Encounters between dance and digital meaning

Discovering Potential in the Question of Movement

Sarah Levinsky

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MOVEMENT

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ABSTRACT

This thesis explores how a series of artistic and philosophical enquiries opened up through dancing with *Tools that Propel (TTP)*, the choreographic improvisation system that was developed (partly) in response to the question 'how might we create real-time interaction between dance and technology that catalyses growth of new embodied knowledge?' The difficulty of delineating movements – determining where one movement begins and one ends – underpins the functionality of the *TTP*; its multiple affordances born of, or affected by, different (digital and human) perceptions of movement are products of recursive causality and make the system (which includes the dancer) self-maintaining (Simondon 2012). This thesis examines these affordances and how problematizing the question 'what is a movement?' foregrounds a series of interrelated investigations into how and in what form new embodied knowledge arises with *TTP*.

Incorporating text, video, recorded interview and dialogue this thesis is a record of relational encounters of practices: talking (about technical mentality, agency, choreography, improvisation, dramaturgy, archives, time, ontologies and not knowing); co-developing *TTP*; moving bodies (material, representational, virtual); reading; and writing. It interrogates *TTP*'s use by dancers in improvisation and performance over two years and navigates an exploded framework of theory to understand the emergent enquiries. Building on the practice of Merce Cunningham, William Forsythe, and Wayne McGregor amongst others, and Mark Coniglio's concept of 'digital intervention', this thesis contributes to knowledge concerning how technological interventions in choreography produce new physical thinking. Drawing on Karen Barad's agential realism and Jane Bennett's vital materiality, Andy Clark and David Chalmers' extended mind theory, and Brian Rotman's discussions of the para-self and gestural-haptic writing, this thesis raises questions concerning bio-eco-technological-becoming as it explores how new choreographic language evolves relationally across human and digital perception and how creative potential is found in a recursive and regenerative process of looking within newly perceived movement. Overall, it suggests that an ecological aesthetics (Stern 2018; Yang 2015) approach to dance/technology collaborations can lead not only to new choreographic thinking, attention, and intention in dancers, but to shifted perceptual awareness and enactment of the dancing self in the world.

This thesis is dedicated to my collaborator Adam Russell, without whom *Tools that Propel* would not have existed, and to my partner and son, Norbert and Caspar Benjamin, with whom I have shared many adventures in Cornwall whilst also being entangled in research.

ACKNOWLEDGEMENTS

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throughout the thesis) and Gaby Prothero for her brilliant work developing my website where my videos are hosted and helping me to put together this final thesis document.

There are many other people who have danced with *Tools that Propel* over the years and I would like to thank them all. They have all deepened the understanding within this research in their own ways. Individually there are too many to name, and many I couldn't anyway, some of them anonymous interactors in a gallery or workshop. However, I would like to extend my thanks to Dr Katrina Brown and Kuldip Singh-Bharmi, independent dance artists and lecturers at Falmouth University; to the dancers of Company Wayne McGregor and Jasmine Wilson, Wayne McGregor and Odette Hughes who enabled the workshop with them to happen; the dancers who Dam Van Huynh brought together to take part in a workshop at Centre151 and Dam himself for organising this; Cardboard Citizens and the participants at a weekend workshop they organised and hosted for me; and Sheila Preston and my colleagues in the weeklong Critical Facilitation workshop at the International Community Arts Festival summer school in Barcelona (2018). I would also like to thank Scott deLahunta and everyone else who organised and attended the Choreographic Coding Lab in Amsterdam in 2017, where *Tools that Propel* was partly developed: I particularly remember a conversation between Adam Russell, Anton Koch and myself about how to determine the beginning and end of a gesture within the code that led to the decision to stop recording a movement either when the system recognised it as being the same as one already archived, or when its length surpassed a certain number of seconds. It is the apparent randomness of this segmentation method to the creation of a movement vocabulary that has ultimately led to some of the knowledge claims in this thesis.

This is a long list of acknowledgements, but I am conscious that this project has been born of collaboration and conversations. Some of those conversations have taken place in formal contexts of conferences and training workshops and some whilst walking my dog in the fields and on the beaches of Cornwall. I will not name the interlocutors of all these conversations but I would like to acknowledge the support and contribution of Ciaran Clarke, Lucie Hernandez, Tom Milnes and Becalalis Brodskis, research student colleagues within the 3D3 Centre for Doctoral Training, each of whom have enabled this research to flourish in their own ways. In addition to her time spent dancing with *Tools that Propel*, I would also like to acknowledge Dr Katrina Brown's continued support of my work, and to thank Dr Lee Miller who gave me an understanding ear and the odd motivational talk when I needed it the most. Finally, last but certainly not least, an enormous thank you to Falmouth University. Here my thanks extend both to the postgraduate studies team, in particular Professor David Prior for invaluable advice throughout the process, and to Jemma Julian-Vicary and Katy Shannon without whose extraordinary capacity to clear away administrative hurdles in the kindest and most efficient of ways, I would have stumbled blindly; and also the Academy of Music and Theatre Arts and the technical team in particular

who gave me a lot of support in the creation of the performance project, *Body of Memory*. I have loved this research process and I am extremely grateful for the opportunity to embark on it, financially supported by the Arts and Humanities Research Council through the 3D3 Centre for Doctoral Training.

READER'S GUIDE TO THE THESIS

This thesis is made of text and videos, which involve in various configurations filmed footage, recorded interviews, and music composed for *Body of Memory*, a performance piece made as part of my research. I have created this thesis as an interactive PDF. I wanted to present both text and video as equally important and entangled. The ideal way to watch the videos is by clicking on the image so that it plays in its position within the text meaning that you do not have to keep moving between alternative online locations and the text of the PDF. Indeed, I intend for the videos to 'fold organically into the writing' as anthropologist Michael Taussig writes of his drawings in his field notebooks (Taussig 2011: 21). I prefer you not to have to disappear into 'another space altogether with a lot of technical junk' between experiencing the ideas in their textual and their visual/aural forms (Taussig 2011: 21). It is also an invitation to embrace the affordances of the techno-ecology with which our becoming is entangled.

Please note that the videos will only play when you view the interactive PDF in Adobe Acrobat Reader, and only on the desktop version. If they do not play you may need to change your Multimedia Trust (legacy) settings in Preferences or download a more recent version of Acrobat Reader which can be found here: https://get.adobe.com/uk/reader/. The PDF is not interactive on a Kindle, tablet, or mobile device, and as many people prefer to read a printed document, I have included links to the videos underneath the image should you need them. Either way, the videos, numbering 17 in total, and varying in length from about 3 to 19 minutes, are to be watched when they appear in the text.

The Appendices (A, B, C, D, and E) comprise *selected* interviews or studio discussions with undergraduate dance students, professional dancers and community participants who have worked with *Tools that Propel*. I have not included all of the interviews and studio discussions which are referred to in the thesis (either as quotations within the text or within the audio of the videos). This is because they represent a substantial volume of textual material and also to varying degrees significant amounts of them are heard within the conversations overlaying the video footage. As such I have chosen to include two example interviews with undergraduate dance students, along with the studio discussions recorded as part of one-off workshops with three dance and theatre companies: Company Van Huynh, Cardboard Citizens, and Company Wayne McGregor. These latter studio discussions highlight the breadth of my research process with *Tools that Propel* even whilst a greater proportion of my findings in this thesis come from more sustained work that I carried out with a group of undergraduate dance students at Falmouth University.

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PROLOGUE:

ON BECOMING WITH THE THESIS

When we move, when we move digitally, that is (and we must not forget that our brains are also digital machines), we move in abstraction and concretisation at the same time. We entangle ourselves in a two-way and coextensive process. We move in thought and body, in software and hardware, and therefore the language machines we can come up with must generate new possibilities of movement representation that no longer carve up thought and body into separate domains.

Nicholas Salazar Sutil 2015

This thesis aims to articulate the experience of dancing with *Tools that Propel*, a choreographic improvisation system developed by fellow PhD researcher Adam Russell and me, and to analyse what that experience affords us in terms of new ways of understanding our relationship with the world. It explores the entanglement of the 'two-way and coextensive process' (Sutil 2015: 4) and considers how *Tools that Propel*, an apparatus that cuts up time in unfamiliar ways, folding the past into the present, and challenging many conceptions we might have about the physical embodiment of time in motion, has come to operate as a 'language machine' (Ibid.). By cutting up motion into different semantic units of movement – at times seemingly also challenging our embodied understanding of other physical laws such as gravity – this experience has asked me (and many of my collaborators) to look/feel/perceive/understand our entangled existence with the non-human again and again. Indeed, it has brought about a practical and embodied understanding of the philosophical concept of *becoming*. For what we discover in the question of movement (where does a movement begin and end, for example?) is that all meaning, knowledge, agency, matter and existence is contingent on entanglements of phenomena (Barad 2007) – when the entanglement changes, it all changes. There is no fixed state of being: everything is always becoming.

The knowledge within this thesis emerges through an ecology of practices that rub, push, pull, open, explode and ricochet against each other. We might say that they are entangled, and their meaning –

and thus particular individuation in the thesis' becoming – only come into being in relation. This ecology of practices includes dancing, improvising, performing, designing, coding, filming, writing, reading, editing and talking. It is through this ecology of practices and the way that they led me backwards and forwards in my understanding of many of the theoretical ideas explored in the thesis, that I discovered the main theoretical frame within which all the other (sometimes conflicting, questioning, provocatively challenging) theoretical ideas sit. Gilbert Simondon's notions of individuation and (techno-) ontogenesis (Simondon 2012; 2017) lie at its core. Espoused in the mid 20th century these concepts might be seen as prescient, or rather assistive, as Brian Massumi states, of the development of an ethics of becoming (De Boever *et al.* 2012a), a framework that intersects with and perhaps underpins so much new materialist and post-humanist thought now.

Gilbert Simondon's discourse in *On the Mode of Existence of Technical Objects* (Simondon 2017; 2011 [1958]) and *Technical Mentality* (Simondon 2012) foregrounds several key ideas that I am exploring within this thesis: not only do I see the development of *Tools that Propel* as (techno-) ontogenetic, but I see its functionality as emergent within the realms of ethics and aesthetics, between the technical and religious phases of the world (phases not being determined by chronological time but by being in relation to each other, both parts of existence). I see it as bringing about new ways of understanding the world with which we are entangled. This thesis argues that the technological development of *Tools that Propel* was one of (techno-) ontogenesis, involving the schema of invention (the idea and design envisioned by Adam and me) and the schema of concretisation (whereby the encounter between machinic and human approaches to determining and experiencing movement brought an unexpected and novel functionality into existence).

ENTANGLEMENT

This thesis, its arguments and the knowledge discovered therein, emerge *within* and *in contribution to* the philosophical paradigm of 'entanglement' that has surfaced as a post-Constructivist and post-Deconstructive, ecological world view: one in which there is no absolute separation between human and non-human, subjectivity and objectivity, and there is a constant reverberation of entangled phenomena, bringing everything to the brink of becoming again and again. Within quantum physics, entanglement is a concept that pertains to the investigation of physical being but increasing currency with the idea is being found within philosophical investigations of an epistemological nature. As such this world view understands matter and meaning to be co-constituent and always subject to the specific entanglements at play.

Entanglement is a concept that underpins much new materialist thought, but there are different agreements about *relation* as an underlying concept: enquiry concerns the possibility of the prior existence of the elements within an entanglement. We can see this as a point of difference between the new materialisms of Jane Bennett and Karen Barad, for example: in the former's notion of vital materiality there is an assemblage of distributive agencies acting on each other whereas the latter's discussion of agential realism states that there are only entangled phenomena, with no elements in existence prior to the entanglement, which in its particularity brings them into (unstable) becoming (Bennett 2015; Barad 2007). So, a point of enquiry rests on the independent individuation (or not) of entities outside of their relation.

Tools that Propel contributes to the study of entanglement through its role as what Barad would call a 'diffractive apparatus', enabling the re-conception of previously perceived entities or relations in its entanglement of phenomena. It *appears* to exist as an amalgam of individual entities – as hardware, software, algorithms, cables etc. – but is it *Tools that Propel* until it is entangled (with) human dancer and everything else that constitutes it as an experience? Certainly, it can only function through entanglement: without a body there to track it cannot do anything, and a body separate – distanced and disentangled – from it would not make the movement decisions that it does, would not be the *particular, instantiated* thinking-body that it is in this entanglement. When we ask does *Tools that Propel* have agency, the answer is that it has agency in dialogue, or perhaps more accurately, in entanglement. This is part of the contribution to knowledge that this thesis brings to the field of computationally-augmented choreography and digital dance: I argue that whilst creative computational systems alone cannot necessarily produce new thought, material, or understanding within dance, they can do so if designed in accordance with the principles of entanglement.

A METASTABLE CRITICAL FRAMEWORK

This thesis travels through, across and along disciplinary boundaries. The theoretical framework underpinning the research and analysis within it might in fact – in honour of Simondon himself – be perceived as *metastable* (Simondon 2011 [1958]). Discussions of process-oriented dramaturgy and improvisation, for example, as well as facilitation, might not immediately seem to correlate with technological emergence but in fact have more in common than one might at first imagine. The thesis examines how the experience of dancing with *Tools that Propel* is also one of ontogenesis, constantly taking us back to the brink of emergence with ongoing transformations and shifts of matter and meaning. In so far as I am understanding and conceptualising process-oriented dramaturgy, improvisation, and facilitation, in relation to my own artistic processes as well as selected theorists and practitioners, they are all predicated on the entanglement of elements (or phenomena) and the

creative act of not knowing (whilst drawing on, reconceptualising, or destabilising past knowledge/being). The thesis forwards the idea of (doing) dramaturgy as something that is held by, and exists in, the creative ensemble, even whilst it is also sometimes a role taken on by an individual person (or here, machine). In this latter case the dramaturg (in process-oriented dramaturgy) collaborates and is entangled within the creative process (rather than sitting outside it). I explore how this relates to choreographic improvisation – whereby the improvisers collectively maintain dramaturgical awareness as movement choices unfold through them and around them – and how it can intervene, sabotage, or disrupt patterns of thinking (embodied, theoretical, constructed) revealing the possibility of discovering new material in the excess of potential in the middle of that which already is. Dramaturgy, as I understand it, is a creative role that is designed to bring about metastability to a process, to catalyse a constant looking to the middle of the thing being created (and the creative process itself) to find potential in the chaotic excess, in order to allow a work or an improvisation to emerge through entangled phenomena rather than preconceived ideas. *Tools that Propel* is explored in relation to facilitation as well as dramaturgy and improvisation, and there are clear parallels between the dramaturgical role (or functionality) and that of a facilitator too. Facilitation holds people in a state of not knowing so they can discover something new about themselves and the world they inhabit, so they can emerge, act, and allow themselves to *become* (with the richness of metastability). It is in relation to this pedagogical role – of *Tools that Propel* as a facilitator of new understanding and ideas – that this thesis can also claim a contribution to knowledge.

ENTANGLED RESEARCH DESIGN

When I began this research process, I had determined that my methodology would draw on iterative interactive design processes, involving collaborations with technologists interested in choreographic practice and a range of participant dancers from community groups, the BA Dance and Choreography course at Falmouth University, and professional companies. In parallel with developing a collaborative relationship with fellow PhD researcher Adam Russell, I investigated a range of digital arts projects to establish some requirements for the interactive systems (which I then called 'digital dramaturgs') I wanted to develop. Through an evaluation of a variety of projects which aimed to elucidate or aid choreographic processes, and (re)connect people to creativity and physical play by capitalising on a fascination with digital interfaces, I determined that projects that delivered positive participant experiences navigated challenging journeys for participants from the familiar to the unknown; co-designed the digital system and content from project conception; and augmented the real through the virtual. These findings do not feature directly in the thesis because the methodological approach became more aligned with artistic research, the discoveries forging the creative and practical decisions

in *Tools that Propel*, and the work undertaken with it, in a more emergent (and entangled) rather than systematic fashion. Yet, in actuality, my initial evaluation of digital arts projects outlined above did feed into the system development through my presence as a key collaborator. The intertwined interests and embodied experiences of all collaborators with the system have guided its development and use in a process of artistic and entangled discovery; this, as opposed to the more pragmatic and structured process entailed in iterative interactive design which might have involved the development, build and evaluation of alternative prototypes. Indeed, perhaps most crucially, a major discovery took place during the development and use of *Tools that Propel*: this was the fact that the system itself and the elements within it were not separable from the research design process. An interactive design process puts humans at the heart of the development and discovery: the system will service human need. Yet I posit that this research process has involved learning from the specific findings that are evoked by valuing all the materials involved and entangled in the project – in the more-than-human interaction. I might in hindsight suggest that the research design process was one of entangled interaction (or as will become clear 'entangled intra-action') and emergence.

Tools that Propel takes on many roles within this research project and thesis. The *design* and *development* of the choreographic improvisation system occurred as part of the research, Adam and I collaborating in the creation of (what we initially saw as) a digital installation in response to multiple conversations regarding our intersecting research interests. Initial studio time with participant dancers during the Digital Artists Residency, after which I held the first semi-structured interviews that contribute to the research findings in this thesis, also functioned as a design laboratory in which the experiences and responses of those participant dancers fed into the iteration of the system that has subsequently been used since (Adam making changes during studio sessions, the dancers feeding into those and testing them). Yet the research did not end with this iteration, for subsequently, *Tools that Propel* has become both the *object* of the enquiry itself and the *apparatus* through which the enquiry unfolded. I have spent significant further time in the studio with participant dancers and professional companies investigating the impact that it has on their choreographic thinking and decision-making, observing it and their interaction with it, asking questions about the apparent affect it has on their dancing selves. But the system also *produces* enquiry: using it produces different ways of perceiving and understanding previous conceptions about our (subjective) human interaction with the world. Throughout this thesis, you will hear and read and experience the ideas and perceptions of dance students from Falmouth University, which are given significant value in the unfolding argument. Whilst not an explicit aim of the research project, its facilitatory role – provoking philosophical and choreographic enquiry in us – has led to pedagogical findings too. It is learning that has been born of methodological pragmatism: the students as potential collaborating bodyminds were first available and then increasingly engaged; the project began to value their voice and correspondingly they valued it.

Through such happenstance the research reveals experientially the value of what we might determine an 'entangled pedagogy', a concept that is developing more widely in relation to the use of digital technologies within education (Fawns 2022).

In the article 'Research Becomes Entangled', Vicki Hargreaves writes '[t]he concepts we use to initiate and enact research (researcher, methods, ethics, research questions) quickly begin to produce connections with particular ontologies, practices and beliefs about research, which may not be productive and in fact may serve to limit what is possible in research' (Hargreaves 2016: 542). Arguing that 'the conventional activities of research referred in these concepts constitute a stratified assemblage narrowing possibilities for the conceptualization and enactment of research', she cites Deleuze and Guattari's use of the term 'order-words' to describe how methodology 'operationaliz[es] such an assemblage [imposing] certain assumptions about what to think and how to behave, how, indeed to conduct research' (Hargreaves 2016: 542). This research project, and its entangled collaborators (human and non-human), has been and continues to be the enactment of a process, a way of becoming, through which the knowledge within this thesis emerged (and is emergent). Despite this, I have presented this research project with some adherence to such stratified assemblages of research concepts, including, for example a series of research questions in the Introduction, though as you will see, these can be seen to *become* along with the thesis, knowledge, system, experience, and phenomena with which they are entangled. In the discussion of methodology in Chapter 2, the methods detailed tease out and attempt to disentangle (for the sake of communication) a series of activities that cannot entirely be disentangled. The methods used within this research are not explicitly instruments used to extract data for an objective researcher (me) to analyse; they are intra-acting materials (to use here Barad's term discussed in From Real-time Interaction…to Real-time Intra-action on p.104) that have allowed (and continue to allow) this body of thesis to emerge.

In her discussion of her postqualitative research process Kristi Bruce Amatucci asks '[c]an data be a verb, an action, a way of becoming?' (Amatucci 2013: 342). Writing ('as a practice for not knowing') is detailed as a method in Chapter 2, for example – as an action and a materiality ever in emergence, part of the process and simultaneously embodying a particular understanding of it, entangled in its becoming. It has not been used as a verb that can be followed by 'up' therefore (as in '*writing up* my findings'), for it is also through the writing that meaning emerged for me, rather than simply during or after any objectively defined 'experimentation' (creating or testing the system *Tools that Propel*). Like Amatucci, I would suggest that '[t]he data happen[ed] – [was] discovered, [came] forth, [took] shape, [made] meaning, answer[ed] my questions – *as I wr[ote]*' (Amatucci 2013: 346). Equally, the videos are not 'documents of a process' nor 'curated data' which objectively signify a series of research findings. They are entangled intra-actions in which, *I* am present and intra-acting, along with the material bodies

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(by which I mean bodyminds) of the dancers and *Tools that Propel*, as well as their digital recorded embodiments. So too, in fact, are you the reader/spectator part of their becoming, in accordance with the entangled emergence of both their matter and their meaning: for as Karen Barad writes 'matter and meaning are not separate elements' (Barad 2007: 3).

DIGITAL MEANING

This thesis argues that it is possible to find meaning through the digital processing of movement material, when the approach to interpreting the movement by the digital agent – complete with its synchronicity, moments of failure and strange non-human decision-making – is symbiotically explored, questioned, recognised, and validated through movement responses. To facilitate a dialogue between the choreographic/improvisational decision-making of the dancer and *Tools That Propel*'s interpretation of the movement data it is tracking in the improvisation, *Tools that Propel* needs to do just that – *interpret it*: '[t]o make out the meaning of, explain to oneself' (OED 2022). Whilst *Tools that Propel* does not interpret the movement that it categorises in terms of sense, quality, import, purpose, spirituality, feeling, symbolism, context (or anything else that we might correlate with the word 'meaning'), it does have to determine what constitutes a 'new movement' for it, in effect to bring into being a new semantic-ontic unit of movement back to the dancer – to create a movement out of a stream of motion.

What then do I mean by the term 'meaning' and more importantly 'digital meaning' as foregrounded in the thesis' title? If we consider the word 'meaning' on its own, it might seem odd to imply that it can be produced or determined digitally at all. But crucially I am proposing that the agency of *Tools that Propel* is 'agency in dialogue' – that it is not an agent until the human interacts with it, and that the agency occurs through this intra-action and an entangled exchange of movement propositions. In this case, the notion of 'digital meaning' in the title is deliberately misleading or provocative – for I do not believe here that the digital can produce meaning on its own, but that meaning can emerge in the intra-action between the dancer and *Tools that Propel*.

As a noun, which of course I am surely using it in the title of this thesis, 'meaning' might signify '[t]he significance, purpose, underlying truth, etc., of something', that is, '[t]hat which is indicated or expressed by a (supposed) symbol or symbolic action', '[s]omething which gives one a sense of purpose, value, etc., esp. of a metaphysical or spiritual kind; the (perceived) purpose of existence or of a person's life', '[t]he sense or signification of a word, sentence, etc.' and crucially, for the phrase 'digital meaning', '[w]ith possessive: that which a speaker or writer intends to express, imply, or insinuate; the intended sense or underlying point of a person's words' (OED 2022). When understood as a verb 'meaning'

implies 'intention' (earlier uses of meaning as documented in the Oxford English Dictionary definition branch VI, 'to go towards' suggest a strong idea of intentionality). At first glance, to suggest that a digital tool or system might have intentionality in its actions appears to be anthropomorphising it. Yet this is to view intentionality (as a source of meaning) through a constructivist frame, and this thesis proposes a move away from the human subject as the determinant and source of all meaning and a move towards the idea that it is the entanglement of phenomena that allows meaning to emerge. The co-constitution of matter – through the entanglement of human and non-human – is also the co-constitution of meaning. Even if we uphold the idea that we can only *know* meaning from a human perspective, this *knowing* can be understood as emerging in relation to other phenomena in the entanglement: it is the act of being 'important *to* a person to the extent indicated, esp. as a source of benefit or as an object of regard, affection, or love; to matter (a lot, nothing, etc.)' (OED 2022).

In the intra-action of the dancer and *Tools that Propel* (the entanglement which constitutes the system) a new language of movement is constantly emergent, and in the attempt to understand, respond to, embody, occupy, and actualise this language (with its shifting, emergent, evolving semantic-ontic units) meaning also emerges for the dancer (and at times the spectator). I differentiate the idea of the 'meaning of movement' from the 'knowledge of movement' because the meaning is always in flux and emergent, whereas knowledge is often considered to be capturable and inherent to the object (impossible if we consider Barad's proposition that nothing exists prior to entanglement of phenomena). Equally, it is not simply the 'perception of movement' that I am discussing. Whilst the Kinect sensor used within *Tools that Propel* perceives the motion, it is the way that the system (the entanglement of dancer and all other phenomena that become *Tools that Propel*) defines this motion as individual units of movement (always becoming), and meaning emerges within this entanglement, that is important.

