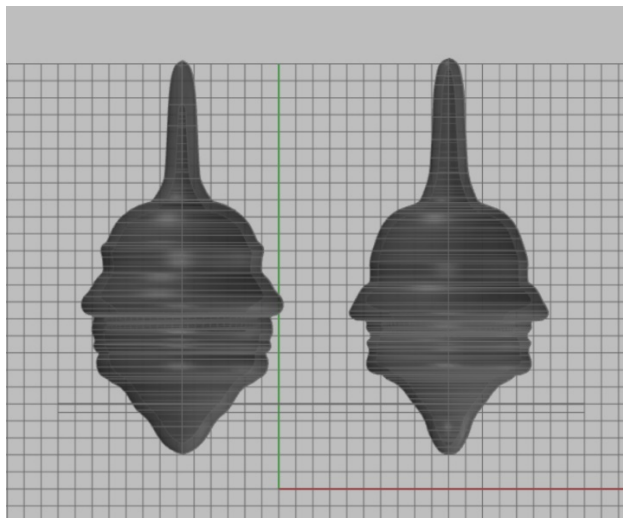
During the thesis show I intended to include a display, perhaps in an alcove, of the funerary portrait top urns I have made for my parents, without their human remains in them.

As described in the body of the thesis paper, the process for making the portraiture tops results in hollow pieces that are threaded together in the last step, to form the top. The offshoot of this approach is that my tops are containers.

When this was revealed to Gord Peteran during my independent study, he leapt at it: A container! What could you put in here? And without skipping a beat, I replied: someone's ashes. And of course, it would hold the ashes of whoever's profile is depicted on the top. Within six months of that conversation, both my parents died. When my siblings and I were

looking at the funerary urns on display, this idea returned, poised for use, now that my mother, and then three weeks later, my father passed on, leaving behind the shells of their bodies.⁷⁹

Years ago, I painted large portraits of them, displayed proudly in their living room. I was never satisfied with my mother's portrait, since I found when painting it, unlike with my father, that I had no compelling visual image in my mind of her; rather, what I had was a strong emotional imprint, a feeling, of who she was. In making these portrait top-urns, I am finally satisfied – my mother had a very distinctive nose, and she was always, persistently, smiling (although she was no one's fool) – and I was able to capture some of that in the funerary object – object that can spin, like she did, never stopping until Alzheimer's overtook her and she stumbled, toppled and fell.



Screenshot of 3 D modeling in Rhino of funerary tops. January 2020

⁷⁹ The idea of an urn is not far off the reliquaries of old Catholic basilicas: in Santander I saw the reliquary of the martyr San Emeterio (the saint for whom my paternal grandfather was named), whose skull has been encased in a silver portrait bust since 1536 (reference: didactic posted, Cathedral of Santander).

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APPENDIX A

UNEXPECTED SURFACE DEFECTS IN LOST-PLA WITH CERAMIC SHELL METAL
CASTING PROCESS

APPENDIX A.1 Results of Research into Surface Defects

SUMMARY

The purpose of this appendix is to provide a consolidation of the research done over the Winter 2019 semester regarding unexpected surface defects which first emerged on bronze works cast in December 2018, from 3D prints printed using Polylactic Acid (PLA)¹ filament. Arising from this research, I offer recommended practices for use of 3D PLA prints in ceramic shell metal casting.

The surface defects occurred on two key pieces I cast for an artwork, manifesting as deep pitting or crevasses in the metal, and which did not appear to be consistent with venting, inclusion or residue issues familiar to experienced metal casters and documented in foundry literature.² Out of ten pieces cast in six molds in the Fall 2018 semester, two in particular exhibited significant defects, and one to a lesser degree, while others came out with great surface fidelity to the original prints. In digital castings the previous year, and in all the other casts in the OCADU foundry by other students in the same semester, no similar defects were seen, and I wanted to understand why this might be. Like many accidental results in art making, the effect had a certain allure of its own, evoking a narrative of eons spent at the bottom of an ocean, but I want to be able to create works with predictable results, at least for some intentions.