The requirement for *Tools That Propel* to determine what a movement is does not stem from the need to document it for posterity, recreation, or the needs of anyone else, nor does it aim to give greater clarity to preexisting documentation of a dance work or practice. It concerns stimulating the intra-acting dancer to move differently – that is to take different choreographic decisions in response to the reinterpretation and reperformance of their movement by the system, and to gain greater bodily awareness of their compositional and choreographic decisions within their improvisation. The dialogue (or entanglement) between perspectives – across the gap between sign and body in motion – opens up the composition. The approaches of the digital agent and the human agent towards categorising and an/notating the movement(s) performed are very different and through this difference an entangled dialogue between dancer and machine unfolds, and within this the possibility of recognising and realising new sense, import, purpose, spirituality, feeling, symbolism, and context emerges.

INTRODUCTION:

A DANCE WITH TECHNOLOGY

Every practice is a mode of thought, already in the act. To dance: a thinking in movement. To paint: a thinking through colour. To perceive in the everyday: a thinking of the world's varied ways of affording itself.

Erin Manning and Brian Massumi 2014

Thought is always moving and feeling, as well as thinking, across a multitude of actors and fields. [...] People and peoples are always in process with the world around us; we are only a small part of intricate, complicated and ongoing systems; we are always more than the boundaries of what we know, or feel or make.

Nathaniel Stern 2018

WHAT IS TOOLS THAT PROPEL? (A BEGINNING)

I ask her to move towards the screen and to see what happens. It reflects back the room we are in. She sees herself on the screen, perhaps the black drape too, scraped across the chairs at the back of the studio, someone's bag on the floor, and a coat hanging over the ballet bar. A lighting tower, stowed in the corner, creates untidy lines. In the projection, she sees me, watching. She sees the other three dancers, ready, a little nervous, waiting to encounter *Tools that Propel* too.

There is a sudden shift, a flicker, and her image doubles. I am still there, hovering. So too the other dancers, those in the camera shot. She moves to the right of the screen. Then the left. The image doubles, her moving body catches up with her moving body.

A sense of playfulness begins to surface: she lifts her arms, drops her knees, pushes her right leg out, turns on the central axis, her weight dropping down through her left leg, curves her spine, comes back to standing. She does it again, activating her own past self on screen. Curious, she places her arm inside her own arm; she moves it with precision, detail and intention.

'Move with yourself' I might have said. 'Interact with it', perhaps. A relationship begins. One which might last quite a long time. Might actually go on for two or more years, intermittently. This dancer is caught. Yet every time she comes up to the screen, it is a new relationship that forms, demanding recognition again.

Another person, a participant at a community workshop, might only get to work with *Tools that Propel*, colloquially known as *Tatiana* in the dance department at Falmouth University, two or three times over a weekend. Yet they too form a relationship, and something is seen to occur: the development of embodied knowledge that I wonder if I would have been able to teach them so quickly without *Tools that Propel*. It is embodied knowledge that grows between them and the affordances of *Tools that Propel*, within the creative space opened up by its intervention, within a kind of improvisational architecture that shifts their perceptions and allows them to see things differently; that sharpens their awareness; brings intention to their compositional decision-making; that allows new knowledge to come into being through its particular mode of thought.

[The video 'First Encounters' can also be found here: https://youtu.be/UTGl0J3gFdU]

WHAT IS TOOLS THAT PROPEL? (RECURRENCE ONE)

Tools that Propel is a choreographic improvisation system developed (partly) as *one possible answer* to the broad research question: how might we create real-time interaction between technology and dancers that catalyses growth of embodied knowledge? Yet *Tools that Propel* is also a system that opens up a range of other questions and enquiries, such that the thesis emerges in recognition of and response to these. Indeed, through exploring what happens in an improvisation with *Tools that Propel,* it becomes clear that an overarching one might be: how does new choreographic thought-action occur in a real-time exchange between the technological system and the dancer? (See Choreographic Thought-Action, p.27, for an explanation of this term.) If, as argued by Erin Manning and Brian Massumi, '[e]very practice is a mode of thought, already in the act' (Manning and Massumi 2014: *Preface vii*), then this thesis discusses the possibilities for developing new modes of thought, within an expanded practice, when we dance with the technological affordances of *Tools that Propel*.

But what is actually happening in the real-time interaction with the system? The interactor improvising or engaging with *Tools that Propel* is confronted by a life-size projection of themselves and other bodies, which blends live 'mirror-like' video and recorded fragments from the recent past that resemble their current movement. When using *Tools that Propel,* moving in relation to the 'decisions'

of the system displayed on its external interface – the screen[1] – the dancer is improvising with 'ghosts'[2] of their own body and the bodies of others tracked by the sensor before them; the entanglement encourages breaking of habits and mining of memories, exploring subtle variations. In practical terms, the latest manifestation of *Tools that Propel* involves a motion capture sensor, which tracks the dancer's movements as they improvise with it, feeding this data to algorithms that assess whether the system has seen the real-time movement phrase before. The system compares what it sees in real-time with gestures/movements it has tracked, recorded and categorised before (classes) and determines the likelihood that the real-time movement is the same as any of these. If this likelihood is above a certain threshold then it plays the recorded footage ('memory'[3]) of that gesture/movement blended with (overlaying) the real-time live projection of the dancer.[4] Certain parameters can be adjusted, for

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[1] I have used the word screen here as it is commonly what we call any flat surface on which we project an image when it is not rendered onto three-dimensional objects through projection mapping. The dancers are moving in relation to a flat 6x4 image reminiscent of a projection/cinematic screen, but this is actually projected onto a wall and could be directed onto any surface. The use of the word screen is important here in its functional description because there are questions to be addressed concerning the 'flatness' of this external interface in relation to the usual voluminousness of dance as a full-bodied, multi-directional spatial experience.

[2] As opposed to the projected images of the real-time dancer, the virtual bodies recorded and brought back by the system became known as ghosts by those using and developing the system in its early stages.

[3] We started to use the term 'memory' for the recorded footage during the practical testing of the system as an installation in the Digital Research in the Humanities and Arts (DRHA) conference exhibition at the Radiant Gallery in Plymouth (September 2017) and during a digital residency undertaken with Digital Artist Residency (https://www.digitalartistresidency.org/). The term might reference the embodied memory involved in choreographic thinking that goes on within improvisation (see discussions of Vida Midgelow's notion of 'dramaturgical consciousness' in Chapter 2). It is also related to philosophical ideas around time as non-linear, but something that contains past and future in the present moment that I will discuss later. That said, there is something to be considered regarding the objectification of memory as something outside of oneself – like a Facebook 'memory' for example – when in fact this is not a memory belonging to anyone/anything in particular but simply a fragment of recorded footage which triggers a memory in the person witnessing/experiencing its presence.

[4] This parameter can be adjusted so that the translucencies of both the real-time projection of the dancer and the recorded footage from the past can be increased or decreased. This means that as well as seeing the past and the present together – the one superimposed on the other – the system can be set so that if it is sufficiently likely that the real-time movement is the same as any of the recently recorded classes ('memories') then it plays that

example the blend between memory (recorded footage) and real-time (live projection) – determining how strongly or translucently we see either – and how many classes of gestures/movements the system keeps before 'forgetting' them.[5] There is something deeply familiar about the movement on screen and also uncanny, disconcerting and challenging (see the video 'Facing Yourself', p.151, and the discussion in Chapter 3).

I have defined *Tools that Propel* as a choreographic improvisation system for the purposes of this research project, that has been carried out with, through and about it. The term 'choreographic improvisation' is used in accordance with the belief that there is a cross-over between the two practices: that improvising is a choreographic affair. As Alva Noë writes: '[d]ancing generates the need for choreography *from the inside*' (Noë 2017: 235). When a dancer is improvising they might also be compositionally aware and making choreographic decisions in the moment of moving (Buckwalter 2010; deLahunta *et al.* 2012), despite apparent temporal differences between the practices – 'choreographic' etymologically linked to writing and thus repeatability, and 'improvisation' evoking emergence and disappearance in the moment (Kloppenberg 2010).

However, there are many potential applications of *Tools that Propel* and I have classified *Tools that Propel* differently in relation to many other systems, artworks, software, and modes of practice and participation. Not all of these classifications would situate it as directly as I am doing here within the field of dance creation and choreographic training processes. It has been shown as a gallery installation which the public encountered with no prior knowledge and it could be optimised for this purpose.[6] Yet it does not share the kind of cutting-edge aesthetics seen in other contemporary interactive

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memory *instead of* the real-time projection of the dancer. In studio practice I have found that all but one participant dancer has preferred to use the superimposed image of past and present movement.

[5] If the memory size were able to grow without any limitation on it then it would be impossible to maintain interactive frame rates. One of the ways that we maintain interactive frame rates is to limit the number of memories it records and keeps in the model to some maximum, typically 12 classes. As it is important that the dialogue with the system progresses, instead of just stopping the addition of memories when we have reached this maximum, we discard a previous memory when adding a new one. In the way that the system is configured there are a number of different ways that the discarded memory is determined: either the oldest memory (we typically work with this), the memory that has been recalled the most times, or the memory which has played for the longest time.

[6] It was shown as part of the Digital Research in the Humanities and Arts (DRHA) conference exhibition at the Radiant Gallery in Plymouth (September 2017).

installations, even whilst drawing on learning from this field, partly because that is not its primary purpose. In fact, this thesis discusses *Tools that Propel* predominantly with reference to its use in dance improvisation. It is in the relational entanglement of the moving human body with the affordances of the system that I am interested, and that this thesis is concerned: whilst *Tools that Propel* is a unique and novel digital system that responds to *and* stimulates a dancer's improvisational offerings in real-time, this thesis investigates how it develops new choreographic thought-action in interacting dancers; examines how a new movement language emerges between the dancer and the system; and explores how it is entangled with the interactor in a process of becoming, asking them to dialogue with new ways of experiencing themselves in relation to the non-human world.

Choreographic Thought-Action

I argue that *Tools that Propel* has the propensity to challenge a dancer's choreographic decisions and catalyse the emergence of new physical thinking within them. There is increasing currency in the idea that there is knowledge inherent in choreography, with terms such as 'choreographic intelligence', 'choreographic thought' and 'physical thinking' being widely used by choreographers and researchers (Leach 2017). Yet I have chosen to name the embodied cognition that pertains to the thinking within improvisation 'choreographic thought-action'. The '-action' part of the phrase 'choreographic thought-action' clearly specifies that the 'thought' is not something that 'is' but something that is *in the process of becoming*, emerging and evolving (in relation to its silent interlocutor – *Tools that Propel*, or other environmental entities – perhaps). So then why not just use 'thinking'?

'Thought-action' involves myriad decisions (concurrently rather than necessarily serially); the phrase brings with it a potential focus on the intricate assemblage of isolated and interconnected thoughts that the body undertakes in the improvisational dance utterance. As cognitive scientist Lera Boroditsky states, 'the languages we speak shape the way we think' (Boroditsky 2011) and my perception of 'thinking' is perhaps culturally and philosophically tied to linearity, cause and effect, determined by my Western linguistic consciousness (see Language: Space and Time, p.203). It is a serial process which might naturally be considered in relation to my concept of time – also 'historically and culturally specific' in its conception as a 'linear progression from past to the present and future' (Radstone and Hodgkin 2003: 15) – which would also be constructed through the languages that I speak, all of which are written from left to right across a page, and consider time to unfold accordingly, with the future '"ahead" and the past "behind"' (Boroditsky 2011: 64). Yet choreography often encompasses parallel and interlocking bodies all existing in different moments of unfolding time, and these bodies in space break up time differently. There is often a plethora of bodies carrying out thought-actions dividing the time and space of the dance composition. What's more, when a singular dancing body moves there are often many thought-actions within it too. These do not necessarily occur sequentially,

but concurrently – in the 'elasticity of the almost' in which 'the microperception of every possible step can almost be felt' (Manning 2009b: 110); because of embodied decisions made in relation to internal and external impulses and according to the body's potential, informed by the memory of technique, previous vocabulary and phrases, and the possible discovery of the new. Moreover, the thoughts that take place occur *in the moment of action within* the body, *through doing*, not necessarily before the physical utterance or after it. Hence, they occur as/in/through '-action'. (See Performing Movement to Realise Potential, p.199 and Simultaneous an/notation and bodily knowledge, p.201.)
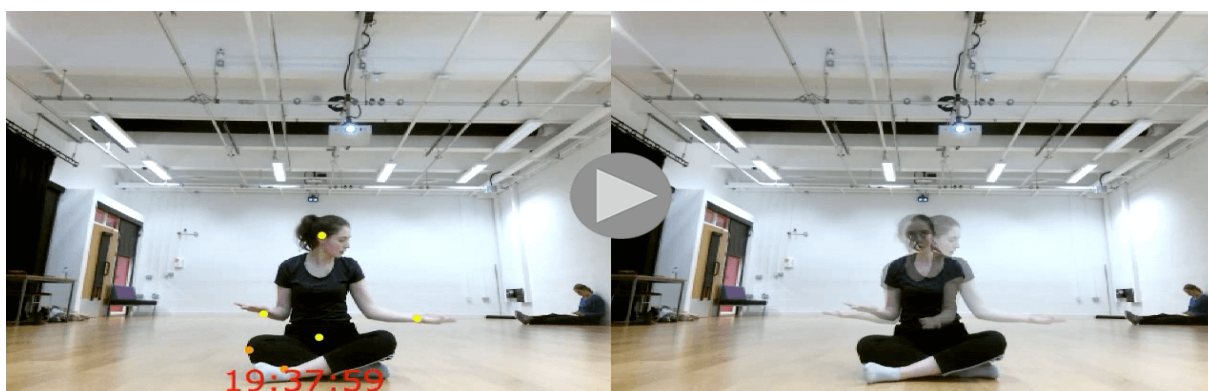
[The video 'What is *Tools that Propel*?' can also be found here: https://youtu.be/1dTdA_Yh9SY]

WHAT IS TOOLS THAT PROPEL? (RECURRENCE TWO)

Tools that Propel highlights the present moment of the thought-action through the fact that it has no predetermined grammar. Starting as a *tabula rasa* it creates new classes of movements as it encounters them, determining their specificity according to the likelihood it has seen them before or not. The language emerging between dancer and the system is coming into being as it is being explored. Time does not here unfold from past to present to future, with linearity: the present and past gestures overlay each other and are compared. Through this process new versions of them proliferate in the dancer. There is no cause and effect; each movement that the dancer does is both digging into the past image presented to her, a looking inwards to find something within it, or an escape to something different. Either 'thought-action' carries equal potential; they are all possibilities and could take the dancer anywhere in a language constantly being invented, and with a grammar that does not inherently contain a consciousness that we already know.

Tools that Propel was born out of a collaboration between myself and fellow PhD researcher Adam Russell, at the intersection of our interrelated but separate research projects, with Adam's concerning

how digital tools can support processes of playing at not knowing what we are doing by interactively folding past time into co-incidence with present action. When we embarked on developing *Tools that Propel* Adam and I were interested in whether it was possible to develop a digital system or platform that enabled an interactor to play it without first knowing the rules. We saw this as akin to improvisation: though an improviser often knows the rules of the improvisational structure or score before they begin, they are evolving them and evolving with them as they play. They transform each other. They affect and are affected by each other. They are open to each other, within and constituting the world they form together. More importantly than knowing or not knowing the rules, perhaps, we did not want the interactor to have to be playing with the aim of achieving a predetermined goal or objective. (See Choreographic Improvisation and Ecosystems Aesthetics, p.92.) *Tools that Propel* is designed to stimulate new choreographic thought-action (that might not happen without it) *as the dancer improvises* and as the computational choreography unfolds *in relation to* the emergent movement. One might almost go so far as to say that the dancer and the computation within *Tools that Propel* (or perhaps a number of contingent components within the system, including algorithms, gesture recognition library, sensor, projector etc.) are *improvising together*.

This thesis grapples with the articulation of a system, and knowledge harnessed within it (or given potential through interaction with it), that shifts boundaries. Gilbert Simondon discusses how the 'emergence of the distinction between figure and ground results from a state of tension, from the incompatibility of the system in relation to itself, from what one would call the oversaturation of the system' and argues for 'metastable equilibrium' rather than 'stable equilibrium' as the source of transformation, change, and the emergence of 'technicity' (Simondon 2011 [1958]: 411). He states that:

> [S]table equilibrium, in which all potential would be actualised, would correspond to the death of any possibility of further transformations; so, living systems, precisely those that manifest the greatest organisational spontaneity, are systems of metastable equilibrium. The discovery of a structure is at least a provisional resolution of incompatibilities, but it is not the destruction of potentials; the system continues to live and to evolve; it is not degraded by the emergence of structure; it remains tense and capable of being modified (Simondon 2011 [1958]: 411).

I argue that the experience of improvising with *Tools that Propel* as an interactor is the experience of a system of metastable equilibrium (a concept discussed further in Becoming-with Technology, p.96). Every time there is a sense of structure and a 'provisional resolution of incompatibilities' (Simondon 2011 [1958]: 411) new potential also opens up as living, evolving choreographic thought-action. Its importance as a technical object is defined as much by its differences to the genealogy of intermedial

performance practices as its relationship to them.[7] Discussing the development and conceptualisation of *Tools that Propel* asks us to push at the boundaries of the disciplines or practices that have also produced it. But we cannot understand the way that *Tools that Propel* as a system 'continues to live and to evolve', that transforms, appears to manifest 'organisational spontaneity' (Simondon 2011 [1958]: 411), and produces new potentials, without a technical interruption here in the thesis: that is, without an attempt to build some foundations (at least) in our understanding of its technological functionality.[8]

Technical Interruption - How Does *Tools that Propel* Work?

I call this section a 'technical interruption' because it bursts into the text to disrupt its flow, especially for those of us that do not necessarily understand the complexities (nor the terms) that govern the backend of our technologically-entangled paradigm. In some ways *Tools that Propel* appears very simple. This is a value in an art/tech experience: simple front-end, complex back-end. But such a value in practice can be a red herring in text, with initial reactions to its description tending to be based on perceptions of it as something simpler and more passé in relation to the improvisational encounter it facilitates. The experience of improvising with it unfolds over time, and indeed, I believe that it is through a sustained engagement with it (which for many interactors is enticed *by* it) that new embodied knowledge really develops. It is not, as we will see during the thesis, largely a confrontation or encounter with technology per se, but with oneself as other, with a different experience of time, and with a series of disruptions to our perceptions of the world we inhabit, that is facilitated by the technological affordances within the system. However, to understand how these perceptual disruptions affect the dancer, we must first encounter the technology that affords them. So, in terms of hardware, *Tools that Propel* is literally made up of a Microsoft Kinect 2 sensor,[9] placed on the floor

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[7] 'Intermedial performance' is a term increasingly questioned now we might be described as being within what Matthew Causey calls the post-digital, discussed further in 'Bio-Eco-Technological Encounters' (Causey 2016).

[8] I have tried to give here sufficient information about the technical functionality of the system to support the arguments that follow in the thesis. More details are provided in the footnotes and if required, there is further information can be found in 'Agency in dialogue: how choreographic thought emerges through dancing with Tools that Propel' (Levinsky and Russell 2019), an article published in the proceedings of the Movement that Shapes Behaviour symposium within the 2019 conference for The Society for the Study of Artificial Intelligence and the Simulation of Behaviour (AISB).

[9] Where many motion capture sensors require the use of markers on a specially created motion capture bodysuit, Microsoft Kinect 2 sensor is a markerless tracker. This was key for us as we wanted the system to be able to work

in front of the dancer (or ideally on a block at about 30cm off the ground),[10] a projector (ideally ceiling-mounted above head-height)[11] behind the dancer and projecting onto the wall in front of them above the Kinect, and a PC or laptop (with sufficiently fast CPU and a dedicated graphics card), and of course, connecting cables. (See Figures 1 and 2.) As well as providing skeletal tracking data,[12] the Kinect sensor also has a camera which provides the image feed for the video recordings and live projection.
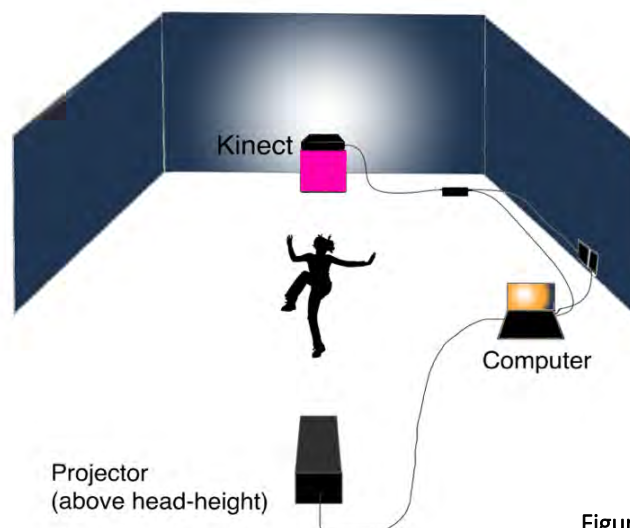
Figure 1: Tools that Propel set-up

as an installation, where interactors entered without any prior knowledge of how it worked or what it did. Also, when we started development of *Tools that Propel* my specific interest was in community dance work and so I wanted to use commodity hardware that was cheap enough and not too difficult to set up in a range of learning contexts.

[10] This height (or roughly the height of five yoga blocks, as we have used frequently in studio sessions) came about as a balancing act between ensuring that a sufficiently face-on camera image of the dancer is captured without placing the Kinect directly in front of the projected image on the wall or screen itself.

[11] Inevitably the system has been set up in situations where ceiling-mounting the projector is not possible. Although ceiling mounting brings about optimal use, I have frequently set it up with the projector on a step ladder to ensure it is above head height, or at an angle to the side of the room, readjusting the image on the wall/screen through keystoning on the projector or on the software framework *Touchdesigner* itself. The key factor is that the projection is not blocked by the improvising dancer.

[12] Whilst the Kinect 2 skeletal tracking data can track up to six bodies simultaneously, each with 25 estimated joint positions (in both 2D camera space and 3D physical units) and 13 of these also offer joint orientation data, this is far too many for interactive frame rates on commodity hardware. We only record a subset of up to 6 bones from one tracked skeleton (usually the head, pelvis, hands and feet to sufficiently differentiate large-scale body pose variations, though this can be reconfigured in the system). This limits the data size and helps to achieve interactive frame rates.

Figure 2: Adam Russell, Katherine Sweet and Keir Clyne work with *Tools that Propel* in the studio.

In terms of software, *Tools that Propel* has been developed on Derivative's visual coding platform *Touchdesigner* (Derivative 2021). Whilst *Touchdesigner* provides a visual dataflow for sensor and video processing, it also uses Python code on the backend and this gives access to a wide range of machine learning libraries, of which we chose the XMM library developed at IRCAM Paris by Jules Françoise and others (Bevilacqua *et al.* 2010; Françoise *et al.* 2014). Whilst most gesture recognition libraries are trained before use on a number of known gesture classes (supervised learning) and identify known gestures from the data after the gestures are performed, we wanted to confront the interactor with their own recent past while they were performing movements identified by the system as 'similar' to previous examples. This meant that we needed to use *online unsupervised learning* and *online recognition*;[13] as such, the system trains itself during interaction and is also continually estimating a 'current' gesture class from the incoming stream of sensor data.

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[13] 'Online' in this context means that the data is processed live, rather than offline.

The use of the XMM library allows us to do online recognition as required and achieve interactive frame rates.[14] However, for the purposes of unsupervised learning of the gesture classes, we do not attempt any kind of clustering to form gesture classes from multiple examples. As such, each class is trained on only one example, formed the first time a movement is seen which is insufficiently likely to be produced by any of the prior classes – that is, the system does not think it recognises the interactor's current movement and thus records and categorises it as a new class. Whilst at initial start-up or manual reset the model is empty (a *tabula rasa*), we begin recording live video and storing accompanying motion data as soon as the sensor starts to track an interactor. After a maximum duration time (usually about 5-8 seconds) is exceeded, the footage and data is added to the system's memory as a new phrase of movement (class); immediately, the system starts to record a new phrase and at the same time receive a continuously-varying likelihood estimate (calculated per frame) that the interactor's current movement is an existing gesture class. As soon as the system thinks that it is sufficiently likely that it is, it stops recording and begins playback of the corresponding memory video. It also continuously adjusts the playback position to follow the progress estimate for the current (i.e. likeliest) class; that is, if the interactor moves faster the footage plays faster etc. The system stops memory playback if the likelihood falls below another threshold (lower than the first) and at this point it begins recording a new class. It can also switch between memories if the likeliest class changes. Finally, if we lose tracking data then *Tools that Propel* stops recording but the interactor still sees the live video feed on the screen. (See figure 3.)[15]

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[14] The XMM library is 'a portable, cross-platform C++ library that implements Gaussian Mixture Models and Hidden Markov Models for recognition and regression [...] developed for movement interaction in creative applications [...] with fast training and continuous, real-time inference' (Jules Françoise - Software 2021). It provides a Hierarchical Hidden Markov Model (HHMM) capable of estimating likelihood and progress within M gesture classes of mean length K using a sliding time window of length T in only $O((KM)2T)$ time (Françoise et al. 2011). This provides a constant time loss during continuous recognition. In our case running on commodity PC hardware with 10-20 gestures each a few seconds in duration using 6 screen-space bone positions gives an HHMM update time of ~50ms i.e. we can achieve interactive frame rates.

[15] When a new phrase is added the HHMM model must be retrained. The model cannot be retrained incrementally so this step is costly – far more so than the normal per-frame update. The system must reset and retrain the entire model from scratch on all recorded phrases of motion data, and this can introduce a perceivable delay to the interaction of at least several hundred milliseconds.
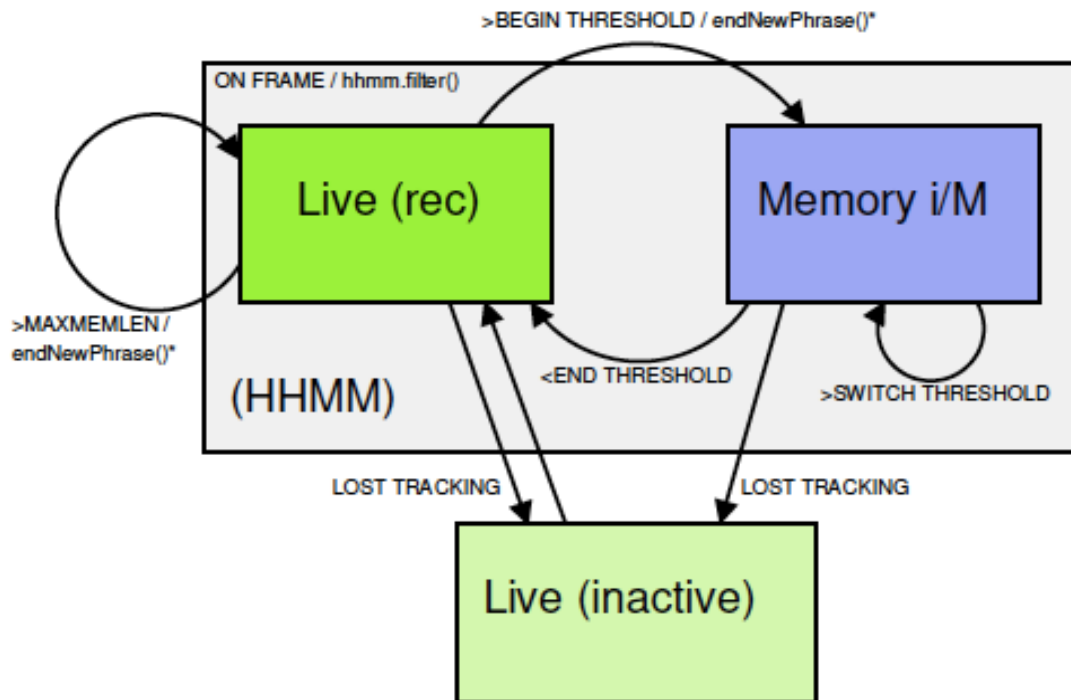
Figure 3: Unsupervised learning and video playback driven by Hierarchical Hidden Markov Model gesture following (*: retrains model). Diagram created by Adam Russell.

WHAT IS TOOLS THAT PROPEL? (RECURRENCE THREE)

Tools that Propel allows interactors to experience a collapsing of the binary between past and present; to become conscious of and have a tangible relationship with the resonances of past actions and the affect on their decisions made in the present. The sequential trajectory of linear time is problematized by the capacity of the system to blend (or overlay) footage of the movement it perceives to be most similar to what it is currently tracking (assessing every live movement against a constantly updated database of past movements) with the projection of the dancer's real-time moving body. The dancer is enabled to dance with and within traces of their past and that of other people, to partner or collaborate with themselves and others across time, rather than just space.

Collaborations between dancers and *Tools that Propel*, and between myself and *Tools that Propel*, underpin this thesis. In both collaborative relationships the role that the system plays could be conceived as being dramaturgical, harnessing its inherent 'capacity for action' (Bauer 2015: 48) to catalyse improvisational decisions in those who work with it. Despite now defining *Tools that Propel* as a choreographic improvisation system, I took the decision to make the 'role' of the system's artificial intelligence that of a dramaturg rather than a choreographer, influenced by Mark Coniglio's concept 'digital intervention' (see Chapter 2) in which he proposes using technology as an 'antagonist' rather

than 'protagonist' within performance works (Coniglio 2015) and André Lepecki's suggestion that a dramaturg can be seen as a creative 'saboteur', leading performance-makers into unknown terrains where they may get lost and find unexpected answers along the way (Lepecki 2015). (See both Dramaturgy and Improvisation, p.87, and Different Kinds of Logic, p.90.) The system that Adam Russell and I were developing was to be something that *intervenes* in a choreographic creative process, stimulating all people involved, rather than something that would *replace* the choreographer, attempting to carry out the choreographic act itself.

Bojana Bauer discusses how process-oriented dramaturgy encompasses a shift of the dramaturgical modus operandi to the centre of a performance-making process (Bauer 2015). She argues that this undoes the 'image of the dramaturg as the subject of knowledge, as a rational entity that brings intelligibility to the chaos of creation' from the outside and points to André Lepecki's model in which 'proximity to the process is associated with embodied experience, associative thinking, and memory' (Bauer 2015: 34). Early in this research, I started to consider whether a digital system might perform the two poetic (or compositional) modes that Bauer aligns with the role of dramaturg – memory (of process) and differentiation – in order to catalyse improvisation and movement development. Whilst a digital dramaturg (as I have at times conceived *Tools that Propel*) could not construct cultural or social frameworks for the work, or understand it contextually, it seemed possible that it might be able to be a presence at the centre of the creative process making associations, providing memory, bringing about unusual causal relations, and observing and playing with the material in some way. This thinking was supported by process-oriented dramaturgy already conceiving of 'dramaturgy' as a process – not explicitly determined by or concerning one person – but something unfolding through the distributed agency of the company of people working on a piece and the material that emerges.

Dramaturgically Entangled Collaborators

The entangled collaborators who have worked on this research project are also *capacitors of action*: the dramaturgy of the research has unfolded through many people's collective holding of both process and memory of process (Bauer 2015; Midgelow 2015), together wanderers and saboteurs to each other's default pathways (Lepecki 2015). *Tools that Propel* would not have existed without the collaboration with Adam Russell. Without our long, wrangled conversations and interlocking interests, without his philosophical curiosity and capacity to encode (literally) our entangled thinking in computational languages, this research project would have materialised as something entirely different. Yet it is also clear that without the other key collaborators, most notably the handful of undergraduate dance students from Falmouth University who sustained their engagement with my research throughout their three-year degree course (Yi Xuan Kwek, Maria Evans, Zach McCullough, Brandon Holloway and others whose participation was less prolonged but still invaluable), the project would not

have become what it has. It has been a research process in two halves, with a cross-over week at the Digital Artist Residency. Indeed, though the non-linear account of the research process in this thesis might suggest otherwise, with discussions of the co-development of *Tools that Propel* weaving through Chapter 2, the research findings I analyse are primarily drawn from my investigation of the system in the studio, within and since the Digital Artist Residency, which was simultaneously when I started to really understand its impact in dance improvisation *and* the last time any of the computational affordances of *Tools that Propel* were changed.

Whilst the development of the system was entirely in collaboration with Adam Russell, our subsequent interests in its use have largely taken us in different directions, and my journey from this point primarily continued with the dance students. Equally, the collaboration of Jess Smith and Matthew Collington, working as lighting operator and composer/sound designer during the creation of a performance piece with *Tools that Propel*, entitled *Body of Memory,* also contributed to the research, and, along with the dance students, other people have added to the generation of knowledge within this thesis through participating in shorter workshops. These were carried out with international community facilitators at the International Community Arts Festival (ICAF) summer school in Barcelona (July 2018), dancers invited by Company Van Huynh (December 2018), participants with experience of homelessness at Cardboard Citizens headquarters (January 2019), and Company Wayne McGregor dancers (December 2019).

Whilst the experience of these interactors is discussed at points during the text, the thesis focuses more on the sustained and evolving experience of the students from Falmouth University. It is perhaps their continued desire to collaborate and improvise with *Tools that Propel* that was most curious to me: most notably it opened up questions for me regarding its capacity to initiate enquiry in the body and the mind. Much of the knowledge produced by this practice research is embodied within these students, and moreover, they are entangled in the dramaturgy of this research. Not only have they also acted on the research and opened up new directions of enquiry through their engagement and curiosity with the system and what it brought out in them, but they also embody the memory of the process – the dramaturgical decisions were not only informed by their collective participation but are collectively spread across them. The voices of these collaborators are woven into the thesis throughout – there to engage with textually and aurally – revealing the different ways that *Tools that Propel* impacts their dance practice and their perception of themselves within their ecological aesthetic environment.

Bio-Eco-Technological Encounters

I use the term ecological aesthetics in accordance with Nathaniel Stern (Stern 2018). I am also inspired by the work of Andrew S. Yang who discusses eco-systems aesthetics (Yang 2015). Ecological aesthetics posits that everything is part of an ecology or ecologies, and everything is relationally experienced and experiences relationally, as 'ongoing events', bodies and 'foreign entities, always interacting and composing: in what we are and do, in what we perceive and interpret, in what we might become' (Stern 2018: 23). As such, there is a dialogue within this thesis that is as far as possible – with some poetic license taken in imagining and articulating affect felt by non-human bodies – also with an ecology at large, through the aesthetic experience of dancing with the technological affordances of *Tools that Propel.* The thesis has emerged through a process of learning to 'listen' to (feel, perceive, recognise) the non-human elements of the composite experience that makes up its practice research methodology – and in so doing, considers the system and its various components, the objects, and things within it and that occur through it, to be 'voices' in the dialogue, not just figuratively, but actually. They form part of the *thinking* that occurs with the system. It is through recognition of them that new modes of thought might emerge, and it is in relation to these voices that the system opens us up to 'sensuous chaotic becoming', to borrow words from Franco 'Bifo' Berardi (Berardi 2020).

Berardi uses this term to discuss what replaces human history, which he declares finished. He states that 'the new agents of history are the "critters" […] small creatures, small playful creatures who do strange things, like provoking mutation', 'spread collectively, as a process of proliferation' and 'invade the space of production, and the space of discourse' (Berardi 2020). Berardi uses the term 'critters' for the Covid-19 virus, but evoking Donna Haraway's 'parlance' (Berardi 2020), it might refer to anything which proliferates, mutates, and spreads (technologically, biologically, ecologically) to overcome human evolutionary agency. It is sensuous chaotic becoming that is both frightening – because we are used to having perceived control – and full of potential; and it is in this sensuous chaotic becoming that I position *Tools that Propel,* as a choreographic improvisation system, a digital dramaturg indeed, that facilitates encounters with alternative ways of seeing, feeling and perceiving the bodies and environment with which we are entangled, and propels the proliferation of new potential and meanings. I posit that through *Tools that Propel* we might contemplate our subjectivity within an ecosystems aesthetics, which as Andrew S. Yang argues 'prioritizes the heterogeneity of smaller scale systems-within-systems in which entropy can *decrease* and new forms diversify' (Yang 2015: 174).

Such diversification of forms and invasion of uncontrollable critters into the space of production and discourse (Berardi 2020) can be allied to a shift in performance ontologies, which Matthew Causey discusses as opening up a postdigital culture (Causey 2016). Causey defines the postdigital as 'a social

system fully familiarised and embedded in electronic communications and virtual representations, wherein the biological and the mechanical, the virtual and the real, and the organic and the inorganic approach indistinction' (Causey 2016: 432). Postdigital does not mean that the subject themselves is 'post or past anything concerning their "entanglements" with machines, networks, and electronic communications'; indeed, Causey argues, the 'post' is 'not an endpoint, but a recognition of the many flows and distributions' (Causey 2016: 432). He states that artists whose work might be defined as postdigital draw on the 'modalities of the digital, whether or not they are computational or analog, technological or organic - for which [Causey] include[s] forms that are immersive, hybrid, and virtual' (Causey 2016: 432). These artists, argues Causey, 'can be understood as *thinking digitally*, embodying an activist strategy of critique within and against postdigital culture's various ideological and economic strategies of control, alienation, and self-commodification' (Causey 2016: 432).

Consciously working within and against the digital, such artists might also be conceived as following the call that Bernard Stiegler made for a pharmacological approach to working with digital technologies, whereby 'only the digital itself, insofar as it can be a remedy, enables an effective struggle against the poison which it also is', something he says is 'without doubt a key to the 21st century' (Stiegler 2010: 19). Some of the projects that have influenced the development of *Tools that Propel* incorporate the challenge to digital ideologies (subsumed within capitalist growth and acceleration) within their very use of the same media (see Chapter 1). Yet, more widely in the performing arts sector there remains a (perhaps dissipating) fear that new technologies (and the critters perhaps) will somehow efface the fundamental (a)liveness of performance, and a constant resurfacing of a binary (between new media and live performance) that seems out of sync with the entangled ways that we experience ourselves and the world. It seems to me that 'liveness' as central to performance (Auslander 1999; Phelan 1993) – both in the moment of it, and in the creation of it, understood also in relation to the weight given to words like spontaneity, flow, and impulse in improvisation perhaps – is something that can evolve with technology. Whilst I am not going to embark on a discussion of liveness directly, I do present this research in terms of a search for how we can 'become with' technology in a way that yields new bodily knowledge in and through performance.

Bodymind (and shedding skins)

It is the body in relation to the world that is examined and put under the lens of *Tools that Propel*, or refracts in its prism, or entangles with the system to recognise new agency emergent within its movements. In all cases, it is a thinking body; it is a bodymind. Whilst bodymind might be thought of as the site and source of internal physical decision making, this research is premised on the idea of 'bodymind' as encompassing a relationship – mental, physical, conceptual – with external sources of information, imagination, and impulses to move and think through moving. With regards to their work

with Wayne McGregor's company of dancers in the development of the *Choreographic Thinking Tools*, Scott deLahunta, Gill Clarke and Phil Barnard discuss the way that dancers use mental imagery – visual, sensorial, aural, kinaesthetic – in the improvisational and creative tasks that lead to the development of dance phrases and performances. They acknowledge how dancers are '[n]ow embraced as creative contributors to the generation of a work and its movement language' meaning that 'skills of attention, imagination and curiosity 'thought through' the body become tools as essential for the dancer to develop as their physical proficiency' (deLahunta *et al.* 2012: 249). The notion of 'attention, imagination and curiosity 'thought through' the body' underlies the use of the term 'bodymind' in this thesis.

Equally, Nathaniel Stern argues that 'every body (human or otherwise) is three bodies: it's always-moving material form; how it is understood in representation – as information or in language or images (by others and/or itself); and its virtual form' (Stern 2018: 23), meaning that it encompasses the body that exists and does things in the material world, the body that is seen and talked about, and the potential action inherent in the body – to (re)act to anything that might happen to it:

> [I]f someone throws a ball at me, as that ball comes toward me, I have the potential to smack it out of the sky, or catch it, or do nothing (and let it hit me). All of those possibilities (and others) are present before they happen, and those possibilities of course impact what I do, now, *and* what *will* happen (virtual). (Stern 2018: 23)

The practice of thinking is distributed between these different bodies - affected by and taking place within its material body, its representational body and its virtual body. All of these bodies form part of the making, performance and reception of *Body of Memory*, discussed in Chapter 5.

For Merleau-Ponty bodily engagement with the world is part of what constitutes its consciousness. This also correlates with Stern's arguments that '[b]oth human and nonhuman bodies - their materiality, representation, and virtuality - *all* interrelate and emerge, together. We are ongoing events' (Stern 2018: 23). This ongoing event, 'always interacting and composing' (Stern 2018: 23), is bodily thinking in practice. Merleau Ponty's translator Donald Landes describes the 'body's unity' as 'lived integration in which the parts are understood in relation to the meaningful whole' (Merleau-Ponty and Landes 2013: xlii). As Landes writes '[t]he body, then, "is a knot of living significations" and its parts are synthesized not through an intellectual act, but because together they "*perform* a single gesture"' (Ibid.).

The digital affordances of *Tools that Propel* bring a body's 'wholeness' into question and it is in this (momentary) disintegration and fracturing of the performance of the 'single gesture' that the interactor starts to reconsider their relationship with the human/non-human environment in which they perform. During the past year and a half during the Covid-19 pandemic a curious synergy began to form in my mind between the virus (the critters) and *Tools that Propel.* Both in their own way play with our sense

of our 'wholeness', and introduce an awareness of our mortality. Covid has reminded us of our interrelationship with the planet we inhabit and also that we are not invincible at all. The march of modern medicine towards the unconquerable seemingly met its match in this pandemic, this proliferation, the sped-up timeframe with which we were – as a species – at least temporarily overcome. For *Tools that Propel* it is by facilitating the shedding of bodies from oneself, like a skin, and the ability to re-evoke what you have left behind by dancing in that past skin. The multiplication of the body and the sense of self focusses the dancer on his/her body and its bodylessness, and simultaneously releases him/her from sole ownership of it, enabling a distribution of bodymind – of thought-action – across the dancer and the system.

Looking at Bodies (the 'Problem of the Screen')

Undeniably similar to a studio mirror, *Tools that Propel* reflects back the room in which the dancer is improvising as well as the moving bod(ies) of the dancer themselves. Yet, its particular affordances mean it is different to studio mirrors which do not usually change or manipulate the image they reflect.[16] The use of mirrors in dance training is both widespread in the West and also evidentially connected to negative body images amongst training dance students (Radell *et al.* 2014). Sally Anne Radell personally testifies that '[w]hen I reflect on my own time as a student training in dance I recall a pervasive and nagging voice in my head telling me that I was never thin enough, that I was not sufficiently strong, and that I was not kinaesthetically "connected" and fluid as the other dancers' (Radell *et al.* 2014: 161); and her feelings were corroborated by students interviewed within their study. When I showed *Tools that Propel* to a group of community arts facilitators at the International Community Arts Summer School in Barcelona in July 2018 an experienced dance facilitator from Australia stated that she couldn't personally imagine using it in a community arts context. Her specific reasoning was that she spent so much time trying to get the women she worked with *into* their bodies and she felt that *Tools that Propel* asked them to look *at* their bodies, opening up the potential for self-criticism which inhibited the creative engagement. The question of whether the reflection of the self on screen is a negative aspect of the system has come up time and time again, though usually by people who have only seen others using it or heard about it through talks, and I would argue that this is in

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[16] I am specifically talking here about studio mirrors as there is, of course, precedence in mirrors distorting reflections deliberately in other contexts (for example, mirrors that are designed to make you look fatter or thinner according to their convex or concave shape and how far you stand from them). Clearly, in the context of the dance studio a mirror plays a very specific role in proceedings and is designed to reflect the body of the dancer and his/her movement accurately.

many ways dictated by a preconceived and inherited notion of what a mirror *takes away* from the dancing-subject, rather than an openness to what *Tools that Propel*, and technology more generally, can bring to the improvisational engagement itself. (See Destabilising Bodies, p.70; Tool?, p.125; and Through the Magnifying Glass, p.134.) Most specifically, the concern is understandably with the directionality of any improvisation work towards the screen, a potential problem I have had to contend throughout the research, but this is often related to statements about dance teachers trying to get dancers to stop looking at the mirror.

Of course, for many, mirrors are considered very beneficial as a training tool, an essential part of the learning apparatus in the dance studio; as such research into the value of using visual cues to help develop a dancer's proprioceptive sense, alignment and kinaesthetic intelligence, has led to technological research projects like the *Delay Mirror*, which was designed to 'support video feedback and fits the context of a dance class or rehearsal' by rendering 'the specular image of the dancer in front of it, only with a time delay of a few seconds' (Molina-Tanco *et al.* 2017: 2). The delay in reproducing the movement that the dancer is performing presumably means that they focus on it for corrections immediately after the event rather than in tandem with doing it. As one of its functional requirements the researchers agreed that for the *Delay Mirror* '[t]he system must resemble as much as possible an imaginary dance studio mirror that reflected an image with a delay of a few seconds' (Molina-Tanco *et al.* 2017: 2). But the argument behind this is in direct contrast to the thinking underpinning *Tools that Propel*. The *Delay Mirror* was designed as such to avoid disrupting normal 'in-studio working flows of dance practice, since dancers would apply their mental model of the real mirror, a basic element at the dance studio which is already integrated in those workflows' (Molina-Tanco *et al.* 2017: 2).

A key concept emerges here that conditions perhaps the majority of recent technological innovations and the 21st century paradigm that is producing them. We can see the idea that technology should *augment* rather than *interrupt* 'normal' modes of working, or human capabilities. *Tools that Propel* uses its own functionality and affordances precisely *to disrupt working flows of dance practice* and thereby to open up new creative possibilities within the site of conflict and friction. The reference to the 'mental model of the real mirror' reminds us of how so many technological devices are designed to be intuitive to use through their transference of our analogue mental and physical models to digital modalities. Whilst it is of paramount importance in ensuring adoption rates and usability and a key concept underpinning embodied interaction design (Dourish 2004), arguably the pure extension of the human inherent in this thinking limits the possibilities that emerge from a non-human centred approach, whereby the agency of objects and elements within the non-human world bring about new ways of perceiving ourselves within the world and new understanding of our responsibility towards it.

Grammar of Bodies (the 'Question of Movement')

If before writing there must have been spoken language and before spoken language there must have been gesture (Rotman 2008; Sutil 2015), then dance, in non-codified forms, is thus; of a time before the separation between subject and object. The importance of this will be examined in much more detail throughout this thesis, exploring the creative potential within the paradox between the oneness of gesture as matter and form (the dancing body offering sign and meaning in one, its expressive quality partly defined by its ability to mutate, transform, and offer multiple simultaneous resonances), and the industrial expectation that we describe it, notate it, grammar-itise it as a means of (re)production (see Chapter 4 in particular).

Digital technologies enable intuitive and seamless extension of the body and its embodied inhabitation of the world because of the functionality of motion capture and haptic sensors to map movement, touch, and physical connection, yet they also operate in the creation of new languages and in turn new understanding of the expressive self, connected and networked to them. Brian Rotman discusses the notion of language as a technology that mediates and co-constitutes human experience. Indeed, he argues that 'the "human" has from the beginning of the species been a three-way hybrid, a bio-cultural-technological amalgam: the "human mind" – its subjectivities, affects, agency, and forms of consciousness – having been put into form by a succession of physical and cognitive technologies at its disposal' (Rotman 2008: 1). So, digital sensing technologies too are not just reflective of physical experience, but part of its mediation, potentially reconstituting human experience of inhabitation and entanglement with the world. Indeed, Rotman states that motion capture technologies, for example, 'offer the potential of capturing the entire communicational, instrumental, and affective traffic of the mobile body – projecting the outlines of a gesture-haptic medium of vast potential' (Rotman 2008: 3). Where both spoken and written languages – as technologies – have always been detached from the body, with alphabetic letters being 'in no way iconic, their visual form having no relation to that of the body or how the sounds produced by the body's organs of speech are received by those hearing them' and 'the sounds which the letters notate [being] meaningless monads' (Rotman 2008: 3), these technologies offer the possibility of mapping or bringing to prominence the untold levels, embodiments and natures of expression that are undesignated, uncaptured, and uncoded by either written or spoken language. Such technologies are prompting questions not only concerning the documentation of such embodied expression but its meaning and how it is entangled with its matter.

Yet, as well as reflecting the embodied nature of human experience, digital sensing technologies, produce embodied experience. There are knowledge opportunities to be found in the gesture-haptic language that Rotman suggests could come to the fore with them. Rotman argues that '[w]riting, like any medium, is a re-mediation; it engenders a clutch of interconnected discontinuities in the milieu of

what preceded it: a disruption of the previous space-time consensus of its users and an altered relation between agency and embodiment giving rise to new forms of action, communication and perception' (Rotman 2008: 6). Just as writing 'introduced a domain of virtual, seemingly 'unreal' objects, entities that are without context, endlessly repeatable, and free to be reproduced at any time, place, and cultural situation' (Rotman 2008: 6) thereby producing an imagined virtual reader disconnected from the text and the moment of its production, Rotman suggests that parallel computing processes and gesture-haptic technologies are producing new languages that are in turn producing new selves. Such a self – a para-self as he goes onto call it – is '*immersive* and *gesture-haptic*, understanding itself as meaningful from without, an embodied agent increasingly defined by the networks threading through it, and experiencing itself (notwithstanding the ubiquitous computer screen interface) as much through touch as vision, through tactile, gestural, and haptic means as it navigates itself through informational space' (Rotman 2008: 8).

It is within this context, of understanding language as a technology that produces human experience and is produced by it, that I call *Tools that Propel* a 'language machine' to use William Forsythe's term (Manning 2009a; Sutil 2015), described by Sutil as a phrase 'to denote tools and devices that yield choreographic structures in space and over time' (Sutil 2015: 3). Sutil is concerned with 'underlying commonalities between families of language machines, and the possibility of a common origin in the deepest and also most abstract appearance of conceptualised movement, before we enter the plane of representation' (Sutil 2015: 3); whilst this is not precisely his intention perhaps, this acts for me as a call for systems – using the affordances of digital technologies – to empower the diversification of dance, makers and form, reaching back to its 'absolute origin' (Simondon 2016 [1958]; De Boever *et al.* 2012: 26) to allow it to be at the brink of emergence again. On the one hand, we can see it in terms of 're-vernacularisation' as Simon Keegan-Phipps does (Keegan-Phipps 2015): 'digital media/technology may be facilitating a re-vernacularisation of traditional arts' (Ibid.) But the word vernacular reinforces the analogous attempt to tie dance to written and spoken languages, commonly shared by communities of people, and what we are seeking here is co-existence of body and thought.