¹ PLA or Polylactic Acid, is a thermoplastic polymer derived from renewable resources, usually from corn starch or sugar cane, and which is biodegradable. (All3DP).

² Notably, Ronald Young and Robert Fennell's 1980 text, *Methods for Modern Sculptors*.

To determine probable cause, in December 2018, I started with analysis of data available; I analyzed 3D PLA filament batch information – stamped on reels - and analyzed ceramic shell dipping times and spacing of the different molds.³ In the hope of finding a way to prevent this defect, I continued in Winter 2019, by introducing testing and further research. I performed tests of the ceramic shell moldmaking process and filaments, I investigated the efficacy of several solvents (Acetone, Xylene, Isopropyl Alcohol, Ethanol, Varsol, and Methyl Hydrate) for sealing or smoothing the 3D print surface, and also looked at three applied sealants (finishing wax, shellac, and acrylic varnish) to determine if they might mitigate the effect. Cannibalizing misprints or test prints from the same two spools of filament (green and blue) used in the cast pieces, I performed dipping tests, and taking two samples to burnout and then cut open the molds. I cast five pairs of samples with the various surface treatments (acetone solvent, shellac sealant, wax sealant, acrylic sealant and untreated). I also examined the size and geometry of the works cast in Fall 2018, especially in the burnout position. I made a set of inclined metal trays, which I used to simulate the melting and burnout behavior of various PLA filaments in the ceramic shell molds during burnout. Furthermore, in late March of 2019, I cast five further works from 3D prints which added more data to incorporate into my research, as only one⁴ of the new casts exhibited the same defects I have been investigating. In parallel, I continued searching for relevant information from two slurry makers,⁵ a large filament maker⁶ and a teaching foundry.⁷

³ This early data analysis was started in December 2018 (Lopez, 2018).

⁴ The work *Unravelling – Coiled Profile*, cast in aluminum, exhibited the same surface defects.

⁵ Remet (Utica, New York) and Ransom & Randolph (Maumee, Ohio).

⁶ Polymaker, an international company headquartered in Shanghai, China.

⁷ The Crucible (Oakland, California).

In early April 2019, I presented the results of my research at that point at the National Conference for Contemporary Cast Iron Arts and Practices (NCCCIAP), at the Sloss Furnaces National Historic Landmark site in Birmingham Alabama, USA. The presentation included many photos of the effects and the testing carried out, as well as the conclusion and the recommendation going forward, based on my research and accumulated best practices. In the sharing environment of the conference, I continued to seek out others' experience and practices.

As a result of the research, I produced a note regarding use of 3D PLA prints in ceramic shell metal casting and shared it with OCADU foundry teaching and support staff, as well as Rapid Prototyping Center staff.

KEY POINTS FROM ANALYSIS AND TESTING

- I was able to duplicate the defects on sample printed PLA pieces that involved the same filaments used in the most affected pieces.
- No defects emerged in process checks before mold burnout (i.e.: during ceramic shell slurry dipping).
- The defects appeared on cast pieces using particular filament samples, and furthermore, surface defects occurred regardless of surface treatments by solvent or sealants. (i.e.: no surface treatment made any significant difference to defects)
- The defect pattern was evident in a cut-open molds of the same filaments after burnout, which was consistent with casting defects.
- The defect pattern was evident in the residue on the metal tray of burnout tests, (both in-kiln and using torch), while other pigmented filaments left a fine powder residue, and natural, unpigmented filament left none.

- Once one particular filament was identified as the issue by the casting and burnout tests, re-analysis of the filament batch information indicated that defects only occurred from filaments from one manufacturer/supplier. Two batches from this supplier, with different ages, can account for all the observed surface defects.
- While a filament from this particular supplier had failed on the reel in a catastrophic manner, subsequent data re-analysis also identified that the filaments associated to the defects were not PLA as sold, but “PLA +”, which has an additive to make the 3D prints more durable.

Figures in following pages provide photo documentation showing the defects in question and the testing discussed above.