This thesis interrogates the affordances of the 'language machine' that is *Tools that Propel* within the context of entanglement with the human as a 'bio-cultural-technological amalgam' and language – and the production of language – as a technology that is part of this entanglement creating 'subjectivities, affects, agency, and forms of consciousness' (Rotman 2008: 1). This language machine is technological and produces technology – language. It is at the disposal of the human interacting dancer to co-produce (through their entangled relation) new movement which emerges with and through the production of its new originating meaning. It is not meaning that is representative – semiotic and made of signs – but of the very matter and motion of the body itself, mapped and

reperformed digitally, meaning, that is, that is *derived by* and *co-actualised through* the interpretation (of both machine and dancer) of what *is a movement, what is this movement, where does it begin and end, what is this semantic unit we will create out of this stream of motion, time, experience*.

Of course, despite various notation systems, there is 'no universal agreement on a definitive dance 'grammar'' (Vincs *et al.* 2009). The fact that the question - *what is a movement?* - has come up at all in this thesis and in other research projects is invariably to do with utilitarian demands of its documentation or its use as an input for determining specific outputs; that is, the mechanisation of something that is naturally 'whole', relational, and not made of discreet and nameable components. Creating a 'consistent, unambiguous way […] of representing human movement with a machine-readable ontology or grammar' (Calvert *et al.* 2005: 9) might seem to be a reasonable aim for those trying to use movement as inputs for computational outputs. But this thesis explores *Tools that Propel* as a system that creates new choreographic language through relational, (gently) interrogative, multi-agential, ecologically-minded ontogenetic emergence.

Mary M. Smyth argues that '[t]he important part of the message in dance is not "what was that movement?"' and that 'for the spectator who is not a dancer, being able to discriminate one movement from another is not the problem' (Smyth 1984: 21) However, for the functionality of *Tools that Propel* this is exactly the question that is asked: it is literally assessing whether it has seen a movement before, which means it needs in some way to determine the beginning and end of it. Yet, this research might arguably be said to have been propelled by a *refusal* to spend time attempting to define and delineate movements and also somewhat unexpectedly argues that the richness of the knowledge that has emerged out of the research is predicated on problematizing the question: what is a movement? This thesis explores the production of (embodied) knowledge that can arise in the relational entanglement of two distinctive modes of perception, classification and understanding of movement, and even whilst it recognises and is premised on a paradoxical, yet functional, need to segment movement in order to work with it, the thesis (and *Tools that Propel*) aims for a defragmentation of movement, in order to recognise a continuous relationship between past, present, and future and to see what happens when we experience it as such.

ENCOUNTERING THE THESIS

The thesis is both to be read and to be watched and listened to. Throughout the text there are a series of videos, two of which you have already encountered; these are curated from hundreds of hours of session recordings created by *Tools that Propel*, an edited video document of the performance piece *Body of Memory* (Chapter 5 only), and a series of semi-structured interviews and studio discussions that

were recorded at key points along the research process. The videos should be watched when they are encountered in the text; they are to be enjoyed in relation to your reading and are simply part of the collective individuation of this work. In most of these videos the filmed footage is overlaid with 'conversations' constructed from audio that has been grabbed from longer interviews and discussions with the dance students about their experiences improvising with *Tools that Propel*. The audio is not a narration of the video: together the filmed footage and the voices encompass two different ways of experiencing the ideas, intentions, and questions within the research and the videos are collective individuations in themselves. They are multi-way dialogues, and quite possibly metalogues, defined by Gregory Bateson as 'a conversation about some problematic subject' in which 'the structure of the conversation as a whole is also relevant to the same subject'[17] (Bateson 2000: 1). These videos are designed to interweave with the text, sit alongside it, or imbricate it. Sometimes they will interrupt your reading, expanding it or contradicting it. Sometimes they rub up against it, sometimes they might elucidate it, sometimes they open up other perspectives or avenues of thought and enquiry. They are not case studies to which I refer directly, although in Chapter 4 there are four videos without voices which more clearly relate to the events discussed in the written text.

Structure

The thesis is broken down into two parts, 1 and 2. Part 1 articulates the genealogy of practice within which *Tools that Propel* and this thesis sit (Chapter 1: Contexts), as well as the way that the approach to developing, using and analysing the use of the system (Chapter 2: Critical Framework and Methodology) advocates for the creativity to be found in embracing entangled becomings as much as the system itself does. Part 2 includes three discussion chapters (Chapters 3, 4 and 5) that analyse the understanding that has emerged from use of *Tools that Propel*. Yet there is a circularity to this thesis. In many ways, the enquiries that grew out of studio practice with the system, and the journeys that they took me on during my reading and writing, revealed the importance of the thinking expressed in Part 1. In many ways, the enquiries are embodied in the system itself – without me knowing that they would be – appearing there with recursive causality.

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[17] Bateson himself gives the example of 'the history of evolutionary theory' which he says is 'inevitably a metalogue between man and nature, in which the creation and interaction of ideas must necessarily exemplify evolutionary process' (Bateson 2000: 1).

Part 1

Chapter 1 examines an array of projects that have informed *Tools that Propel* or to which the system speaks – in intention, function, aesthetic, technological specification or otherwise. It is, after all, with the use of technology in dance creation that this thesis dialogues. The research is at its core about how *Tools that Propel* – as a choreographic improvisation system that has been developed in relation to an already rich research field – stimulates new choreographic thought-action in dancers. As such, I discuss an array of projects working with computation to explore the relationship between movement, choreography and technology, and the potential of artificial intelligence to expand choreographic thinking and possibilities; in doing so I raise questions about how artistic works that mediate themselves through the digital shift our understanding of what constitutes a 'body', what dance is and is becoming, the nature of materiality in the virtual, and how embodied learning can take place in relation to and in dialogue with a digital system.

Chapter 2 is about *how we encounter* technology and *how this encounter with* technology unfolds. I have already stated that *Tools that Propel* might be called a digital dramaturg, and this chapter begins by exploring how the research methodology and the development of the system might be understood as being informed by process-oriented dramaturgy as well. Yet given that I began this thesis calling it a choreographic improvisation system I also interrogate the relationship between dramaturgy and improvisation, and consider how choreographic improvisation can be understood in terms of the realisation of new potential within ecosystems aesthetics and metastable equilibrium. Overall, this chapter is advocating for a particular way of engaging with technology underpinned by Gilbert Simondon's philosophical writings on technical mentality and the mode of being of technical objects – an embrace and openness towards technology as part of an ontogenetic becoming that entangles us together. It is also laying the groundwork for the new ways of thinking that were brought about through this, those that opened up ontological and epistemological questions about human constitution and our relationship to the non-human world, and outlines the methods that are used to produce, discuss, and document this research, arguing that they are also part of the collective individuation that is the knowledge emergent when improvising with *Tools that Propel.*

Part 2

In Part 2, I interweave the videos with the text. Each chapter is interrupted by 4-6 videos of differing lengths. They are not necessarily specific to the research material or critical framework analysed within the chapter they cut into, but they contribute to the entangled knowledge within the thesis as a whole. The thinking within this thesis is not necessarily linear, even if the words on the page are – by (sometimes frustrating) necessity.

Chapter 3 examines how dialogue comes about when the dancer improvises with the system. It interrogates how a feedback loop between what the dancer does physically and what decisions *Tools that Propel* makes in response increases the choreographic awareness within and for the dancer; it explores how this is catalysed by entangled and relational thought-actions. The chapter begins by examining the relationship between the animate and the inanimate in *Tools that Propel*, through considerations of what it means to call it a 'tool' and what it means to see it as a 'collaborator' (or to anthropomorphise it in any corresponding human role). Through this it opens up the question of whether it feels more like an extension of one's self or like an other, acting in an assemblage of distributive agencies. As such, the way that *Tools that Propel* acts on dancers and is acted on by dancers is explored with relation to Andy Clark and David Chalmer's 'extended mind thesis' (Clark and Chalmers 1998) and Jane Bennett's theories on vital materiality (Bennett 2010). I argue that in fact *Tools that Propel* appears to be fluctuating between both 'extension' and 'other', and that this might be understood in terms of Mark Coniglio's call for systems that can both 'reflect' the performer and 'intervene' in (or antagonise) their action (Coniglio 2015). I conclude by exploring how given this relationship between extension/other, reflection/intervention, the impact that *Tools that Propel* has on choreographic thought-action might be best understood through performative new materialism and Karen Barad's agential realism in particular (Barad 2007), whereby agency exists through and within relationality of (disentangle-able) matter and meaning. Choreographic agency becomes something that is only emergent because of the particular intra-action of the elements within the technical object: indeed, in the dance with *Tools that Propel* the 'phenomena' of the choreographic improvisation taking place with the system comes about as 'the ontological inseparability of agentially intra-acting components.' (Barad 2007: 33).

Chapter 4 explores questions of archiving and the an/notation of movement with particular reference to the affects brought about by the computational affordances of *Tools that Propel* which fold the past into the present; in doing so, it ensures that the 'living present in bodies which act and are acted upon' (Deleuze 1993: 43) interactively involves the past. It looks at what it means for the past to repeat, return and re-perform in the present, and how this enables the dancer to look to the middle of the movement to find new potential within it and discover the emergent moment in the choreographic improvisation. I discuss the use of *Tools that Propel* with pre-existing repertory, exploring how it enabled the dancer to understand core elements within the movement they were investigating with their bodies. The first part of the chapter explores how it is through acts of reperformance and repetition brought about by the system that 'new potential becomes available' and '[n]ew territory opens up inside the old' (Rothfield 2016: 19). However, leaving behind the specific focus on past repertory, and investigating the relationship the dancer builds with their own (and others') past movement more widely, the second half of the chapter explores an/notation and note-taking,

reinterpreting and reembodying the seen/witnessed, and focusses on *Tools that Propel* as a real-time an/notation tool for improvisation. It interrogates how bodily knowledge can grow as the dancer negotiates the gap between their physical movement in the studio and its reemergence as a virtual document from the past. It explores how an/notation, a practice which is historically associated with the preservation and analysis of the past might interact with the present moment of movement, becoming an impetus to make new choreographic decisions and (re)shape bodily knowledge. I will argue that one answer to how we derive meaning from the digital annotation and archiving of movement lies in the gap between the approaches of the digital agent and the human agent collaborating with them when it comes to categorising and annotating the movement, and the dialogue that this gap provokes.

If the previous chapter is concerned with the memories coming from the system in relation to time, Chapter 5 more directly starts to evaluate the role the memories play in forming and transforming subjectivity. It was through the creation of *Body of Memory*, an installation performance created in September 2019 with two systems of *Tools that Propel*, that I gained greater understanding of how different linguistic configurations and gesture-haptic languages (Rotman 2008; Bleeker 2015) – in which there is no gap between signifier and signified – might open up different perceptions of selfhood and human enactment of their relation with the world. This chapter examines how a new language is created with *Tools that* Propel, as the functionality of the system comes into being with the intra-action of all the entangled phenomena including the improvising dancer, and parallels this with the way that the dramaturgy of *Body of Memory* unfolded through learning the language of installation, listening to its affordances, and letting its agential reality emerge. The chapter examines the production of language and the conceptions of selfhood embodied within it in relation to the idea that *Tools that Propel* is a diffractive apparatus that enables the stream of motion occurring in the improvisation to be 'cut' into new semantic units (Barad 2007). As a diffractive apparatus, creating the conditions for objectivity (repeatedly), *Tools that Propel* reveals the potential for indefinite proliferations of potential creative possibilities within in the semantic-ontic indeterminacy that is the entangled mass of matter and meaning in the improvisational experience (Barad 2007). Ultimately, we understand how *Tools that Propel* is.

In examining the functionality of *Tools that Propel*, as both a language machine (Sutil 2015) and a system of metastable equilibrium (Simondon 2011 [1958]) this chapter explores how the 'other' that is formed of our own movements, re-performed according to a constantly emerging grammar of the system, opens up an alternate way of conceiving and experiencing ourselves within the world, contained and held within a different perception of time and space. The dancers meet themselves as other, as virtual selves, and get to know themselves anew through this encounter. They see the past

and the present concurrently and in embodying their own past movements and animating them again, playing into and out of them, changing their speed and dynamic, they create future manifestations within them too. In seeing themselves as other the dancers are seeing themselves as objects in a sense, embedded in a landscape and networked to the entangled non-human phenomena running through them – we could understand them as splitting themselves off from their subject-oriented worldview to (re)consider their place alongside other objects, or more accurately perhaps, as neither subjects nor objects, but always on the brink of becoming.

Dancing with *Tools that Propel* involves a process of learning a new language when the language is not only unknown but only comes into being in its utterance *between* two interlocutors equally alien to each other. This chapter (and indeed the thesis as a whole) discusses the ways that dancing with the other in *Tools that Propel* can lead to a shift of perception, consciousness and embodied thinking in the dancer; and explores how through drawing on and digging within the familiar we might perceive the unfamiliar and discover new ways of imagining our futures.

PART 1
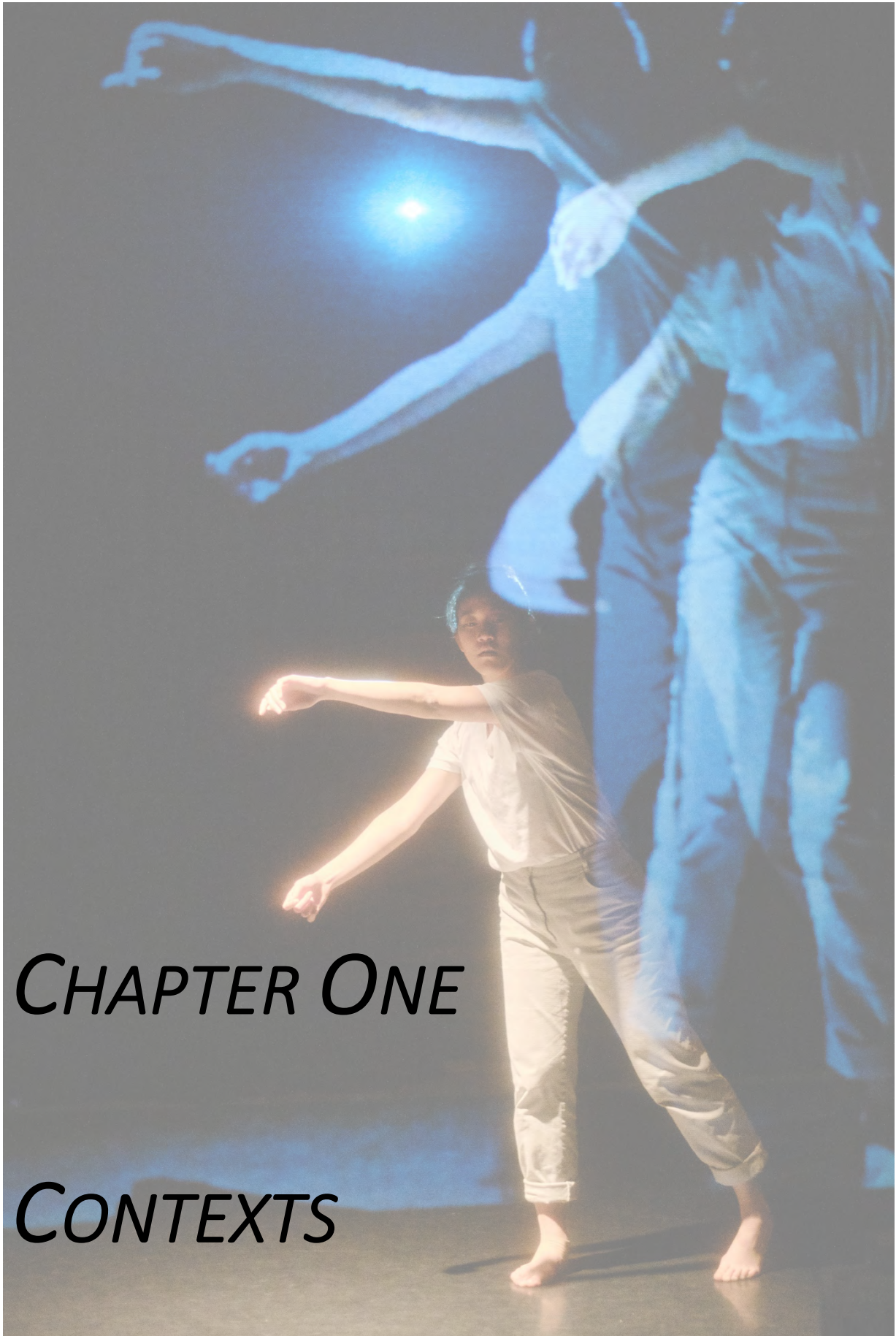
CHAPTER ONE

CONTEXTS

SURVEYING/SURVEILLING THE

TERRAIN

WITH AND WITHOUT BODY

D eveloping and working with *Tools that Propel* has raised various points of enquiry in relation to the body and the kind of digital bodies that might catalyse a growth of embodied knowledge in interactors. These are shared by a range of other projects that have influenced aspects of this research, and through surveying the terrain of this work, this chapter seeks to gain greater clarity on the particular knowledge that my practice brings to it. The enquiries are wide-ranging but interconnect through their relationship to body: as such, I will explore the relationship (or not) between the technological (machinic, digital or virtual) body and the physical body, as well as a range of social, ethical, and political questions that arise from technology's impact on the human body and the body's interaction with its environment. Equally, important questions arise across some of these projects regarding who owns our bodies – when they occupy public, private and virtual space – and the gestures they make; hence the play on survey/surveill(ance) in the chapter title. Whilst we explore how digital technologies can give us access to other people's bodily data – to inhabit or interact with – we also need to consider the manifold implications of this.

The question of body has also come to encompass the question of bodylessness. Hetty Blades argues that projects such as the *Choreographic Language Agent* (Downie and Kaiser 2009), developed for Wayne McGregor by the OpenEnded Group, show how 'movement can be created and made visual on a computer, and therefore embodied without the body' (Blades 2012: 227). She discusses the 'chasm between the thought of movement and the actual event' in these projects and concludes that

the shapes and visualisations through which movement is revealed challenge the 'notion of embodiment as involving the human body' (Blades 2012: 227). Yet, just because computation can reveal the cognitive process of movement without the human body, is virtual *bodylessness* the best way of stimulating a dancer (professional or amateur) to explore further movement whilst *interacting with a digital system*?

The enquiry into how abstract or figurative a digital body needs to be to catalyse the imagination of a physical dancer is ongoing research in this field. The OpenEndedGroup, the team behind the programming of the *Choreographic Language Agent*, stated that 'if you show dancers a traditional keyframed body animation, it is hard for them not to simply imitate its movement directly rather than to invent strategies for reinterpreting the movement it shows onto their own bodies' (Downie and Kaiser n.d.). In recent work at Studio Wayne McGregor where the new choreographic tool *Living Archive* (Girshig 2019) developed for the company by Google Arts and Culture was first used in a creation process for *Living Archive: An AI Performance Experiment* in June 2019 (Studio Wayne McGregor 2019), the question of what the rendered body that danced the AI-predicted choreography should and could look like was still in play. The fleshier figures based on previous Company dancers took too much time to render and arguably their weight and presence at this stage probably not worth the wait; whilst the stick figure was deemed *to not have enough body* it was this body that was used in the creation process. Despite its limitations, the Company dancers, with all their virtuosic skill, responded to its offerings well, with Wayne McGregor remarking in the studio that he felt that it had changed the movement each of them created in tasks.[18] The question of *body* in computationally-augmented choreographic practice is a complex one and the literal reflection of the dancers' real bodies in *Tools that Propel* also presents only one answer with as many limitations.

Of course, the entanglement of bodies and machinery is not new as a point of academic enquiry. In *Entangled: Technology and the Transformation of Performance*, Chris Salter traces the historical entanglement of bodies and machinery, from the technologising of the concept of body as something mechanical and made up of mechanical parts, to the extension and imbrication of the body mechanically and technologically, to the conceptualisation of the body as incorporated into a larger-

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[18] This is anecdotal evidence I collected during a 3-month research placement I undertook at Studio Wayne McGregor in 2019. As well as going to Google Arts & Culture in Paris for meetings about the development of the AI-driven tool for choreography, *Living Archive,* in relation to commissioned education and learning workshops, I observed some of the creation process for *Living Archive: An AI Performance Experiment,* the first piece made with the tool.

than-human system – 'as something to be transcended through implants, prosthetics, sensors, actuators, and even genetic invasion' (Salter 2010: 221). Marshall McLuhan first introduced ideas concerning how communication technologies affect human cognition (McLuhan *et al.* 2011 [1962]) and Mark Hansen has since discussed 'technogenesis' and the co-evolutionary processes of humans and technology (Hansen 2000), as have Andy Clark and N. Katherine Hayles (Clark 2003; Hayles 2012). Numerous appraisals and critiques have been written of Stelarc's particular disfigurations of his body and its entanglements with technology (for example, Popat 2015; O'Donnell 2011; Abrahamsson and Abrahamsson 2007; Jones 2005) and Steve Dixon explores the virtual body and the digital other in the seminal book *Digital Performance: a history of new media in theater, dance, performance art, and installation* (Dixon 2007). It is indeed a 'cliché [...] that our traditional understanding of the body is blurred and extended through technical apparatus' (Salter 2010: 221). Furthermore, there can be a tendency to take a rather humanist approach, seeing these entanglements as extending, progressing, augmenting and empowering the human, in ways that are modelled on our already-known potentialities. But I posit that what is interesting is how the body is *challenged*, *disturbed,* or *disrupted* and *motivated* by, *explored* and *thought-through* the technological systems we develop. Nathaniel Stern has written about this in terms of our embodied interaction within installations, exploring the perceptual and corporeal implication of the human body within digital interactive art (Stern 2013) and Ian Heisters' work *Human ID,* with its use of deepfakes that appear to show dancers performing choreography they have never performed in real life, seeks to question 'how deepfakes and AR alter our abilities to know one another and our perceptions of reality' (Heisters 2021)[19].

However, the focus of this thesis is on how the interaction between the body as physical and the body as virtual simulacra can produce a circuit of learning that increases the embodied knowledge in the situated live fleshy body on the studio floor. By 'increases', I also mean that new ways of thinking and perceiving are facilitated by digital technologies – those that might not be possible without the technological entanglement. Whilst these questions encompass both political and philosophical implications of tracking and processing of bodies, as well as the distortion and destabilisation of bodies in the digital realm, and the materiality (or not) of bodies produced, replicated, repeated, and transformed through digital media, the answers to them are all contributing to an understanding of

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[19] It is worth noting that whilst Heister is exploring deepfakes with artistic and political intent, a new app *Everybody Dance Now* is being developed to enable us all to see our bodies dancing movements we might not be personally able to do in the physical realm (Chan *et al.* 2019), in much the same way that face-swapping has become part of the vernacular in terms of everyday smartphone-mediated fun.

how to use these bodies to tease and teach our own, and an enquiry into what they can indeed reveal to us about the world we live in.

Insistence of Flesh

Self-proclaimed cyborg artist Moon Ribas (Cyborg Arts 2020), whose implanted seismic sensor sees her sensing (and translating through dance) every earthquake that takes place in the world, and performance artist Stelarc (Stelarc 2019; Smith *et al.* 2005), whose techno-bodily fusions are more well-known, literally embody the question of where the human body begins and ends. As Stelarc enacts brutal technological acts on his body – suspending it with hooks in his skin, unfolding a robotic agent inside his stomach, subjecting it to exoskeletons that control it, growing a third ear on his arm which can both hear and transmit sound – he declares that his body is obsolete. No longer useful on its own and embroiled in technology, he finds meaning and a way of acting by being extended by it. Yet, as Amelia Jones argues, the power of Stelarc's work is so often its insistent return to the flesh. She writes that his 'project is to refigure our understanding or comprehension of the technologized world around us by manipulating the body – by embracing the extensions and violations perpetrated on human subjects by technology rather than resisting them' (Jones 2005: 94). It could be argued that through work that seems to expound mind over matter, the power of the mind to endure physical reconfiguration, distortion, and pain, Stelarc might well be enacting the ultimate realisation of Cartesian dualism – the split between mind and body so absolutely prevalent in our increasingly technologized lives. But actually, his work focuses us back onto the body, and makes it front and central, even in its new thinking, moving, form.

In less extreme ways, artists working in the dance/tech field also argue for the affordances of technology to get us *back to our bodies*. Architectural Choreographer Laura Kriefman, who works in what she terms 'Augmented Dance', argues that our sense of movement has been affected by ever-increasing devices which are designed to save labour. Yet, rather than shy away from technology, the work of her company Hellion Trace embraces it; they are interested in how technology can be used to change how we see the world, and indeed, to liberate people's sense of movement (Hellion Trace 2021b). There is no doubt that each new generation is interfacing more and more naturally with new technologies. Jo Verrent, Senior Producer at Unlimited, highlights the potential of digital technologies to give access to the arts to everyone: '[r]ather than access being limiting, boring, a pain the arse – which I think is how a lot of people see it – for me it's a liberation. It's something that, through the use of technologies, elevates all of humankind to genuinely encompass universality and think bigger' (Digital R&D Fund for the Arts *et al.* 2016: 25).