CONCLUSIONS

I conclude that the observed and unexpected surface defects were due to the nature of the residue left in the mold after burnout and were associated to filaments obtained from one specific smaller scale supplier, which turned out to be a variation of PLA (PLA+). Furthermore, these defects are predictable from a simple burnout test of melting filament using a torch. In regards to surface treatments, such as coating the print with finishing wax, shellac or acrylic varnish, or smoothing with acetone, these have little or no effect in reducing the defects. My best piece of advice regarding the use of PLA 3D prints in ceramic shell metal casting in a “lost PLA” process is to use filament from a well-established manufacturer, and especially to use natural or un-pigmented (not white) filament for the prints, as it burns out of the mold the most cleanly by far. Also, for casting purposes where the PLA is melted out to produce a mold,

PLA with additives to make material to enhance the printed objects durability or visual aspect should be avoided, as it is likely that the additives leave residue when burnt out, and in particular “PLA +” should not be used for casting.

One potential aggravating issue identified during the course of these investigations, in particular through correspondence with a representative of the ceramic shell slurry manufacturer,⁸ is that the OCADU kiln is run at considerably lower temperatures than recommended⁹ or practiced elsewhere;¹⁰ while this is not an issue for wax models, it may result in poorer burnout for non-wax models such as organics or PLA.

Based on this work, and practices accrued from my research, I compiled the note regarding the use of 3D printed PLA, for use by OCADU Foundry teaching staff and the OCADU Rapid Prototyping Center.

ACKNOWLEDGEMENTS

I would like to acknowledge the OCAD University teaching and foundry staff who assisted me in my investigations into what might have caused the surface defects. Many thanks to my primary advisor, Dr Claire Brunet, professor and chair of Sculpture/Installation and Life Studies, OCAD University, and to Kip Jones, OCADU Foundry Instructor, and to Olenka Kleban

⁸ Email correspondence initiated February 7 2019 after a phone call between Dr Claire Brunet of OCAD University with Elizabeth Lopez, and representative of Randolph & Ransom (R&R), of Maumee, Ohio. Email correspondence took place between February 7 and March 11 2019, and included results of some slurry/PLA interaction tests that R&R conducted in response to our inquiries.

⁹ Recommendations regarding kiln temperatures during burnout are also included in the Technical Tip sheet published by the slurry manufacturer (Technical Tip, 2019).

¹⁰ Experience shared by other metal casters at the NCCCIAP indicates that their practice is to run their kilns at the recommended temperatures, which is between 1400 to 1800 degrees Fahrenheit, as opposed to the OCAD University kiln which runs just below 1000 degrees F.

and George Farmer, OCADU foundry technicians, for their time and interest in examining the castings, discussing potential causes, based on their experience and knowledge, and for accommodating my experimental investigations.

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FIGURES



Left - 3D print used in lost PLA casting (three pieces – White spindle, Blue I/Green head, Red cone - threaded together)

Right - Surface defects on bronze cast middle piece(head) during divesting and gating cutoff

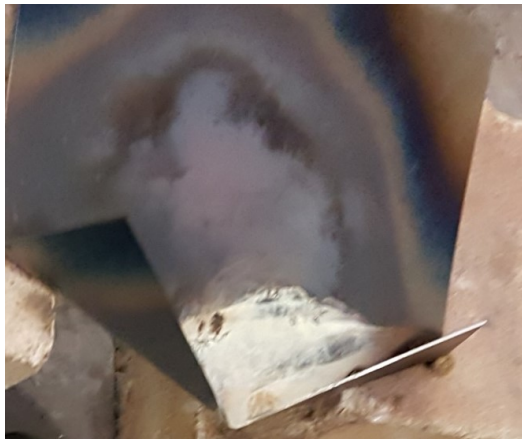


Left - Surface defects on bronze cast middle piece(head) during divesting, compared to cast spindle piece.

Right - surface defects on bronze cast middle piece(head) after 3 components patina-ed and threaded together.