Yet, there are fears surrounding the impact of technology on creativity and physicality. Remarking that '[w]e look at a screen, at a phone or an iPad, at such an early age', choreographer Akram Khan has stated that he is 'hugely nervous about the technological revolution that stops us moving' (Crompton 2019). He argues that 'the more technology advances, the more it entices you into a virtual world and the less you are physically active in the real world' (Ibid.) Despite these reservations though, Khan was guest choreographer for the Big Dance Pledge in 2016, meaning that his choreography was transmitted through the internet to stimulate the practice of community dance groups across the world. In many ways, there is an inherent contradiction in using the two-dimensionality of the computer screen to disseminate an artform which is bodily, full of flesh, breath, touch and sweat. This is even more acutely felt when Khan describes how the intentions behind the piece included 'trying to go back to the body, because [he] feel[s] we are in a technological age where things are transforming, where the body is becoming stagnant' (*Behind the Scenes, Creative Process Documentary* 2016). Yet, with its global reach the internet was an appropriate tool to enact his intention, and Khan was interested in the transformations that would occur as the piece spread across the world: 'each tree becomes different, yet you know they're all connected to this one seed, to one idea' (*Trailer* 2015).

Online resources to support people to learn the choreographic themes included invitations to perform them in different configurations – seated, standing, or kneeling; and a sense of permissiveness was embodied in the materiality of the digital embodiment of the dance itself. The original background against which the dancers were filmed was removed and the moving bodies are viewed in different locations, which seems to make the dance placeless, timeless, rootless and oddly ownerless – free and ripe to be placed, timed, rooted, owned by any community (*Choreography Film* 2016). The focus is very much on the dancing figures, facing in different directions, suggestive of myriad possibilities: we are somehow anchored in something deeply human. We can absorb the movement and take ownership of it, going to its centre, joining the ritual and rhythm. Literally and metaphorically, 'by going into the virtual world we are losing a sense of what's around us' (*Behind the Scenes, Creative Process Documentary* 2016).

This project used the internet to transmit embodied knowledge which then stimulated performance which took place in the physical world. But it also shows how careful use of form impacts the development and reception of content. The fact that the choreography is about returning to the body, to the human, to connections, and refutes the impact that new technologies are having on our lives, demonstrates that a re-appropriation of the online mode of delivery can give us something positive – a physical reconnection to our bodies and communities.

Homogeny and Regulation

The thinking that led to *Tools that Propel* does not explicitly pertain to the transmission of dance through the internet. But the use of the internet in the Big Dance Pledge raises questions about whether technology can (or should) be a neutral conduit for the transmission of either creative process or works of art. The technologies we choose to use for the engagement of audiences and participants carry with them entangled political questions concerning ownership, power, and privacy. O'Dwyer writes that

> Homogenisation of cultures through the electronic circumvention of borders is a widely known pernicious condition of globalisation; but the erosion of history via processes of disindividuation is a discreet aftershock whose disastrous effects are hitherto widely unappreciated. Analogously, the type of knowledge that *is* passed down, as well as the means of transferral, also become homogenised; that is, knowledge is digitised and remediated through mnemotechnical channels. Physical applications of knowledge/skills become a rarity because everything is remediated through digitised audiovisual symbols. The possibility of individuals individuating themselves against the group is undermined because the symbols, which constitute the general make-up of reality, are increasingly homogenised (O'Dwyer 2015: 47–8).

In the Big Dance Pledge, it was perhaps also the quality of the facilitators working with community groups, acting as human conduits of the disseminated movement material, that enabled the use of video to open up (rather than close down) creative possibilities within the dance. In contrast, the constant stream of dance videos on YouTube and TikTok, through which people have learnt complex dance styles, usually encourage copies rather than interpretation. The emancipatory potential of technologies undoubtedly can encourage choreographic agency in people outside dance world hegemonies and this in turn could impact art form development (Keegan-Phipps 2015). Yet, in many ways the proliferation of dance moves via the web and through apps, whilst democratising knowledge, closes down creative potential, and reveals the pernicious way the internet can both enfranchise and colonise remote cultures at the same time. There is little space in these videos for reimagining, and they often disseminate commercialised and increasingly homogenised dance moves.

LIGNA is an example of a company whose use of media for transmitting embodied knowledge to distributed people wrangles with its own political import in terms of power, control and agency. With Radio Ballet (2003), LIGNA were interested in the 'political potential [that] lies in the fact that radio has a scattered audience' (Conrads 2011). They described it as 'a radio play produced for the collective reception in certain public places [giving] the dispersed radio listeners the opportunity to subvert the regulations of the space' (Ligna 2009). Listening through cheap portable radios and earphones, the participants were instructed to perform a series of 'permitted and forbidden gestures (to beg, to sit or lie down on the floor etc.)' to reclaim public space which has been 'under private control of the German

railway company (Deutsche Bahn - DB) and its associates since the mid-nineties' (Ligna 2009). These gestures challenged '[t]he system of control [that] is designed to keep out every kind of deviant behaviour' as well as the 'panoptic regime of surveillance cameras, security guards and architecture, that avoids any dark and 'dangerous' corners' (Ligna 2009).

This work aimed to make a statement through the presence of the participants' quotidian bodies, and their embodiment of everyday gestures whose meaning is controlled in this space. The makers stated that they were serious about 'putting themselves in the background and understanding their audience as a scattered collective of producers' (Conrads 2011). In *Radio Ballet*, both the collective nature of the 'happening'[20] and the freedom of interpretation between the instruction and the performance of the gesture empowered people to realise the potential of art and their bodies within it to make political and social comment: 'a completely new way of experiencing one's own body in the urban space is opened up to anyone wishing to take part in the performance' (Conrads 2011).

The use of analogue radio invokes a time before the surveillance *Radio Ballet* questions in our public spaces had digitally invaded every aspect of our private lives. Indeed, Martin Conrads states that '[t]he extent to which LIGNA's critical and performative radio activities require further technical, communicative and artistic development following the digitalisation of radio, Facebook parties and the "end of privacy" is something that needs to be examined' (Conrads 2011). Unlike the Big Dance Pledge, whose primary intention is to get people dancing, the use of choreographic instructions in *Radio Ballet* to catalyse mass collective movement is overtly political in nature. The research within this thesis is also not explicitly concerned with the way digital technologies enable the political co-opting of private and public space, discourse, and experience. However, it is an underlying theme; both with regards the ideological fear of technology propagating linear and prefigured processes of creation and knowledge generation, enabling an increasingly data-driven idea of success, and the ethical, philosophical, and social questions that are raised in using and performing with tracking technologies.

Digitally Distant and Physically Permissive

Tools that Propel affords interactors the ability to embody (overlay and make move) other people's virtual bodies – we might call them avatars in that they are digital imprints, memories, movements, and recorded moments of action, ready in the system to be brought back into digital materiality. This raises

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[20] Here I refer to the participatory events called 'happenings' within the 1960s as part of the lineage from which works like this belong. The term 'happenings' was coined by Allan Kaprow in 1959 for his work *18 Happenings in 6 Parts* which took place over six days at the Reuben Gallery in New York (Aronson 2018).

uncomfortable and yet resonant questions about the ownership and rights of the embodied self when it is captured, stored, and tracked. Despite its mirror-like aesthetic, the system does not share the accountability of a real-time mirrored reflection of our physical actions; our 'reflections' are no longer attached to what we do now and are disconnected through computation from our ability to control their use. This raises the spectre of abuse, manipulation and disquieting questions about surveillance and agency throughout our daily occupation of public spaces. We might refer here to the seminal artwork *Telematic Dreaming* (Sermon 1992) in which performer Susan Kozel occupied one bed whilst audience could encounter and interact with her real-time virtual presence projected onto another bed in another room. Kozel discusses how she felt the bodies of her partners on the other bed as material presences and talks about the visceral feeling of experiencing their virtual actions, some of them violent (Dixon 2007).

It is important to note what the digital affords in a piece like *Telematic Dreaming*. Steve Dixon says that Kozel emphasises 'the electronic body as an amplification and extension of the flesh body to which it is intimately entwined' (Dixon 2007: 219). Citing Kozel, he states that '[r]ather than rendering the corporeal body obsolete, telematics offers it a kind of fourth dimension, where it is able to do things the physical body cannot "such as map itself onto another or disappear"' (Dixon 2007: 219). Kozel is recorded as saying that '"[w]e could pass through each other… Our bodies seemed to be infinitely mutable, while they never ceased to be *our* bodies"' (Dixon 2007: 219). But do the same social rules apply in this *fourth dimension*? The violence enacted virtually on Kozel would (probably) not be enacted on her physically, unless explicitly invited as it was in Marina Abramović's *Rhythm O* (Abramović 1974). The disconnection of the physical from the virtual encounter with the body reveals truths about expectations, beliefs and rights concerning it. Here, as in *Radio Ballet*, yet in a very different way, technology's ability to bring together distributed bodies in a shared act highlights hidden agendas and desires within the social and political realm. Undoubtedly, just as social media and the internet has brought the onslaught of trolls - people who feel empowered by the supposed anonymity afforded by the lack of their physical presence and write obscene, incendiary, and stigmatising comments to others – there is no doubt that giving up our bodies and our body data comes with risk.

Yet, whilst the social and political ramifications are huge, there are enormous creative benefits of enabling bodies to play across different types of materiality – digital and physical – and we must weigh these up. The appearance of the body in a new materiality is creatively stimulating and can engage audience to play in ways that might not otherwise happen. Steve Dixon writes that '[f]ew people would dare to venture onto the same bed as the real Kozel (or other stranger) to commence a physical improvisation, but her virtuality enables it' (Dixon 2007: 220). I suggest that the same technological affordances that can be maximised for insidious purposes are also those that are artistically generative.

Following Stiegler's call for a pharmacological approach to digital arts, it is in co-opting that which is malign, power-driven, and homogenising within technology and using it for its creative, generative, and emancipatory potential that I am interested. As will be discussed later in 'Destabilising bodies' there is a key question in *Telematic Dreaming* that pertains to this research: this regards how a disruption of the laws that dictate our understanding of the body in time and space can affect how we create dance. In both *Telematic Dreaming* and *Tools that Propel* there is a giving up of the ownership of one's own body in the very act of participation in the installation; but with this comes freedom – from the usual parameters of our lived experience – and the possibility of new interactions.

MAPPING BODIES AND CREATING FEEDBACK LOOPS

Tools that Propel presents us with literal 'mirror-like' images of ourselves moving; dislocated from the time of, and causal link to, their moment of production. But what conditioned this decision? Many choreographic software and interactive artworks mediate bodies through far greater levels of abstraction to different affects. But, in designing *Tools that Propel*, we had to ask: what kind of digital bodies make us want to dance?

In *Telematic Dreaming* (1992) both Kozel and the audience encounter each other's virtual bodies in their most literal realisation – the use of technology brings an illusion of the presence of a physical performer into the bed where the interactor (audience) is also free to lie down. The physical is literally mapped to the virtual with no manipulation; and vice versa. But mapping a body from one place to another does not induce participation and active engagement. Television maps bodies similarly and we do not relate to these bodies interactively. Here, in *Telematic Dreaming* it is the framing of the experience that engenders interaction; bed with bed, moving body with moving body, projected and real. It offers something both known and unknown, familiar yet defamiliarised by the virtual body and the opportunity to lie down with someone – virtually – *without consequence*. As well as the violence, Kozel describes the *intimate* improvisations she performed in with strangers on the other bed; the movements she enacted on one bed virtually interacting with the movements of the stranger on the other. But whilst the situation encourages a sense of play and exploration, the creative extent to the interactions is arguably limited to the literal world from which the body is mapped; it enacts its embodied metaphor – the relationship and intimacy of sharing a bed. This is its context, its theme, and its content; but if we want to use the affordances of digital technologies to produce new physical thinking (or choreographic thought-action), then how far does the body have to move away from its literal mapping?

Sonic transmission of choreographic instructions possibly opens up a greater interpretative gap for a participant than the visual mapping of their movement data – if sound acts as the digital output for physical movement, then there is a larger gap between the real body and its digital representation, that which stimulates the feedback circuit and further movement. There are copious examples of projects that couple movement to sonic outputs using wearable or object-embedded sensors or motion capture to stimulate movement play, for example *Rolling Stones* (Hellion Trace 2021a), *Sonified Body* (Murray-Browne 2021), or performance work *Les Gestes* (2011-13) by Van Grimde Corps Secrets, in which a spine-like technological instrument, worn and/or physically manipulated by dancers spatializes and transforms the music (Van Grimde Corps Secrets 2011). Hellion Trace (formerly Guerilla Dance Project) premiered *Rolling Stones* at the South Bank Centre, London and is a public engagement project that used physical artefacts to encourage play; these 'Henry Moore-esque sculptures', as they describe them, emit sound in response to movement and touch (Hellion Trace 2021a). Participants at the South Bank Centre can be seen experimenting with these objects in filmed footage (Ibid.). In doing so, there is a disruption to their habituated movements; they begin to 'dance' with and in relation to the objects and the sound they elicit. They play with how they move them through the air; they jump with them, spin them, and lift them overhead; they change the dynamics with which they move them – all choreographic decisions made unwittingly whilst exploring the effect the movement has on the soundscape.

There is great mileage in exploring how sensor-embedded objects can create a correlation between sound and movement, becoming each other's creator and stimulant in tandem. Equally, the rendering of movement data as sound can release interactors from the spatial restrictions associated with visual mapping of bodies, especially with research projects such as *Sonified Body* seeking to develop a more intuitive relationship between movement and sound-creation through 'using AI to generate a bespoke movement language out of how someone already moves' as opposed to 'designing a system for someone to learn how to move to interact with it' (Murray-Browne 2021), thereby countering problems often encountered between interactive systems and dancers whereby the latter are required to 'adopt specific physical techniques to play the instruments of the medium' (Birringer 2008). However, *Tools that Propel* ended up taking more influence from participatory installations and public engagement projects where movement is stimulated and rewarded by interaction with a visual environment.

Between Me and My Extraordinary Other

The development of *Tools that Propel* was influenced by two interactive installations in particular, Klaus Obermeier's *Ego* (Obermaier 2015), and *dance room Spectroscopy* created by a team led by David Glowacki (Glowacki *et al.* 2011). Examining how both implicate interactors within the feedback loop between their movement and the visual output, we can gain insights into the importance of the specific

materiality of the digital rendition of the 'human body' that reflects and responds to the actual bodily movements in the space. *Ego* projects stick figure people on the wall; these are seen by participants to be in response to their own presence. It uses a single Kinect sensor to capture movement data from interactors, which is then passed through MaxMSP to map joint data to curves. When the interactor enters the room, the projected lines are in a tangled mess but quickly establish themselves as his/her reflection moving as he/she does. The interactor is compelled to move, twist, turn, jump, and contort themselves, excited by the simultaneous movement of the reflection – and importantly, they seem disinhibited by the fact that they do not directly recognise themselves in the stickman/woman. The reflected body is far enough removed from the actual substance and matter of the human body to not feel like they are really having to watch themselves 'dance' in a mirror. As another interactor comes in his/her reflection establishes and then swaps over with the other stickman/woman and each person's movement is mapped onto the other's reflection.

The stylisation of the human figure, reduced to bendy lines, is cool, seductive, and full of character. The interactors look like they are playing a game with their counterpart. The classic drama game of mirroring is usually about working as a team, not trying to trick your partner but tuning into them and moving together. Here, in Ego, the interactor is rewarded with a partner who never fails to reflect his/her movement and even makes it bigger, longer, stretchier – the projected figures have limbs that extend and elongate, are elastic and bounce beyond the interactor's own proprioceptive space. Perhaps this encourages them to reach beyond and outside their own boundaries, to move in new ways? The tacit understanding – of the gap between their real and projected selves – reverberates in the gap between the movements they feel themselves doing and those that they see simultaneously reflected and feeds a playful exploration of their bodies in motion.

Equally, it is a beautification of interactors' movements into something similar but 'other' that is key to the experience within *danceroom Spectroscopy* (*dS*), a dance-physics installation that was designed as a public engagement project to give people understanding of the nano-sphere. *dS* was developed to give people a tangible understanding of the dynamic behaviour of the atomic world, enabling interactors 'to have a real-time immersive experience of "becoming" energy landscapes' (Mitchell *et al.* 2016: 140): '[m]icroscopic dynamism determines the macroscopic properties of matter and thus shapes our phenomenological experience of nature' but '"seeing" this [dynamic] behavior requires temporal and spatial resolutions that far exceed the capabilities of our eyes' (Ibid.).

Unlike both *Tools that Propel* and *Ego*, it is not the joint data that is mapped to the visual image. Interactors' movements are captured through 10 depth sensors and '[a]n interpolated representation of this depth image' becomes 'a dynamic energy landscape, the ebbs and flows of which correspond to people's movements within the space' (Mitchell *et al.* 2016: 140). The interactors 'sculpt the dynamics

of the atomic ensemble in real time' (Ibid.) and gain experiential insight into scientific phenomena previously intangible and invisible to the human eye. Seeing something they can't normally see, the disruption to interactors' understanding and experience in the physical world feeds their movement exploration. People's movement impulses are fed back to them in beautiful, almost spiritual images and in their own unique contribution to the sonic output. Examples of audience commentary after the experience include: 'So I was a blob, or I was a line, or I was on fire'; 'You weren't an individual person, you were like…. People'; 'You kind of feel self-conscious doing it but it's kind of so much fun that you don't care' (*dS Installation* 2011). *danceroom Spectroscopy* encourages and facilitates interactions. It creates the space and the structure for improvisation, choreographing people in relation to each other whilst they choreograph their own movements in response to their projected representations, rendered into something mystical and yet acutely and specifically full of matter.

Qualitative feedback of *danceroom Spectroscopy*, gained from 60 participants, suggests that some people were confused by the more abstract renditions of themselves, and were more comfortable when the energy field was more representative of the human body – however, those who had seen *Hidden Fields* (a choreographic piece that took place in the installation prior to public interaction) could better relate to the abstract representations (Mitchell *et al.* 2016). The idea of discoverability in the feedback loop is key to sustaining participants' enjoyment and connection. *The Sound Maker* at Simon Fraser University invited participants to discover intuitively how their movement affects the sonic output in different ways to investigate how mapping the relationship between input (movement) to output (sound sequences) through embodied metaphors (for example, more activity makes the sound louder, less makes it quieter) means the interaction is both more intuitive for users and also discoverable (Antle *et al.* 2009). In developing these kinds of interactive environments or translating this learning back into arts activities designed for tablets (combining screen-based interactions with tangibles or kinetic sensors and cameras), it feels important to investigate the discoverability of the user interface and to focus on how the user interface architecture might harbour a learning curve (Birringer 2004). It is also worth thinking about how 'creative' this sense of learning feels.

Yet, regarding *danceroom Spectroscopy* important insights can be gleamed from the fact that '[in] general, installation participants consistently [had] the most enjoyable experience when their encounters with dS [took] them on a sort of narrative journey, transitioning from extremely literal, 'personshaped' energy fields to more abstract energetic representations' (Mitchell *et al.* 2016: 145). This is valuable learning for developing interactive systems that facilitate choreographic development – there appears to be a need for the virtual dancer/reflection/feedback to bear some similarity to the familiar human bodily form, whilst not necessarily being absolutely identical to it. As with *Ego,* there is a sense of liberation, disinhibition, even engagement that comes about when the 'reflection' is, whilst

strangely, comfortably, familiar, also made 'other'. As one interactor stated of their experience with *danceroom Spectroscopy*: 'I wanted not to have an old body anymore, I wanted it to flow, you know, and then yet, on the screen it kind of just lost who I was and just became a beautiful mark' (*dS Installation* 2011).

But the question remains: if we consider the intersecting spectrum of dynamics in movement – that which we might explore in dance improvisation and choreography – then how sensitive does the technology need to become to interpret this? Mark Coniglio draws an important parallel between dramaturgy and the relationship between the human performer and the digital system with which he/she interacts in performance (Coniglio 2015). Discussing dramaturgy in terms of the subject and frame having a conversation, each carefully and precisely balanced, he wryly states: 'And, of course, we should seek to achieve no less with our ultra-responsive-Kinect-and-Arduino-powered-intelligent-agent-based-media-intensive-low-latency-real-time-interactive-hyper-instruments, right?' (Coniglio, 2015: 274). His joke is predicated on the prevalence of digital performance works in which there is a 'palpable imbalance between the artwork and the technology that was purportedly there to support it' (Coniglio, 2015: 274). *Rolling Stones*, *Ego*, and *danceroom Spectroscopy* as participatory installations offer balance in terms of the dramaturgical relationship between interactors and their digital others. But what if we expect anything further (in terms of movement complexity or learning) from this interrelationship between the human body in motion and either the object giving out sound or the virtual body extending the physical body's spatial limits? Does the encounter with the technology simply overpower the creative experience?

Levels of Attainment

Clapping Music App (London Sinfonietta *et al*. 2015), whilst not a movement app, provides an interesting case study for the use of technology to increase people's embodied knowledge, as opposed to just provoking play and exploration. It was developed for iPad and iPhone by a team involving researchers, musicians and technologists from the London Sinfonietta, Touchpress and Queen Mary University of London, and is designed to foster greater rhythm in users as they are challenged to 'tap' (on screen) the complex rhythms of Steve Reich's Clapping Music. Importantly, it draws on game design in the way that it hooks the user into a progressive journey through increasingly difficult levels of attainment. Johannes Birringer discusses that 'in game design the programmer generally follows the logic of three levels: (1) the attraction level, allowing the user to become interested and slowly comfortable with the environment and the rules; (2) the engagement level, which draws the user into the game and allows quicker and more competent actions; (3) the experience level, involving increasing complexity to sustain curiosity, energy and excitement with the player' (Birringer 2005: 160). The three-level logic can be seen in Clapping Music App: the original piece is made up of 12 different pattern

combinations and 'transitioning from the first pattern to the second pattern and so on is equivalent to progressing through levels in a game' (Burke et al. 2015: 39).

The team behind *Clapping Music app* deliberately chose to base it on gaming to 'hook in' a generation of digital natives and see how this kind of approach might serve to engage them; they aimed to 'inspire non-musicians who are intimidated by musical jargon to learn musical skills in a non-didactic and enjoyable way' (Burke *et al.* 2015: 8). Interestingly, 'overall accuracy in the game was highly correlated with self-reported musical sophistication, suggesting that previous musical training and active engagement with music were factors for success in the game' (Burke *et al.* 2015: 27). Equally, within the focus group, whilst 'a small subset emerged of musically experienced users who played the game very competitively' there was also another 'small subset [who] reported being frustrated by their lack of progress in the game, and became bored' (Burke *et al.* 2015: 5). Whilst the majority of the 59 focus group participants had some, if not substantial, music experience, it was notable that 'players who scored higher on the Musical Sophistication index tapped the patterns more accurately, and so probably performed better in the game' (Burke *et al.* 2015: 33). Consideration to how engaging *Tools that Propel* is for a range of dancers with more or less embodied knowledge has been paramount during its use within various workshops and in the studio, as is discussed in Part 2. It is also why the functionality of both participatory apps and installations and choreographic software used by professional dance companies is analysed here.

The research partners involved with the *Clapping Music App* concluded that 'the gaming paradigm is something that can be applied to digital engagement in other art forms' (Burke *et al.* 2015: 60). They celebrated the success of the app for developing the already inherent, but eminently trainable, human attribute of rhythm, rather than focussing 'on a specialised knowledge area of a particular art form' (Burke *et al.* 2015: 60). Arguably, whilst it does improve clapping accuracy, at least for those with the requisite musical experience to rise to its challenge, it is possible that engaging people in participatory arts practice through new technologies necessitates an element of imaginative learning and connective growth beyond mere skill development. The app demands a task be performed and gives the user a sense of needing to find the trick to fulfil it, but the evaluation of this project showed a decline in many users' interest levels over time before they completed all the rhythmic patterns. This might have been due to the difficulty of the task, but it could also be put down to the instrumentalism of the approach.

In his comparison of interactive art to video games Massumi writes:

> You often feel there's a trick you need to find and master, and once you've done that, you lose interest because you've got the feel of it and know how it "works". When something loses intensity instead of becoming more compelling when you get the feel of it, it is a sure sign that it is

operating more on a level of predefined objective function than fully lived relation (Massumi 2011: 46).

The experience of using the *Clapping Music App* can be a stressful one; it can create tension. The localisation of the engagement - through the finger on screen – can feel non-intuitive and disconnected to a bodily sense of rhythm. The question arises: why not use a sensor that responds to the sound and vibration of a clap itself? Whilst the research findings state that 'more than a third of the group agreed' with the statement 'my rhythmic skills have improved since playing Steve Reich's Clapping Music' (Burke *et al.* 2015: 51) it is equally revealing to read the notes that state that '[o]ne person overrode the response choices and wrote "sometimes I enjoy, sometimes it gives me a headache" and '[another] commented "Sometimes I'm frustrated because it doesn't work when I clap"' (Burke *et al.* 2015: 36).