Left – Blue I filament burnt out in kiln, exhibiting defect pattern, (loose flakes are from charred covering foil, used to keep filament from blowing around in the kiln)
Right- Green filament burnt out in kiln (loose flakes are from charred covering foil)



Left – Blue I filament burnt out with torch, exhibiting defect pattern
Right – Green filament burnt out with torch (powdery ash)



Left – Natural (unpigmented) filament burnt out with torch,
Right – Blue II filament burnt out with torch (powdery ash)



Left – Pink filament burnt out with torch, exhibiting defect pattern,
Right – Orange filament burnt out with torch (powdery ash)



Left – Red I filament burnt out with torch (powdery ash),
Right – Red II filament burnt out with torch, exhibiting defect pattern



Mold of Blue I sample cut open after burnout in kiln, exhibiting defect pattern.



Array of solvents tested to smooth or seal printed surface, showing relative amounts of red filament dissolved



Left – Samples of same filaments (Blue I and Green) used as print to cast piece with surface defects
 Right – Cast sample with acetone surface treatment – some minor lessening of defect observed.



Left – Cast sample with Shellac surface treatment
Right – Cast sample with Acrylic varnish surface treatment



Left – cast sample with Wax surface treatment
Right – cast sample with no surface treatment



Left - Surface defects also appeared next semester on aluminum sculpture – *Unravelling* - cast from pink filament with same “PLA +” batch number.
Right – Pink filament 3D printed model used.

APPENDIX A.2 – BRIEFING NOTE

BRIEFING NOTE CONCERNING THE USE OF DIGITAL PRINTS IN “LOST PLA” USING CERAMIC SHELL TECHNIQUE:

some points gleaned from advice, experience, testing and research
compiled by Elizabeth Lopez, MFA candidate, IAMD, OCAD University. March 2020.

Producing the 3D Print:

3D Print Design for metal casting

- **Venting:** Need to create “chimneys” to vent gases during burnout. This is best designed right into the 3D model. You want to have a point that you can easily see and drill through the shell until you hit plastic, without actually drilling into the intended object.
- **Gating Attachment:** Consider designing the gating attachment points right into the print; a spike will suffice. However, if this complicates the print too much (perhaps requiring complex support system) another trick is to drill holes into the print and use short sections of 3D print filament as a spike to help make a strong gating system connection point.
- **Scale:** If the work is going to fit precisely to something else, design in a slightly higher scale where needed to accommodate the metal shrinkage. That is, if you need a precise size, you need to print a slightly larger print. This applies as when using wax models. This is usually important in industrial applications.

Printing:

3D prints are not solid!

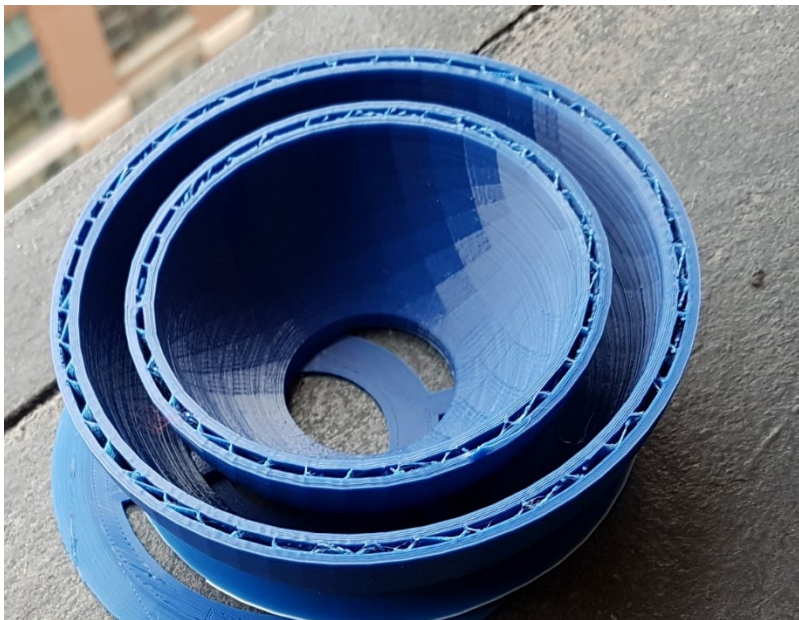
If you are not printing it yourself, tell the Rapid Prototyping Center (RPC) staff that this is going to be a lost plastic casting, as they may want to change materials, and adjust settings for wall thickness and/or infill.

- **Material:** Unless printing in a specialized filament for investment casting, (such as Polymaker Polycast), it is highly advisable to print in unpigmented, or “natural” PLA.¹¹ In tests, the unpigmented PLA burns out extremely cleanly. Pigments will produce a residue during burnout that need to be well blown out with compressed air, or even washed out (see next section). Other additives to strengthen or produce special effects in a print should

¹¹ Based on testing by Elizabeth Lopez in March 2019 at OCAD University.

be avoided as they likely add residue inside the mold. Pigments and additives are extra chemicals that do not contribute to the cast product.

- **Infill:** With selection of the default 20% infill (which means 80% air) burnouts on relatively large prints can be successful without cracking of mold. However, usually a 10% infill can be used with excellent results as well. This is similar in concept to the hole through large sprue bars. This will be more important for small pieces. One 3D filament manufacturer¹² recommends 10% infill be used.
 - Depending on the structure, and whether internal support will be needed, it may be possible to go as low as 4% infill¹³, using a honeycomb infill pattern, rather than square lattice.
- **Wall thickness:** Default settings can be used, although this can be somewhat reduced as well. Note that if an object is very small, the object will be mostly wall. This means that expansion of the plastic prior to draining out may cause cracking of the mold, as there is proportionately much more plastic in the mold than air space.



Wall thickness and Infill are shown in the photo of aborted print. This print shows 10% infill in a square lattice pattern.

¹² Polymaker application sheet for PolyCast filament.

https://polymaker.com/Downloads/Application_Note/PolyCast_Application_Note_V1.pdf

¹³ Practice shared by professor from an American university at National Conference on Contemporary Cast Iron Arts and Practices (NCCCIAP) at Sloss Furnaces in Birmingham Alabama, April 2019.

Casting Process:

During dipping process:

Reinforcement around the model at the appropriate stage is highly recommended, to protect the mold from cracking during burnout; if in doubt, reinforce!¹⁴

Preparation for Burnout:

- Drill venting holes or “chimneys”. The filament will let off vapours/gases during burnout, and the vents will protect the mold from cracking. Drill until hitting plastic, for vents (which will point up, in the burnout position).
- Drill sufficient holes for the plastic to melt down and out, as in testing it appeared less fluid than melted wax from the gating system. This is to help drain the melted PLA out and reduce residue.

Burnout: consensus is that extra burnout is advisable to reduce residue.

Post Burnout: eliminating residue gently

- Especially if the print was pigmented, extra blow out with compressed air will help remove any powdery residues, although this could break off fine details captured in the ceramic shell. This is true with lost-wax as well.
- Washing out the mold with water is a practice that could help ensure any powdery residues are flushed out.¹⁵ Intuitively it seems that water rinse is gentler than compressed air blow out. However, if there are suspect cracks in the mold, filling the mold with water may cause the cracks to widen and break the mold.

Preparation for pour:

- Ensure extra holes for venting are well patched when preparing the mold for the pour, as the chimneys are probably just where the molten metal will hit hardest.
- Consider using discarded fired ceramic shell “plugs” with at least two layers of fibreglass cloth & refractive cement to seal chimney holes.
- At least two layers of patches should be made, laid at right angles to each other.

¹⁴ This was confirmed when casting identical models with and without reinforcement on a tapered cylindrical form.

¹⁵ Washing out of molds that had contained PLA was a practice shared by participants at the 2019 NCCCIAP who use PLA. It appears in a process diagram as well in the Polymaker Facebook user group (posted by the Polymaker group facilitator). Polycast is a trademarked 3D printing filament designed specifically for metal casting, made by the Polymaker company. See polymaker.com for up to date information.