Reflecting the Real

User experience design bases our interactions with technology on our already embodied reasoning of the environment and objects within it (Dourish 2004): as such, the precepts behind both *The Sound Maker* and the desire for an actual clap rather than a tap on the screen to make the clapping sound in *Clapping Music App* make sense. This latter desire arises even whilst tablets such as iPads are entirely designed to be intuitive – so much so that children are growing up with inherent ability to navigate seamlessly their informational structures – and is possibly based on our embodied reasoning which is changing due to experience of other types of sensors within technologies which suggest that this is possible. In this way, the technological interfaces that we communicate through and interact with are often designed to not only reflect the real but to embody the conceptual systems of analogue experience.

The fact that so many interactive installations make people play – often in ways that are about releasing them from inhibitions and physical restrictions – is often based on an embodied understanding that movement creates movement. The interactor is rewarded in their movement by visual and sonic outputs that in turn serve to increase their movement exploration and play; we see the import of the research behind *The Sound Maker* here – that is, more activity makes the sound louder etc. Yet, artist Alex May's *Shadows of Light* (May 2017) works in the opposite way: it encourages a slow interaction in order to yield visual changes in the installation. A different quality of our bodies in relation to our environments and our embodied minds is captured.

Visitors to the installation are rewarded for standing still; the installation slowly takes their silhouette and uses it as a digital stencil. It 'sprays' paint that starts to drip and spread into the silhouettes (or memories) of others. Of course, the enjoyment of the digital rendition of spray paint does come from embodied reasoning and experience born of the analogue world, but there is a

subversion of the metaphor that activity is productive. It feels as though this work is speaking against utilitarian post-industrial technocratic tendencies which optimise activity and production and advocating for stillness as part of embodied encounter with the world of which we are part. Nicolas Salazar Sutil discusses the impact of the 'emergence of industrial modernity defined by how well (i.e., how productively) people move in the workplace' on human motion (Sutil 2015b: 35). He outlines the correlation between movements that are 'considered to be "good" for machine interaction and device operability' and those 'deemed good as far as work and productivity are concerned', calling it a '"kineconomy"', 'an economy through movement' (Sutil 2015b: 36). *Shadows of Light* subverts the correlation between movement, productivity, and machine operation: it goes against the notion of time-effectiveness sought within Soviet cybernetic research underpinning the 'state-sponsored laboratories of industrial work movement' which Sutil discusses (Sutil 2015b: 35), industrial production more widely, and indeed capitalism, all of which are brought about by the regulation of the human body in correspondence with machinic production. Yet, in some ways *Shadows of Light* is creating its own 'kineconomy': the installation reveals just how human movement can be conditioned by digital interaction.

Shadows of Light is also countering an objectified sense of time as fragmented and compartmentalised into distinct and universal units (of labour): internal rhythms, somatic and embodied sense of time is re-introduced and given value through the emergence of individual imprints at different moments, challenging the synchronisation of time and work that was brought in with industrialisation (Sutil 2015b). The trace left behind by a visitor's imprint bleeds into those of others, left at different moments; there is no synchronicity to these imprints nor to the lived experiences they re-present. They are overlapping, not serial, thus merging timelines and potentials. It is a reflection of the real; but not the real to which we are often expected to adhere. It is offering possibility and insight into freer, less conditioned, experience and consequently opens up curious questioning of our conceptual systems and how they are embodied. As we will see in later chapters *Tools that Propel* does this too; it is advocating for technological experimentation that seeks to counter our prevailing conceptual systems (in varying ways and to varying degrees). In doing so it seeks to destabilise our embodied minds, to throw our bodyminds into a state of curious questioning, in order to open up new enquiries - both in terms of choreographic thought-action and embodied philosophical engagement with how we live in the world (though this latter enquiry was less an aim and more an accidental outcome).

ARCHIVED, ELUCIDATED AND DISRUPTED BODIES

Tools that Propel draws on a range of projects that explore how digital technologies can both enable greater engagement with archived choreographic works, for example Siobhan Davies' *RePlay* (Whatley 2013) and the *Digital Dance Archive*[21] (Fensham 2017) and elucidate embodied knowledge within choreographic practices, for example, William Forsythe's *Improvisation Technologies* (Forsythe *et al.* 2012) and *Synchronous Objects: One Flat Thing* (Zuniga Shaw 2011).[22] The ability to display graphically the invisible connections between dancers and between body parts, across time and space, and analyse the multimodal nature of choreographic works, has given greater value to the transferable knowledge within dance (Leach 2017). James Leach argues that the development of choreographic objects which use digital technologies to impart the knowledge within their makers' choreographic processes is compelled by both an internal desire to communicate the thinking within dance creation, thereby making it more accessible to the public, and an external impetus propelled by the social dictates of the knowledge economy (Leach 2017). The attempts to an/notate movement and choreographic thinking could be argued as driven by the value-dictates of dominant hegemonies which prize the written over the performed, the fixed over the ephemeral; regarding notation, Victoria Watts has suggested that the desire to document dance in a written form can be understood in terms of a call to create a 'literature' of dance, seeking to give it a legitimacy that it somehow lacks (Watts 2010). But as Emilie Gallier argues in her exploration of the performance of readership as a mode of participation, 'William Forsythe's choreographic objects are essential examples of an initiative instigating a readership that awakens choreographic thinking' (Gallier 2015: 13). Being able to reveal choreographic knowledge also increases the ways we can interact with it, participate within it, and make it available to form part of improvisation and dialogue.

William Forsythe discusses *Improvisation Technologies: A Tool for the Analytical Dance Eye* (originally created for his dancers and then released as a CD-ROM) as being '[m]aybe less about how to improvise than about how to analyse when you're improvising. If you're dancing, how do you actually say what happened? The technique is one way of taking mental note of what just happened to you while improvising' (Haffner 1999: 36-37). The annotation is created in the CD-ROM by graphic animated lines placed on top of Forsythe's movement to elucidate its properties. This is designed to contribute

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[21] These websites are no longer accessible; hence I have referenced articles discussing the projects.

[22] The web-based *Synchronous Objects* seems currently inaccessible due to the discontinuation of Flash player by Adobe; hence, I have referenced an article written by Norah Zeniga Shaw who developed it with Forsythe.

to the development of new embodied understanding in those using it, which in turn leads to the exploration of new movement possibilities when they improvise. Forsythe states that '[t]he purpose of improvisation is to defeat choreography, to get back to what is primarily dancing' (Haffner, 1999: 24) and that:

> the biggest difficulty in the kind of improvisation we practice is not consciously shaping your body, it is actually letting your body fold and to develop a more reactive and a many timed body as opposed to a shaped body. At any given moment, you have to be able to say: what is the potential of this configuration of my body. And at one point, I guess a long way down the line, you know intuitively what it is. And then I would suggest you try the results of that which you don't know, move on from there, with no idea how it's going to turn out (Haffner 1999: 24).

Improvisation Technologies teaches how to develop skills for improvising; building up these new habitual skills – using mental pictures of orientation, reorientation, lines, compression, extensions, extrusions etc. – the dancer is able to produce more complex movement, instinctively, to intuit changes and potential choreographic manipulations, and to draw on richer sources of vocabulary. In doing so they also break their already-embodied habitual movement – their default, go-to vocabulary, for example. The new knowledge underpins the improvisational capacity of a dancer, leaving them ready to express themselves more articulately through movement. The performance of readership that Emilie Gallier points to in *Improvisation Technologies* is indeed one that activates new embodied thought, understanding and action as it implicitly builds the skills, attention, awareness and articulacy of the improviser (Gallier 2015). Yet in relation to this thesis, it is important to note that choreographic objects such as *Improvisation Technologies* are not directly interacting with the improviser in the moment of dancing. They can be used, and returned to over and over again, as a resource that impacts the dancer, but not as an active agent in the moment of improvisation.

Equally, though one of the aims behind *Digital Dance Archive* was to explore how a 'transversal temporality of dance images' would 'modify understandings of continuity or adaptation within choreography' (Fensham 2017: 71), the focus of archives by their nature is *backwards*. Digital archiving has made the canon more available, according to a range of categorisations and search criteria which open up access to it, there to be 'raided and looted' (Burt 2003: 36) but does not generally facilitate creative processes that discover something new within the loot.

Naturally, the interest with archiving choreographic works and documenting them in different ways to written notation goes along with the wider concerns with disseminating performance recordings that have already dominated the cultural sector's digital interests for some time. In dance, the focus on documentation and archiving is natural perhaps, given the fact that none of the various systems of

notation, such as Labanotation and Benesh Movement Notation, are particularly widely used, due in part to the difficulties of learning them and the complexities of inscribing movement. Equally, as notation renders movement into symbols it already bears some relation to computational systems. But how far might inverting this process – that is, using a symbolic input to produce or stimulate a movement output – close down potential in new movement creation, whereby the symbol leads only to a precisely signified gesture? The retrospective approach to dance through digital interfaces so often seems to occlude the potential of digital technologies to facilitate choreographic making and improvisation – not just for professional dancers, but people who want to rediscover the innate sense of movement inherent in humans, and to understand compositional processes and choreographic structuring. How might digital technologies structure and shape creative choreographic tasks, provide spatial structures that disinhibit and disrupt the 'known', and catalyse and develop choreographic potential in an interactor?

Destabilising Bodies

The AI-driven choreographic tool *Living Archive*, developed by Wayne McGregor in collaboration with Google Arts and Culture, was designed to create something new from his archived material (Girshig 2019).[23] Trained on movement from McGregor's archive it creates novel choreographic ideas which might not have been conceived by the dancers. This might be one of the latest iterations in the burgeoning relationship between digital technologies and choreographic processes, but using computers to generate, as well as elucidate, choreographic ideas is not something new. The development of software designed to destabilise the choreographer's or dancer's habitual movement vocabularies, and historically-embodied thinking patterns, goes back at least as far as Merce Cunningham's use of *Life Forms* (Credo Interactive Inc. 1999); and indeed, Cunningham's chance methods used a far more basic technology to bring about surprising choreographic ideas – dice. For its capacity to stretch the limits of human choreographic thinking, Merce Cunningham saw *Life Forms* as seminal in the development of dance, stating that: 'Computers are the future of dance. People just don't understand the future possibilities of the computer and dance' (Jacobs 2020). Through his particular way of using *Life Forms* Cunningham created choreographic phrases using key-frame animation that often defied the laws of physics and human physicality (Coniglio 2015). His demands on dancers to realise sometimes near-impossible movement sequences, originally created with the

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[23] There is also a public facing version of it that allows people to create their own movement sequences by tracing a trajectory across poses captured and tagged within the archive (*Living Archive* n.d.).

software, brought about unexpected, imaginative and novel solutions within his dance creation in the studio (where Cunningham did not take the computer).

Comparatively, another computational system for choreography, the *Choreographic Language Agent (CLA)* created for Wayne McGregor by OpenEnded Group (Downie and Kaiser 2009) expanded the dancer's physical imagination and acted as a form of interactive notebook. As Scott deLahunta discusses, '[w]ith its digital memory, the CLA uniquely documents aspects of [the dancers'] decision-making – making part of the choreographic thinking process available for revisiting and examination' (deLahunta 2015: 226). Yet in contrast to all of these examples, *Tools that Propel* aims to reflect back and challenge the movement decisions of the dancer in a real-time interaction. In this, it draws influence from the *RAMDanceToolkit* (YCAM InterLab 2013), as well as the interactive installations already discussed.

Developed with the involvement of the Forsythe Company, in *RAMDanceToolkit* computation transforms the dancers' tracked movement data into visual geometric outputs which reconfigure what they are doing. With this system, which like *Tools that Propel*, is utilised during improvisation, the dancer's movement data is captured via motion capture sensors and transmogrified by a computer which outputs it with a visual geometric suggestion that relates to what it reads in the movement. Virtual stick-figure dancers stimulate the dancer's improvisational decision-making and improvisational rule-creation, enriching the potentiality of the landscape. Scenes or filters – such as 'stamp', which makes a visual imprint of the dancer at any moment in time as a reference point for the dancer, or 'joint' which sends out lines in the direction each joint is travelling, or 'monster' which makes a stick-figure version of the dancer and distorts it, moving its limbs around to different points but still in the same orientation – are almost like seams, where potential can be found hiding, in that they are anomalies from the real world of the body in improvisation. Perhaps they act as a kind of release from embodiment, which causes the dancer to reflect and change the rule that conditions their movement improvisation.

There is indeed a productive and creative gap between how a machine perceives and ascribes meaning to movement and how a human dancer or non-dancer does. Indeed, Nikolina Pristaś et al. discuss this idea with reference to *Whatever Dance Toolbox*, which was created through a collaboration between performance collective BADco. and German interaction developer/artist Daniel Turing (Pristaš *et al.* 2017). *Whatever Dance Toolbox* is described as 'a suite of software tools designed for analysis and development of dance and movement' that is a 'technically non-demanding set of real-time video analyses which can work as an interactive mirror by displaying various transformations of a real-time video image and/or visualisations of the body/movements actually being performed' (Pristaš *et al.* 2017: 118). Nikolina Pristaś et al. state that 'moving in front of an interactive mirror induces a split in the

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attention of the observer/dancer so that s/he needs to consciously process two images of her moving body, an internalized image and an on-screen, transformed one, almost simultaneously' (Pristaš *et al.* 2017: 118). This schism, seam, or 'split in the attention of the observer/dancer' can operate in different ways. With *RAMDanceToolkit* perhaps it serves to disrupt the dancers' default movements, forcing them 'to try the results of that which you don't know, move on from there, with no idea how it's going to turn out' (Forsythe in Haffner 1999). It serves to prompt the dancer to make new rules to impact their improvisational decisions. Certainly, part of the effect of the ruptures between human and machinic perceptions of reality in *Tools that Propel* is to catalyse new improvisational rules for dancers.

As will be discussed in 'Negotiating with Bodies of Knowledge', the failure - or refusal - to answer the question of what a movement is, also causes small ruptures in the solid structures of our perceptions and received constructions of reality. This is key to introducing quality to the movement, beyond the focus on motion in the purest sense, rather than the expressive potential of the human body, that we can see in many of the software or systems developed for choreographers. In this, *Tools that Propel* perhaps departs from *RAMDanceToolkit* which Yoko Ando, a lead artist in its development, says is about 'motion, not expression' (*Film about RAMDanceToolkit* 2013) and aligns more with the creators of *Whatever Dance Toolbox* who state that '[t]he differences between human perception of movement and the way a machine represents that movement enables a shift in the way dancers and non-dancers alike relate to the creation of movement in terms of placement, quality, and spatial and temporal organization' (Pristaš et al. 2017: 118). Of course, it is interesting to recognise where the sense of 'quality' comes from when we are talking about interaction between computation and live dancers. As remarked by the MovingStories research group including Thecla Schiphorst and Tom Calvert at the Simon Fraser University in Canada, there is a 'large gap (or chasm) between capturing movement *data* and representing movement *meaning*' (Schiphorst and Calvert 2015: 246). They state that '[w]hile movement *data* is more, and more readily, available in the burgeoning growth of consumer sensing technologies, from Microsoft Kinect, to Leap Motion, the iPhone, Fitbit, and the Apple iWatch, movement *meaning* is much more difficult to extract, recognise and tease out from all of this data' (Ibid.). The team worked on *idanceForms*, an iPad app facilitating the development of choreographic sequences on a timeline using keyframes like in *LifeForms*; the aim with *idanceForms* however, was to move away from manipulating body poses with a mouse and to use the actual body physically moving interactively with the app. Their research was also focussed on how to take advantage of the embodied affordances of movement within mobile technologies, using the sensors within tablet devices, including camera, touch surface and accelerometer, and eventually the integration of 3D depth cameras (Schiporst and Calvert 2015). Using the accelerometer and gyroscopes within tablets and smartphones their research aimed to measure and capture the 'dynamics of a live movement by recording the acceleration/deceleration signal' (Schiporst and Calvert 2015: 254). They argue that '[t]his cannot

replace whole body motion capture but it provides a very direct way to demonstrate the quality (affect) of movement' (Schiporst and Calvert 2015: 254).

Equally, and perhaps more importantly for this research project, Nathaniel Stern argues that '[w]hile the computer is always limited in its responses, which are programmed, there are limitless possibilities in how we investigate the space of the situation that program creates' (Stern 2013: 44-45). He argues that '[t]hings like feedback loops, layering of time-based forms, or multiple and proportional sensors can create ever-more affective digital spaces that might highlight the body, interaction, performance, and relation, rather than technology and its coded replies' (Stern 2013: 45). In relation to affect, and maintaining attention on the interactor's movement, Erin Manning discusses the importance of recognising and making felt the failures in technology (Manning 2012). This notion of *feeling* the failure, *feeling* the gap (the seam, the schism, the split in attention), feels important.

Affective Bodies

Tools that Propel departs significantly from *RAMDanceToolkit* in its aesthetics and the visual rendition of the body's movement after its digital transformation. With *Tools that Propel* the virtual bodies reflected back are literally the dancer or other dancers, with no transmogrification to their appearance or capabilities except through the destabilisation of the linear trajectory of time and the consequential disruption of a dancer's understanding of their body in motion. The dancer is confronted by themselves performing movements that might start halfway through the trajectory the dancer previously associated with that movement, breaking into the train of their physical thinking, for example. Here we come back to the important question of 'body' that emerges frequently as we question what kind of visual outputs make people want to move; but it is not just about what kind of shape or visual look of body – whether it a geometric rendition as in the *Choreographic Language Agent*, or a stick figure (disfigured or otherwise), or a graphic or silhouetted body, as in *Whatever Dance Toolkit* – but also the affect of it.

If we understand the bodily capacity to be affected and affecting as intricately tied to tendencies, memories, habits and thoughts, any one of which has the capacity to emerge at any point, 'a virtual co-presence of potentials' (Massumi 2015: 5), then in the interaction between dancer and computation there are many facets to the nature of the digitally rendered 'body' – implicit and explicit, environmental and relational, that might affect the efficacy of the feedback loop to stimulate further movement exploration. With *RAMDanceToolkit* the geometric renditions of the body of the dancer require significant mental translation on behalf of the improviser, but with *Tools that Propel*, whilst this research focusses primarily on its use in the studio by dancers and dance students, the initial aim was for anyone and everyone to be able to engage with it in participatory settings. Arguably, an interactive

learning environment to engage participants with less training in dance and choreographic making needs to evoke expression as much as motion and the feedback needs to be more embodied than the small stick figures and graphic movements of *RAMDanceToolkit.* It is a relational kind of expression I am talking about – one that evokes and concerns an ecological aesthetic both in process and form perhaps. It is not about personal expression per se being visible, signifiable, or readable in the movement data or its transmogrification; hence in fact the reason why this research aligns more with Stern and Manning's respective concerns with the affective space and technological failure as affective rather than the technological potential to read dynamics through different smartphone sensors held by the dancer.

Pristaš et al. discuss BADco's work as making visible the 'process of compositional, improvisational, and dynamic decision-making in the very act of performing' (Pristaš et al. 2017: 121) and state that the 'performer's decision-making process, in micro-situations and micro-events on stage, is firmly grounded in their capacity to analyse the environment around them, including, in some cases, audience behaviour, the network of the distribution of attention in the performance space, and also the internalized effects of temporal and spatial organization of movement that come from working with various software' (Pristaš et al. 2017: 121-2). Whilst again, *Tools that Propel* has a different aesthetic to *Whatever Dance Toolkit* (the affective nature of reflecting the room as it is/was – present and past overlaid – will be discussed in Part 2) it is interesting to find that there are similarities in terms of both the intention and artistic ethos. These lie in the shared concern with twisting and disrupting the flow of normal physical conditioning of movement – temporally, spatially, causally etc. – though each do this very differently, with *Whatever Dance Toolkit* incorporating a range of specific algorithms which treat the movement in different ways, such as turning the image backwards, or delaying it, and *Tools that Propel*'s affordances being born of its constant assessment of whether it has seen the current movement before or not. Yet perhaps more importantly, both systems are created through a similar understanding and belief that interaction requires a relational and environmental approach to improvisation and movement creation.

Susan Kozel states that 'the distinction between materiality and immateriality in the technology is movement: as moving beings people take on an alternative materiality, while objects become immaterial in their inertia' (Dixon 2007: 218). As such, separating out 'living, moving human bodies' and 'inanimate objects' in her 'conception of "alternative materiality" she discusses her 'inability to grasp' a rose whose 'outline' 'she could only trace […] in virtual space or pass her hand through' and suggests it was as such 'fundamentally immaterial' (Dixon 2007: 218). She focusses on 'its lack of kinetic or emotional response (in stark contrast to the bodies of her virtual partners)' meaning that it did not have a 'material presence' (Dixon 2007: 218). In contrast, the interactions with others through her virtual

body brought her back very materially to how she experienced her corporeal body – 'her real body rebelled […] became stiff and painful […] her digestive system and internal organs were beset by aches and cramps' (Dixon 2007: 217). Yet, whilst in the public installation *Telematic Dreaming* Kozel felt the bodies of her partners as material presences, a key problem with digital interventions in choreography has been their lack of 'body' or matter, in terms of substance, feeling, touch, physical response. This has been the case whether the bodies were visually represented by keyframe or stick figures, or configured as movement beyond and outside of the human body.

When the OpenEnded Group and Wayne McGregor developed the *Choreographic Language Agent* the aim was to create an 'independent dance agency […] an entity that could respond to and solve the kinds of choreographic tasks that [McGregor] set for his dancers' (Leach and deLahunta 2017: 462). James Leach has described the Choreographic Language Agent as a 'kind of prosthetic dancer's brain' and 'an extended digital notebook' (Leach and deLahunta 2017: 463). It was built on the foundations of extensive, invaluable research into how the choreographic process works and was designed to produce choreographic possibilities that are different from those of McGregor's company of human dancers, inspiring them to explore and investigate new terrain. Leach states that the 'agency' of the *CLA* 'was a function of having some degree of autonomy, tightly coupled with the choices the user would make' and discusses how it was not the 'choreographic entity that had been envisaged' (Leach and deLahunta 2017: 463). This revelation led to a further investigation into the need for the agent to have a 'body' and what that meant for McGregor and his dancers; following this came the creation of *Becoming*, a more recent iteration of the *CLA* which McGregor described as an 'eleventh dancer' (Leach and deLahunta 2017). *Becoming* was designed to give 'body' to the computational tool, reflecting McGregor and his dancers' desire for something that had a sense of matter, energy, presence, and movement.

Leach writes that

> [m]aking movement material with others, or with others in mind is about the relational aspects of movement. When articulating the qualities of working with others in a studio, or in tasking situations, dancers said that they are aware of a constant negotiation of feeling and presence, of desire, shame, imposition, power, politeness, domination, or facilitation. These are qualities *felt and worked with* in making movement material (Leach and deLahunta 2017: 464).

As such *Becoming* was developed to be a bodily presence in the studio with the dancers, 'an aesthetically and kinaesthetically compelling presence', designed to 'elicit a kinaesthetic response' in dancers working with and alongside it (Leach and deLahunta 2017: 465). It still does not explicitly

respond to what they are doing, however. It is not 'in constant negotiation' with them even if it is constantly present and constantly negotiating its own body.

NEGOTIATING WITH BODIES OF KNOWLEDGE

Let us remember the broad research question on which this thesis is premised: *how might we create real-time interaction between technology and dancers that catalyses growth of embodied knowledge?* If motion capture technologies are used in the development of an interactive installation, as *Tools that Propel* started out its life, then there arises a question of what to do with the motion data being captured and how to render it as an output that stimulates the interactor. I have explored this partly in terms of the level of abstraction (or not) of the visual or sonic rendition of the digital body in motion and the situation in which the interactor (re)encounters their own movement data or another's. But whilst a human material body is always-moving (Stern 2013; 2018) the motion data in an interactive installation – or choreographic improvisation system – might not be used continuously; indeed, one way of transmogrifying the data in its rendition is to segment it into discrete components of information. If so, then how do we determine its segmentation? Certain codified dance techniques – ballet, for example – and some notation systems have specific named steps, positions, and corresponding signs (graphic or symbolic), but much dance – contemporary and improvisational forms, for example – do not necessarily break down in representationally convenient ways.

The phrase 'question of movement' in the title concerns the question of what a movement is; for this is a problem that faced us in the development of *Tools that Propel.* In fact, the difficulty of determining *how* to break down movement into units of discrete components or a specific vocabulary, at least in improvisational dance and contemporary choreography, that is, non-codified dance forms, offered its own solution: *not doing so* brought about new choreographic thought-actions in the dancers interacting with it. In the separation between subject and object, we understand that there is a gap between the bodily experience of a movement and any sign representing a movement. But how might the difference between perspectives on either side of the gap lead to a dialogue – real-time interaction – between them through which something new might emerge? On one level, this might be new potential choreographic forms or understanding of what constitutes dance. The extraction of dance from its 'body' to document it in systems like Labanotation already began the journey towards the ontological challenge to dance presented by Hetty Blades (2012) – there is no figurative depiction of the human body in its signs, but its premise on the analytical study of what constitutes movement forewarns its capacity to exist beyond the body. Indeed, Heiland states that Labanotation has been seen as being 'similar to engineering code, that it must require logical mathematical intelligence and that it is a second language' (Heiland 2019: 166). A clear difference, of course, lies in the fact that a

software such as the *Choreographic Language Agent* can render the movement visible – embody it – without a body, whilst as Victoria Watts argues, a notation score requires the human body to reinterpret it in movement – in doing so, translating the language, and giving body back to the dance (Watts 2010). For Watts, and with *Tools that Propel*, there is a relational interaction between the live dancer and the an/notation of dance; and new emergent form very much comprises the moving body. The questions regarding what a movement is, how you distinguish one from another, and where they begin and end are never answered in this thesis; ultimately, this is precisely because it is in not knowing the answers that their potency really came to the fore. In many ways, it is the relatively arbitrary way that the system parses movement to differentiate it that has led to a creatively rich sense of disruption and unpredictability, and the real-time interaction which feeds embodied growth.

In a very different way to Wayne McGregor's *Living Archive, Tools That Propel* is also concerned with archives as a source of new movement decisions that might not occur without the interaction of artificial intelligence. It was not designed to draw explicitly on any predefined archive of choreography but aimed to use the *act of archiving* movement to propel new actualised ideas within improvisation. *Tools That Propel* is creating new understanding of the movement it is capturing *as it* is categorising it. It has not been created and then archived according to predefined categories determined by the prevailing dance hegemony; the process of determining *what it is* happens *as it is created, danced, tracked, captured* according to its difference from anything that has previously been created, danced, tracked and captured. The constant 're-performance' and 'return' of the past images and memories from the improvisation is like a facilitation of a perpetual process of raiding one's own immediate past creations and finding impetus from looking to the core of them. It is notoriously hard to recapture the 'gems' of discoveries made in improvisation; though an improvisation can be filmed, the act of looking back and selecting past movements to find seeds for the present and future creation is retroactive, and in the process subject to predetermined cultural and aesthetic ideas of what is 'good' and meaningful. One of the key drivers within this thesis is the question of what happens when meaning is determined by a machine.
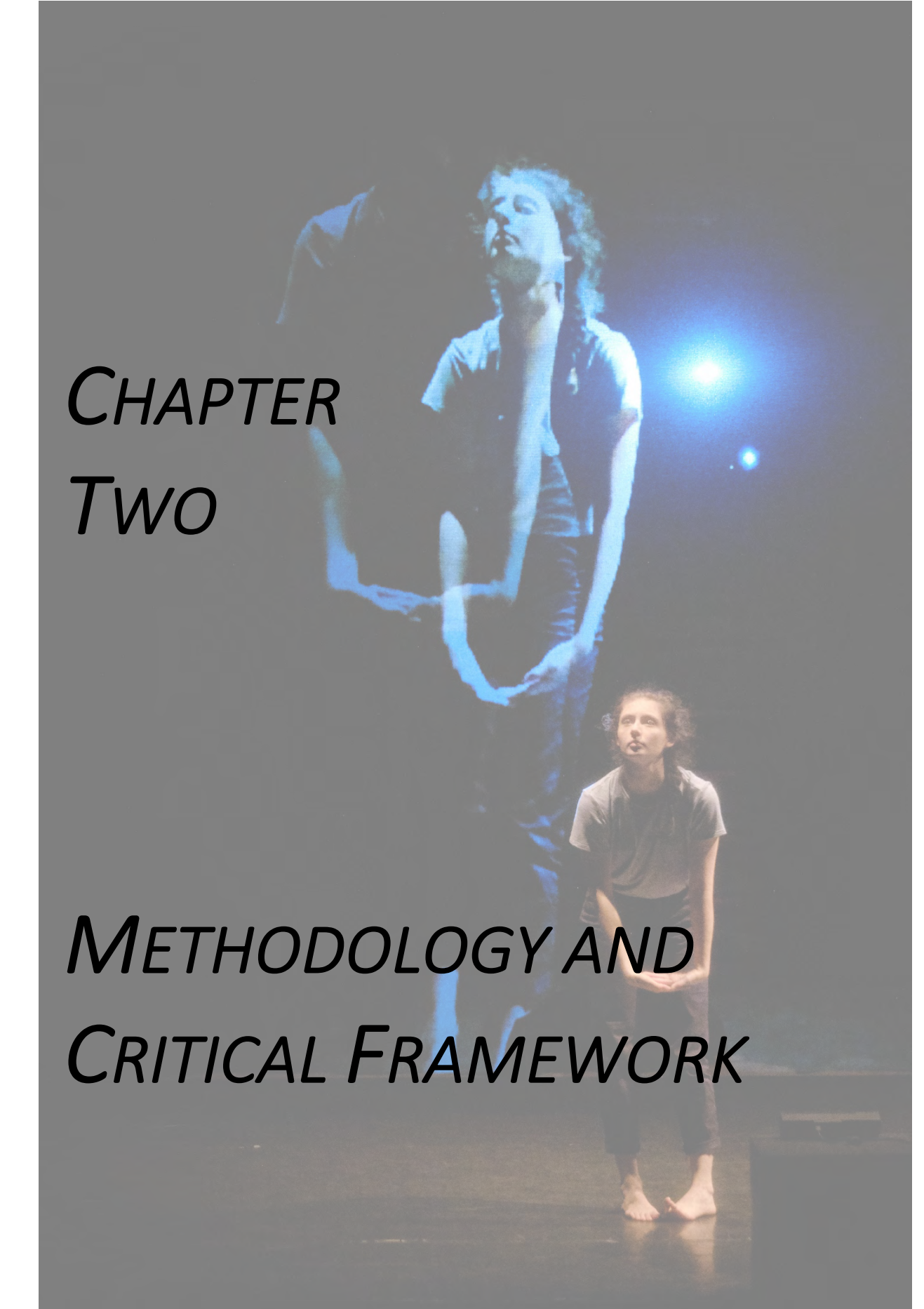
The research question largely situates the functionality of *Tools that Propel* at the interstice of two different genealogies of practice: one, the use of computational systems and software for choreographic development; and two, participatory or interactive installations. It might also occasionally touch on intermediality in performance but despite the use of *Tools that Propel* within a performance project, *Body of Memory*, I have not referred to any projects or artworks whose primary use of technology is within performance works (to an audience, rather than with an audience participating) because I think that the development of *Tools that Propel* draws influence from interactive installations, participatory projects and choreographic software, and does not share the

same concerns (on the whole) as intermedial works on stage. It does not attempt to create the same leading-edge aesthetics either, as my interest lies with the affordances and functionality of the system and what this brings about for the interactor or dancer in improvisational terms.

Computational systems for choreographic development rarely seem to use real-time interaction (bar *RAMDanceToolkit* and *Whatever Dance Toolkit*). Even if a system is entirely capable of creating its own choreographic languages and decisions, as is the case in very recent applications such as *Living Archives*, it does not develop with the dancer – there is no dialogue or relational exchange between them. Equally, whilst real-time interaction is the basis upon which many, if not most, participatory installations are developed, the interaction does not usually evolve with the dancer, continue to challenge them, nor lead to growth of embodied knowledge. They do often catalyse 'play' which arguably is a state in which learning takes place, whatever our age (Varela Afonso and Roque 2015; Kanhadilok and Watts 2014; Kolb and Kolb 2010); but this research project aimed to explore *how* and *what* new embodied skills could be developed through real-time interaction and feedback loops that evolve the play.

Tools that Propel is less of an agent than the *Choreographic Language Agent*, *Becoming* or *Living Archive* in the sense that it cannot generate choreography on its own or respond to choreographic tasks. It needs the bodies of the dancers interacting with it to come to life at all. But therein lies its specificity too. In this interaction, it can respond to the dancers and what they give it in *real-time*, and it can also surprise them. It can take them into themselves and deeper into the moment of improvisation. In its ability to dialogue, challenge, and reveal, it sustains dancers' engagement over long, evolving, improvisations and inspires them to improvise with it over and over again. The description of what McGregor and his dancers said about bodies - the 'constant negotiation of feeling and presence, of desire, shame, imposition, power, politeness, domination, or facilitation' they bring to a dance studio (Leach and deLahunta 2017: 464) – is also important to a recognition of the contribution that *Tools that Propel* might bring to his field of research. *Tools that Propel*, though significantly different in aesthetic to *Becoming* also has presence and also brings out kinaesthetic responses in people working with it.

Throughout this thesis I continue to examine the functionality of *Tools that Propel* in relation to the nature of its body, its fleshy materiality in relation to the world around it because unlike the *Choreographic Language Agent* abandoned by Wayne McGregor's company as the 11th dancer due to its fundamental lack of body, *Tools that Propel* does have body, despite its visual output being projected on a flat screen or wall. Where it differs from *Becoming*, beyond the programming and computation informing its particular mode of bodily thinking of course, is that it challenges and responds to dancers; it *negotiates with their bodies*.

*CHAPTER
TWO*

*METHODOLOGY AND
CRITICAL FRAMEWORK*

ENCOUNTERING TECHNOLOGY: ONTOGENESIS, (NOT) KNOWING, AND ENTANGLED COLLABORATIONS

This chapter outlines both a critical framework for this thesis and my research methodology: they are combined here because they too are entangled. The system itself has been developed within a dramaturgical process that is also one of emergence and it has surprised us with the affects of its affordances. Equally, the way that the system works serves to bring about emergent thought-action in surprising and sometimes disorientating ways that bring about new dramaturgical understanding in the improvising dancer: as I have stated in the Introduction, it might be understood as a 'digital dramaturg' as much as a choreographic improvisation system.

The thesis is situated within what Brian Massumi calls an ethics of becoming, for which he argues philosopher Gilbert Simondon presciently paved the way (De Boever *et al.* 2012a). Such a *becoming* focusses on matter and mattering, and in doing so is differentiated from constructivist thought – in which the focus lies on the coming into being of new social and cultural perspectives on things, rather than the things themselves (De Boever *et al.* 2012a). Constructivist thought leads to new paradigms, perspectives and corresponding subject positions, and unlike an ethics of becoming, is very much about the human at the core of everything. It is indeed about how we know the world around us; not how we *become with* the world.

Such an ethics of becoming chimes with critical theories espoused by performative new materialists such as Karen Barad and Alice Kirkby, who proclaim that our being shifts and evolves in relation to, and in entanglement with, everything around us – material or otherwise – and that as such the ontology of humanity changes with it, as does our knowledge about ourselves and the world (Barad 2007; Kirby 2017). Technology – or new emergent technologies – are not new in affecting us thus. Yet, the speed

of their development is perhaps bringing us into an awareness of this shift, or an awareness of our inherently entangled relationship with other forms of matter, and thus challenging our apparent essentiality as perceivers, conveyers, and communicators of the non-human world.

For many, this shift – to an entanglement with technology and the non-human world – feels threatening, and indeed the popular trend of using technology to augment human capabilities is arguably built on a desire to reign in and control this threat, subject it to the dominant order, and thereby consolidate and enhance the power of humans over everything else (or each other). Yet 'threat' in this context says more about our perception of something we do not understand, than about the nature of the technologies themselves. Looking for a word to describe what I am arguing is a desirable conception of the relationship of technology towards humans, we might instead choose 'challenge'. This allows for a range of possible outcomes from the entanglements between assemblages of entities that include humans and technologies: the technology might intervene in our mode of being and knowing, it might threaten it, or it might bring about new potential within it. As it 'challenges' us, technology carries the capacity to change us – if there is any 'us' that exists at all outside of specific entanglements.

The way that technology might challenge humans in performance can be understood in relation to the concept of 'digital intervention', a term coined by Mark Coniglio for performance works or systems in which the technology intervenes in the performance in ways that surprise or antagonise the human protagonist, leading them to come up with novel solutions to near impossible challenges (Coniglio 2015). Coniglio uses this term in contradistinction to what he calls 'digital reflection', which he says is when technology acts as the protagonist in the performance and is used to empower and augment the performer, expanding the space of their performance, through interactive systems, for example, that use performers' gestures to trigger sounds and video. Whilst often producing spectacular visual performances, Coniglio believes that the work he defines as 'digital reflection' is never really memorable or profound because it has not earned what he calls the 'ecstasy' of great art through any sense of conflict (Coniglio 2015: 277).

In many ways, Coniglio proposes 'digital intervention' as a *temporary* modus operandi for performance-tech projects, until advances mean technology can 'cheat' in an improvisational exchange with humans. Coniglio recognises that there are no technological instruments which are currently as sensitive in improvisation and intuitive decision-making as a human body, which he describes as 'incredibly high-resolution', responding 'very dependably to the commands sent to it by their brain' (Coniglio 2015: 278). As such, he argues, in many uses of technology in performance there is no 'dramaturgical conversation' with a human performer (Coniglio 2015: 274); that is, one with sufficient push and pull between the subject and its frame to excite and engage an audience or creator in anything

more nuanced and extraordinary than the spectacular. Yet, as he proposes, if we engage with the aspects of technological materiality and operation that we do not understand, or that rupture our human sensibilities, or that fail in fact, they can indeed surprise us.

One imagines that Mark Coniglio envisages a day when machine learning genuinely will be able to engage us in surprising conversations with the sensitivity he ascribes to a human performer. Of course, this might or might not be possible. Yet, it does not mean that computational decision-making or intuition should or will be modelled on human functioning. Either way, I suggest that we develop interactive systems from a cultural understanding and foundation of entanglement rather than augmentation – because the surprise or disjuncture or intervention that comes from a different perspectival mode of being and knowing can open us up to unexpected modes of being and knowing in ourselves; ones that might help us to exist in balance and flux with the non-human world, as well as ones that increase the potentiality of our embodied and creative thinking.

Tools that Propel aimed to enact *digital intervention happening in real-time*. It explores digital intervention as a mode of stimulating and producing new choreographic thought-action *as the dancer improvises* and *as the computational choreography unfolds* in relation to and propelling new emergent movement. However, in its coming into being, indeed in the becoming that is the transformation of dancer and system, affective on each other, it inadvertently embodies Coniglio's quest for digital systems that digitally reflect as well as digitally intervene (Sutil and Popat 2015). This chapter discusses the approach that has been taken to developing and using *Tools that Propel* in relation to aesthetics, dramaturgy and an ethics of becoming, and the possibility that this can offer a way of punctuating the idea that technology is somehow intrinsically instrumental and about inputs and outputs. It also forwards an open approach towards developing and using technological objects or platforms in ways that are primarily driven by curiosity rather than preconceived aims and objectives.

The methodology that has led to this thesis includes studio practice; but this practice has not been driven by an empirical framework, so much as artistic and ethnographic processes, as well as an expanded range of sources and artefacts – technological, choreographic, improvisational, theoretical, philosophical and literary. Through the practice, a number of enquiries opened up that have been explored through philosophical, theoretical and fictional writings, which in turn fed back into practical exploration in the studio. Strangely, though, the thinking and theoretical questions that were provoked by use of *Tools that Propel* now appear to have always been there; through recursive causality the affordances of the system actually seem to have been informed by such theoretical understanding too. Perhaps this is partly the outcome of an entangled collaboration, whereby both mine and Adam Russell's thinking and prior experience worked together to crystalize new knowledge. Certainly though, this research is underpinned by ideas within two key texts by Gilbert Simondon – *On the Mode of*

Existence of Technical Objects and *Technical Mentality* – although it did not know it was going to be so. Like the interactor and *Tools that Propel*, the methodology for this research project can be seen as *becoming* too – entangled with various elements of an ecology of practices which include the evolving system, the collaborators, the dancers, the pages in books and journals. These are the methods within the methodology, discussed in more detail in this chapter. Through using and analysing such methods in Part 2, I will examine the capacity of *Tools that Propel* to change us and the extent to which this capacity is inherent within the technological objects and affordances (that is, they are inherently agential themselves) or comes about through the relational nature of entanglement itself.

PLAYING IN THE WILDERNESS

Tools that Propel was *discovered* as much as it was created, developed or invented. The system and the research processes that have been enabled by, and through it, have been born within a state of play in a productive wilderness. Entry 3a for 'wilderness' in the Oxford English Dictionary defines it as 'something figured as a region of a wild or desolate character, or in which one wanders or loses one's way; in religious use applied to the present world or life as contrasted with heaven or the future of life' (OED 2022). This research has indeed been carried out in this figurative wilderness: a place where we have freely lost our way. Such a state of wandering or lostness defines the methodology; it has been an 'an exact yet rigorous' methodology but one that has unfolded through a (deliberate) process of 'errancy', that is 'to err, to get lost, to go astray' (Lepecki 2015: 54).

I have borrowed these phrases from André Lepecki's discussion of process-oriented dance dramaturgy: the research methodology used here has been akin to a dance creation process and the dramaturgical process within it, not exactly out of place given the focus of this thesis. It is one that asks questions about the nature of *knowing* (and *not knowing*) that are totally integral to both the ideas and aims underpinning the development of *Tools that Propel* and their actualisation in it as a system, with dialogical exchange between it and the interactor within improvisation. It is one in which the material has emerged, with its own agency.

In accordance with Lise Amy Hansen, when I refer to material, I mean not only 'physical attributes' but 'the various elements that contribute to creative practice', including in the design of 'movement-based digital interactive settings' for example, the 'programmer's material' as well as the 'choreographer's' (Hansen 2015: 108). By material here, I refer in practical terms to the choreographic improvisation system, the movement created with it, and the collaborations formed, and in theoretical terms, to the questions and critical frames that have been lenses through which to understand the embodied knowledge within the practice. There has been an interplay between the felt potential or

intuitive idea and the emergence of its embodiment throughout, that has both surprised and felt absolutely like it was always meant to be. Lepecki states that 'what fuels dramaturgy as a practice *for* dance and *in dance* is the tension established between multiple *non-written*, and *errant processes of thought* and multiple *corporeal processes of actualising these thoughts*' (Lepecki 2015: 52). He argues that this 'tension' creates a 'problem deeply tied to the question of *knowing*'; that is 'claiming knowledge over the process of composing a work that from the start presents itself as oddly unscripted' (Lepecki 2015: 52). The ideas within this thesis have informed the research process and also seem to have been actualised within it, there to be found and unearthed.

In the deliberate choice to wander, to get lost in order to discover something new, this thesis finds its knowledge in the wilder space, on the move and shifting boundaries, discovering potential in known unknowns. This research is predicated on the idea of *not knowing* as creatively productive, something that might be seen in antithesis to current trends that prioritise the prior conception and framing of any potential knowledge that a process of learning seeks to gain (Erikson and Erikson 2019; Barnett 2007). Equally, whilst its insistence in interruption and disjuncture as creative and productive (Peters 2009) is not new, it still goes against much choreographic and improvisational thought and practice that focus on the importance of flow (Louppe and Gardner 2010; Hefferon and Ollis 2006; Smith 2003; Albright 2003), though arguably the state of flow encompasses the ability to be surprised by something and to absorb and respond to it creatively (Biasutti and Habe 2021). It is also perhaps unusual to propose that it is the journey to *the middle of the thing we are in* that can yield new knowledge and solutions (Yang 2015), as opposed to the more accepted and celebrated promise of innovation and futurity. These ideas – sometimes 'unrecognized, out of favour' as per the OED's definition 3c. *in the wilderness* (OED 2022) – are all connected.
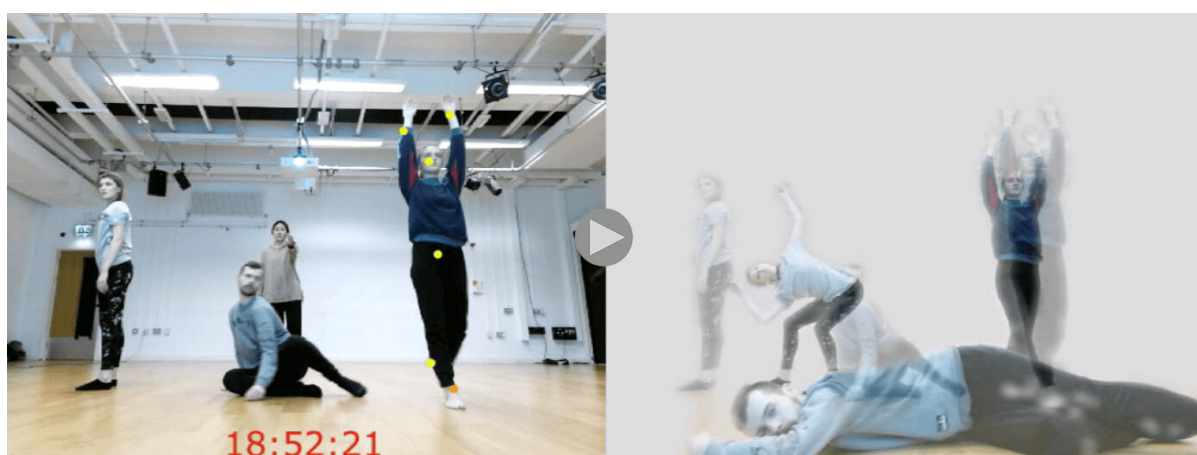
[The video 'Trying Background Removal' can also be found here: https://youtu.be/SneKnc-XICA]

Facilitating Not Knowing

Let us go back to before *Tools that Propel* came into being. During the initial scoping phase for this research, I looked back at my own practices within dance and devised theatre over the past 15 years through the filter of the theoretical frameworks I was encountering. I began to understand that my processes had placed me in the position of dramaturg as much as choreographer/director and this opened up questions surrounding the relationship between dramaturgy, choreography and improvisation and the role that technology can take in dance creation. But I also realised I needed to interrogate the notion of 'facilitation', a term more commonly used within participatory and applied arts. At first glance this may be considered an unnecessary complication and conflation of practices; but for me it is perhaps ideological, linking to questions I have over whether my processes are markedly different when working with professionals or untrained participants, and whether *Tools that Propel* is useful to *anyone* wanting to develop their dance language and choreographic thinking, whatever their background and experience.

I have always devised tasks in which limitations and boundaries coupled with stimuli and prompts catalyse discovery of unexpected, materialised ideas that could not necessarily be preconceived. Designed to enable individual performers to explore and actualise their perspectives on subject matter through their own idiosyncratic performance languages, the 'task' is perhaps akin to a 'facilitator', a role described by Sheila Preston in her book *Applied Theatre: Facilitation: Pedagogies, Practices, Resilience* as '[b]eing in the place of 'not knowing', resiliently coping with 'unpredictability and uncertainty' as 'we cannot always 'know' what will happen in the next moment of working with real people in real contexts' (Preston 2016: 10-11). In understanding *Tools that Propel* as a form of facilitator I believe that it operates as a blank canvas for any interactor or dancer. This constitutes an ethical openness that does not judge the movement presented to it but offers back gestures and phrases to be reconsidered bodily. As will be seen throughout this thesis, dancers approach *Tools that Propel* with different degrees of trepidation and some are more concerned than others by questions of functionality and 'how it works' – that is, some are more worried by its technicality. For others, and sometimes for those that start off concerned with its functionality, *Tools that Propel* appears as a portal, a maze, a reflection, a series of traces. They feel like they have been offered a way to consider something beyond themselves, something very human or perhaps, significantly, more than human.

Preston discusses Paul Murray who 'conceptualizes his facilitator role as a clown [...] enabl[ing] him to be in the moment, to stay in a place of 'not knowing' to enable him to be fully reactive in the moment and to 'look again'' (Preston 2016: 11). It struck me as interesting how much of my work as a director and choreographer had been in participatory and applied settings given this clear resonance with my burgeoning interest in creating digital systems that support dancers to stay present in the thing they

are in and to excavate unknown potential they find within this. In referring to a range of terms that people use to define their own 'role, function and practice with participants' because they 'may consider the term 'facilitator' too bland or 'neutral' to express their practice' Preston states that '[t]hese alternative 'character' descriptions also signify the nuances of the role being played in different contexts along with the kind of engagement that will be attempted, an indication of the emphasis of their interventionist 'style' or intent' (Preston 2016: 4).

The key word here, in relation to this research, might be 'interventionist'. Whilst considering Coniglio's concept of 'digital intervention', I realised the improvisational tasks I devised for performers to generate material also involved a degree of antagonism between the subject and the task. Sometimes they might be understood as the type of facilitator that reflects back difficult questions at its participants, asking them to engage in new ways of seeing or conceptualising a problem, posing the possibility of multiple perspectives and pushing at the boundaries of dogmatic, dramatic (as per Aristotelian conception of drama) or reductive ways of conceiving the world. Sometimes they might be the type of facilitator who changes the rhythm of the encounter all the time, catalysing new possibilities of thought through unpredictability and confounding the impulse towards over-preparation. But whatever the case this conflict between subject and task (or frame) has often become part of the performance itself; informing the unfolding dramaturgy of the piece.

This understanding of my previous analogue practice as well as new encounters with digital intervention and process-oriented dramaturgy kicked around in discussions with Adam Russell, feeding design ideas for *Tools that Propel* and the practical realisation of the system. In developing the system, one of our aims was to see whether digital processes could mediate the kind of creative practice in which the artist succumbs to fear, uncertainty and not knowing; trusting that something unexpected will emerge. The idea of 'not knowing' as creatively productive might be understood through Keats' term 'negative capability', meaning the capacity 'of being in uncertainties, mysteries, doubts, without any irritable reaching after fact and reason' (Keats and Scott 2002: 60). For me it is also about the discovery of shapes, forms, and ways of seeing that cannot be preconceived because language only describes those shapes, forms and ways of seeing that are already known. The focus on knowing and not knowing discussed here might somehow seem to make this research entirely epistemological, the technological system a veil or lens which conditions how we come to know the world around us. This seems particularly strange when the work itself is of the body and is premised on the idea that one also knows in the body as well as the mind. But *not knowing* can be a sensation felt in the body and become a source of potential for new discoveries and knowledge. We might position this in relation to Brian Rotman's analysis of pre-linguistic gestural intuitive thought – that which allows us to understand a triangle, which 'before all else [is] "thought" through the active body' (Rotman 2008: 34). Where

constructivism is aligned to linguistic models regarding the gap between the signifier and the signified, human subjects and their language constituting the *meaning* of objects and a way of knowing them, improvisation with *Tools that Propel* affords the interacting dancer the possibility of exploring new gestural referents by embodying and bringing them into being.

Whilst later in the thesis, Chapter 5 looks to the development of a new language between the dancer and *Tools that Propel,* it discusses language not just in terms of epistemology but also ontology – a new language coming into being between the system and its dancing interlocutor in which there is no separation between symbol and referent, in which they affect each other, and in which new vocabulary (be)comes through its differentiation to what it is not. My analysis of this draws heavily on Brian Rotman's thoughts on the implications of new gesturo-haptic writing (Rotman 2008), motion capture technologies facilitating a potential 21st century 'corporeal literacy' (Bleeker 2015), which capitalise on the trajectory (or blurring perhaps) between subjectivity and objectivity embodied in the gesture (prefiguring spoken language). With constructivism, as Massumi writes, whilst it 'telescoped becoming on to the human plane' it also 'reduced the constitution of the human plane to the question of the human subject' (De Boever *et al.* 2012a: 21). But the emergent gestural language between dancer and *Tools that Propel* is a language that does not originate just with the human, but also the machine. For both dancer and computational system, use of this shared language constitutes and contributes to their (entangled) becoming.

Dramaturgy and Improvisation

I have stated that the methodology has been akin to the dramaturgical process within a dance creation process; but in appropriate entanglement of form and content, I am also suggesting that *Tools that Propel* takes on a dramaturgical role within choreographic improvisation. The focus on process-oriented dramaturgy moves away from *knowing from the outside*, to *knowing through becoming.* Dramaturgy, in the way that it is being conceived within this thesis, is something that emerges within a process, that evolves in form, that helps bring form into being, and does not simply analyse the meaning within the form. But what exactly is the relationship between dramaturgy and improvisation?

Bojana Bauer refers to the dramaturg as forming the memory of the process, suggesting someone/thing that collects up material (Bauer 2015). But Melinda Buckwalter writes that improvisation is 'the experience of moving and not knowing, finding the next thing, and learning about what is becoming in the process' (Buckwalter 2010: 3), suggesting a practice based on impermanence, the expression of an act in the moment of its coming into being, and a building of that moment, into the next and the next. So how can *Tools that Propel* be understood as both a choreographic improvisation system and a digital dramaturg? In answering this, it is important to note that Buckwalter

identifies the opposing ideas of improvisers who 'eschew composing', which they consider to be 'planning ahead', for the 'purely intuitive or physical act' of improvisation, and those who 'emphasise the composing component of their improvisation practice' and 'might see composing as a combination of faculties – feeling, thinking, sensing, and intuiting through both mind and body – that inform the improvised moment' (Buckwalter 2010: 10). It is this latter notion, with its emphasis on composition as part of improvisation, that informed the development of *Tools that Propel*. However, I argue that composition within improvisation is not about 'planning ahead' so much as maintaining what Vida Midgelow calls 'dramaturgical consciousness' within the present-tense of the improvisation, something that 'entails a critical and reflexive awareness, which is an essential aspect of dramaturgical practice, and yet [...] often produces tension within the field of improvisation' (Midgelow 2015: 111).

Indeed, Midgelow argues that 'the practices of improvisatory dance performance and dramaturgy are not actually separable and might be better considered as the ends of a related continuum' (Midgelow 2015: 108). Highlighting the importance of 'dramaturgical consciousness' within improvisation, Midgelow discusses the role of memory in the emergent movement. She states that 'developing this particular consciousness entails a reconfiguration of the dramaturgical and the improvisational, which allows us to understand them both as embodied practices that play with memory' (Midgelow 2015: 106). She writes that a dramaturgical understanding of improvisation insists 'on the importance of memory and perception as an ongoing process of knowing' (Midgelow 2015: 112). Indeed, advocating for critical thinking within improvisation, she writes that 'improvisers require a deeply routed memory in order to, perhaps, avoid that which is well known, or even clichéd' (Midgelow 2015: 112).

Midgelow discusses doing dramaturgy as a mode of thinking rather than as a specific role. It is about responding to the logic of the 'demand' of the work, that is 'the demand for a work from within the confines of a limited material universe' that Gary Peters claims 'all improvisers must face' (Peter 2009: 11). Regarding the idea that dramaturgy is traditionally about outside observation, assigning meaning from a critical distance, Midgelow states that 'improvisation resists any such controlling mechanisms – with movement, structures, and meanings occurring in an emergent fashion, unplanned and unknowable prior to the moment of performance' (Midgelow 2015: 107). This emergence can be something that is 'listened to', or recognised as within the potentiality of the work. Indeed, Penny Campbell conceives of dance improvisation as 'start[ing] with the basic skill of being aware of oneself in the moment' (Buckwalter 2010: 16). There is a process of listening to subtle impulses in the body and letting them percolate and grow or rise through us and evolve; improvisation involves the act of paying attention to these. Here the universe is limited to the materiality of the dancers' bodies, but there are still choices being made about how to use what it is that is being offered, how to respond to

its demands. Buckwalter states that '[a]ccording to Campbell, ensemble awareness is a sense of what's developing in the dance in a given moment and how the individual's movement choices play into that development' (Buckwalter 2010: 17).

Equally, Buckwalter writes about 'the study of influence' within the improvisational practice of Barbara Dilley, who danced with Merce Cunningham's company in her 20s, and later became a dancer with Yvonne Rainer, a Judson choreographer. In Dilley's work, Buckwalter recognises the importance of 'how we take on the movements of those around us in our own movement, copying bits and snatches, taking on timings, the impulse to move and change what we're doing, when someone else initiates a change' (Buckwalter 2010: 15) and states that '[a]nother facet of working with influence' means 'being able to accept influences, to pick them up and put them down; letting them arise, dwell, and fall away like they are thoughts in meditation' (Buckwalter 2010: 16). Dilley's practices limit vocabulary to '"5 basic moves": walking, standing, turning, arm swinging, and crawling' (Buckwalter 2010: 15), which she uses in 'specific structures she has designed, like corridors […], or grids […]'. Of the limited vocabulary, Buckwalter writes that '[t]hese limitations create simplicity, which informs the dancers about their movement habits, seeds awareness, and results in what Dilley refers to as '"elegant pedestrian," everyday movement done with mindfulness' (Buckwalter 2010: 15).

Whilst words such as 'meditation' and 'mindfulness' run contrary to my own interests in the way that interruptions and interventions can open up new creative potential, the conscious awareness born of limited vocabularies (which might grow and evolve) and the influence of others' movements suggest an element of composition within the unfolding improvisation itself. External sources beyond one's own body are being drawn on; there is an outside eye within the inside of the improvisation, even if the effect is meditative. Midgelow asks 'during improvisation, if the act of dancing and the process of choreographing merge, then how might a dramaturgical practice deal with this conflation of doing and conceiving? How might a dramaturgically conscious improvisational practice respond to movements and meanings that emerge instantaneously?' (Midgelow 2015: 108). She writes that her workshop activities 'develop the dancer's self-awareness of his or her embodiments, histories, and movement patterns in order to generate and go beyond a reflective approach to improvisation' (Midgelow 2015: 111). The act of picking up influences from others and evolving them in Barbara Dilley's work, as well as maintaining an awareness of the possibilities emergent within the limited vocabulary, is also for me about dramaturgical consciousness – a conflation of 'doing and conceiving' (Midgelow 2015: 108) – even if it is more about a spatial relationality with others' movement and less about memory.

In Susan Sgorbati's ensemble work, which she calls 'Emergent Improvisation': a key skill is 'recognizing a form as it emerges in the course of an improvisation and contributing to its development' (Buckwalter 2010: 18). She argues that a 'self-sustaining dance evolves' and that '[d]ancers learn to be

on the lookout for unfamiliar patterns and develop a certain tolerance for ambiguity in the process, while the dancing takes shape' (Buckwalter 2010: 18). This 'tolerance for ambiguity' is an interesting idea: it raises the importance of improvisation as processual and predicated on *not knowing*. Equally, the focus on emergence supports the idea that perhaps improvisation is not just about collaborative, collective or subjective decision-making but about the demands of the work itself to be materialised. Gary Peters argues that 'it is not a question of the availability or not of actual technical resources so much as the inherent *possibilities* of material at any particular given moment as part of an inherent temporal unfolding that is largely unresponsive to the whims of the individual subject' (Peters 2009: 11). The dramaturgical consciousness might here be understood as recognising what is available and how it can be used. The improvisational work has within it all its potential: 'It is not a question of how much material the improviser has available but in what ways all material contains, sedimented within it, historical patterns of human engagement and creativity that impose limits on what can and cannot be done on the occasion of the material's subsequent reworking, whether improvised or not' (Peters 2009: 11).

Different Kinds of Logic

In processes common to dance creation, that involve the individual dancers' materialisation of ideas and associations through their own bodies in response to tasks and through improvisation, Bojana Bauer states that there are 'complex relationships between the material and its remembering, reactivating, or transforming' (Bauer 2015: 41). She argues that '[t]hese processes accentuate the need to repeat the unrepeatable: improvisations, situations emerging from multiple sources, heterogeneous experiences' (Bauer 2015: 41). The dancer's memory is one of sensations, colour, nuances; it concerns how to produce actions and states. The choreographer's is connected to their vision for the piece and how to arrange material to produce specific experiences for audiences. (Bauer 2015) But the dramaturg's is a *memory of process*; it

> assumes the function of a kind of score because it is relatively disinterested in the manner or source of the production of the material per se [… and] this score is progressively inscribed in a larger analytical framework through explorations that crystallise in the dramaturgical question: 'how do elements of the heterogeneous material produce meaning, affects, atmospheres etc.?' […] The scored memory is […] what allows the final work of staging. It is, more importantly, that which enables the logic of the staging to be found (Bauer 2015: 42).

Following this argument, it could be assumed that *Tools that Propel* as a digital dramaturg might be expected to produce a 'scored memory' and certainly to produce the 'logic of the staging', forming its own memory of the material produced, and identifying emergent patterns and structures. As a digital

dramaturg should *Tools that Propel* be able to weave all the movement it captures into a piece that 'makes sense'? To bring a certain 'order' to the 'disorder' of the creative process?

Perhaps it could be perceived that *Tools that Propel* does bring a certain 'order' – though not one that might be understood in terms of Rudolf Arnheim's call for order as a 'necessary condition for anything the human mind is to understand' (Arnheim 1971: 1), that which Peter Lloyd Jones reviewed as a 'plea for another classical revival' (Jones 1973: 30). A session recording is produced by *Tools that Propel* each time it is used. This shows the interweaving movement of the real-time dance and the memories, as well as the literal tracked movement on the studio floor. This recording could be used as a score to produce new choreography. The impossibility – as defined by the physical laws governing time and space – of reproducing it exactly would become a catalyst for the dancers and choreographer to find novel ways of moving and connecting movements in the score. A composition would be produced in collaboration with a machine based on the random interplay between 'new' material and material it perceives as 'old'. This would produce unexpected causal relations, which challenge the compositional principles espoused by Arnheim, for example, but which might speak articulately of a growing entanglement of humans with technological interfaces, or allow for alternative conceptualisations of the spatial and temporal structuring of movement material for new meaning and perspectives. However, it is the ongoing interplay and feedback loop between the dancer and the system that primarily interested me rather than the production of a score that challenges our conceptions of dance and compositional structuring.

Whilst 'digital intervention' was a key underlying concept, its application within free improvisation may well yield different aesthetic or methodological implications to Coniglio's experience with it. When Sophia Lycouris writes about Troika Ranch's earlier interactive work, she celebrates Coniglio and Stoppiello's 'highly precise decisions about the dynamic qualities of the audio-visual materials and how these materials coexist with the 'live' action of the dancers in the shared physical space of the performance event' and states that 'it is because Troika Ranch is prepared to engage with narrative structures and devices that their compositional techniques work so well' (Lycouris 2009: 356). The work Lycouris describes predates Coniglio's interest in digital intervention but the sense of acute attention to detail in the compositional decision-making, and precision regards their application, would probably apply to the making of *loopdiver* (2009) too, the piece that led to Coniglio's change of approach. Whilst the software was cutting the material in infinite ways they could not foresee, it was the careful collaboration Coniglio and Stoppiello undertook across their choreographic and musical disciplines in putting the loops together into a 45-minute score that was also vital to its artistic success. This is in contradistinction to the more roughshod aesthetic of *Tools that Propel*, that intervenes in the dancer's perception (projection) of their movement to offer other trajectories, half-formed movements, and

strange ways of seeing themselves in the bodies of others, demanding a fresh approach to the unfolding improvisational material. Coniglio's digital intervention is in many ways more demanding. It insists, or he insisted, that the dancers follow its logic, its cuts, its physical impossibilities. *Tools that Propel* can be ignored. But equally, the impact of the intervention occurs in the moment of creating the movement and raises interesting questions about how the virtual implicates the physical and material and how this manifests in new embodied cognition. What I realised is that I wanted to investigate how new ways of thinking become manifest in the bodymind of the dancer/interactor through this, developing in them the more they use it and the more they were implicated in an ontogenetic becoming with it (De Boever *et al.* 2012b).

Choreographic Improvisation and Ecosystems Aesthetics

Johannes Birringer states that '[t]he notion of 'interactivity' – connecting bodies to digital interfaces – gains its aesthetic sense if we read it in the context of design processes which build an extended nervous system with high variables' (Birringer 2005: 156). However, he argues, '[i]n artistic contexts, a theory of inter-acting has peculiar consequences for interaction design, if I am looking at the 'nervous system' from a dancer's point of view, for example, who wants to move in it not based on choreographic principles of constraints but on low-viscosity principles of free improvisation and kinetic exuberance' (Birringer 2005: 156).

If *Tools that Propel* segments movement into components in order to produce new relations between the live situated movement of the dancer in the studio and the virtual movement appearing on screen, and to fold the past into the present thereby creating non-linear and defragmented time, then to some degree it uses the segmentation of the movement *instrumentally* in what Brian Massumi calls 'action-reaction circuits' where 'what gets foregrounded is the element of nextness in the flow of action' (Massumi 2011: 46). In such cases Massumi states, the 'voluminousness of the experience [...] shrinks from feeling' (Massumi 2011: 46). From the start, I was resistant to an instrumental use of technology within dance and choreography; it was not about making a creative process that cannot be quantified in terms of efficiency somehow more efficient, for example. The feedback in *Tools that Propel* is to a degree unpredictable, and certainly doesn't follow choreographic constraints that are programmed into the system, but rather proposes other ways of perceiving and responding to a movement that might not correspond with 'choreographic structuring' and the history of what constitutes a movement as understood by the prevailing dance hegemony.

If we refer again to Arnheim, he suggests that there is a natural inclination towards order within organic and inorganic matter and that this contradicts the Second Law of Thermodynamics, which states that in a closed system there is a degradation of usable energy and a tendency towards increased

disorder. Equilibrium, he argues, is the final state of entropy with 'the incomplete, clashing structures in states of disorder [creating] tensions directed toward the realization of a potential order' (Arnheim 1971: 26). This is brought about by tension reduction through the removal of constraints in the system: 'If the partition is taken out of the water container, the two unequal bodies of water are set free to attain and equilibrated state of simpler order' (Arnheim 1971: 27). Choreographic principles of constraints, referred to by Birringer above, might be understood in relation to what Arnheim calls the 'structural theme' that 'brings about organized form through its interaction with the tendency to tension reduction' (Arnheim 1971: 31).

Yet if we think about Richard Bull's improvised choreography (Foster 2002) rather than the emergence of 'structural themes' within the collective that resist the tendency towards entropy (or dissipation of tension, process, and tightly wound decision-making), it is possible to understand choreographic improvisation in terms of ecosystems aesthetics, the understanding that it is the constantly shifting interaction between human and non-human systems and being in the world that meaning is found, and the generative potential coming about through human activity in entanglement with the environment we live in (Yang 2015).[24] As Susan Leigh Foster writes, 'Bull believed that improvisation offered a means to construct a new way of being in and interacting with the world, not because it leads to new perceptions or discoveries about how the world really is, but instead because it provides a process for learning how to make the world anew collectively' (Foster 2002: 237). In choreographic improvisation, I suggest, the individual embodied thought-action of the improvising dancer interweaves relationally with the forms unfolding collectively or produced by the demands of the work. Indeed, in Bull's work there appears to be an explicit interest in 'collective negotiation' and a more active engagement with the material unfolding of the work: a dramaturgical push and pull with the evolving demands of the improvisation (Buckwalter 2010: 22). Buckwalter writes that her experience with Richard Bull showed that 'Bull was interested in making the choreographic process and the collective negotiation of the choreography visible as the improvisation developed' (Buckwalter 2010: 22). Like Midgelow there is also an emphasis in his practice on the improviser 'being able to remember physically what has already happened in the dance and being able to reference those earlier choices' (Buckwalter 2010: 22). This notion seems not so much about emergent form but also the material body-making-choices (perhaps in relation to *changing* structural forms, perhaps in relation to

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[24] Yang argues that where system aesthetics 'envisioned systems in which human life had insinuated itself in every aspect of the world as both subjects and objects of creative agency' (Yang 2015: 174) ecosystems aesthetics prioritises the idea of 'eco from the Greek oikos – a "home, dwelling place, habitation" of living creatures that are in unfolding exchange with the wider world' (Yang 2015: 174).

its own self). In choreographic improvisation, arguably there is an interplay between 'natural' impulses and 'cultural' ideas of form and composition. This interplay forms an eco-system, emergent and in existence for the duration of the performance, and conscious of and using the interacting systems within it, a 'conflation of doing and conceiving' (Midgelow 2015: 108). In this it might be contrasted to improvisation practices which prioritise purely somatic impulses over compositional decisions. In this interplay between the natural and the cultural in choreographic improvisation, we are witness to diversification of new forms and exchanges with old forms; we recognise structures replete with meanings, that reference outside sources, shapes, and images, even as they shift and transform, never settling and understood ambiguously by their executors.

Choreographic improvisation as a dramaturgically conscious practice in which there is a 'conflation of doing and conceiving' (Midgelow 2015: 108) is what *Tools that Propel* catalyses. The intrusion of memories from *Tools that Propel* – as we will see in Part 2 – act as interventions which send the interacting dancer back to the centre of the movement that is occurring, rather than always flowing onwards. Ecosystems aesthetics is about journeying inwards – to the centre of the thing we are in to find new potential in systems-within-systems, so that 'entropy can *decrease* and new forms diversify' (Yang 2015: 174). Similarly, in his discussion of systems of 'metastable equilibrium', as 'living systems, precisely those that manifest the greatest organisational spontaneity' Gilbert Simondon states that there is, through the 'discovery of structure' a 'provisional resolution of incompatibilities' but that it is not – as we see in entropy – the 'destruction of potentials' (Simondon 2011 [1958]: 411). Rather than stable equilibrium, which comes about when all potential is actualised, inevitably leading to the death of any further transformations he argues that in systems of metastable equilibrium the 'system continues to live and evolve; it is not degraded by the emergence of structure; it remains tense and capable of being modified' (Simondon 2011 [1958]: 411). If choreographic improvisation works when it is a self-sustaining system, continuing to live and evolve, 'not degraded by the emergence of structure' but remaining 'tense and capable of being modified' then so too does a digital system need to, when it is designed to improvise with dancers.

This thesis is in many ways exploring exactly how the system – which from here on in, I am going to specify as referring not just to *Tools that Propel* itself, but also the interactor whose constant injections of energy and information (movement data) into it evolve in relation to it – 'continues to live and evolve' (Simondon 2011 [1958]: 411). Yet, Simondon himself does not believe that technical objects themselves 'live' – indeed he differentiates himself from cybernetics precisely along these lines, arguing that cybernetics is more concerned with the automaton and attributing liveness to technological objects themselves.

Massumi describes how Simondon's philosophy is realist idealism, arguing that what makes it so is the combination of the very 'real' way that Simondon's individuation takes place in the 'material clinching of an effective event' and the 'ideal' way that it 'comes into the effective present of that energetic event as the action of its future' (De Boever *et al.* 2012a: 33). He states:

> The real and ideal are two facets of the same event. Together they make the event of individuation more resonantly material than any mere formalization, and give it more of a mental 'touch' than any set of quantities could have (De Boever *et al.* 2012a: 33).

Referring to the difference between Simondon and Gregory Bateson's cybernetics, Massumi states that 'Simondon never lets the touch of mentality hypostasize into a 'Mind' that is one with Nature. There is no 'Mind' immanent to Simondon's Nature – only form-taking informational *activity* (with as yet - that is to say, until its own future occurs to it – no content, no structure, no meaning)' (De Boever *et al.* 2012: 33). Throughout this thesis I will explore the question of '(a)liveness' within *Tools that Propel* and how the movement offered up by the dancer(s) within the system is the informational activity that takes on structure and meaning when – through the collaborative, relational endeavours of all parts (live and technical) of the system – 'its own future occurs to it' (De Boever *et al.* 2012a: 33).

Simondon's philosophical ideas concerning individuation, technicity and metastable equilibrium are an underlying foundation upon which I seek to understand the way that *Tools that Propel* and the dancer become together in a unity of technology, matter, and meaning, and indeed how the relational nature of their entanglement leads to choreographic agency, whereby the choreographic improvisation appears to unfold with its own agency in between them. Yet in the attempt to detail how embodied learning occurs with *Tools that Propel* and unearth the particular way that this specific configuration of technological objects encourages a *being-with* (or *becoming-with)* and a consequential shift in perception of one's place in the world, I explore a range of other theoretical positions[25] – all grappling

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[25] Both practice and theory in this research project are understood relationally through an intra-active use of the *Tools That Propel* system and through intra-action with its written, filmed, and aural explications. During the development of the thesis, the range of theoretical positions adopted started to suggest fruitful connections. Significant contributions to the various ideas explored in Part 2 come from Karen Barad (2007), Jane Bennett (2010), Lera Boroditsky (2011), Ramsay Burt (2003), Andy Clark and David Chalmers (1998), Gilles Deleuze (1993), André Lepecki (2016), Brian Massumi (2016), Brian Rotman (2008), Nicholas Salazar Sutil (2015), and Andrew S. Yang (2015). These theorists are connected to the thinking of Gilbert Simondon through a consideration of *Tools That Propel* itself: how it works in relation to its ontogenesis, its use, and the movement entangled with it, as well as through the practice and reflection that emerged through intra-active improvisation with it. The underlying work of Bernard Stiegler that plays an important role in theorizing the co-evolution of human ways of thinking, imagining, and experiencing with technology, would also feature in this list. See, for example, Stiegler (2013), and Stiegler (2014).

in one way or another with an entangled becoming – exploring how they have emerged in relation to practical use and observations made by dancers using *Tools that Propel.*

BECOMING-WITH TECHNOLOGY

Gilbert Simondon describes 'technicality' as a phase of the 'mode of existence of the ensemble constituted by man and the world' and states that it is one of two phases (Simondon 2011 [1958]: 407). It is important to note that a phase is not determined by time but is 'an aspect that results from a division of being and that is opposed to another aspect' (Simondon 2011 [1958]: 407). In this case the aspect that technicity is opposed to is religiosity. This idea of phases opens up a key idea in Simondon's thinking. He states that:

> This sense of the word phase is inspired by the notion of phase relation in physics; one cannot conceive of a phase except in relation to another or to several other phases; in a system of phases there is a relation of equilibrium and of reciprocal tensions; the present system of all the phases taken together is the complete reality, not each phase, itself since a phase is only in relation to others, and it is distinguished from them in a manner that is totally independent of notions of genus and species (Simondon 2011 [1958]: 407).

This relational notion is different from the dialectical schema as it does not necessitate 'an intervention of negativity as engine of progress' (Simondon 2011 [1958]: 407). It is about a differentiation rather than an opposition. In such a way, it is always in process, always becoming, as differentiation always occurs. The differentiation that occurs to create technicity is 'a phase-shift of a central, original and unique mode of being in the world, the magical world' (Simondon 2011 [1958]: 408). Whilst the religious mode of being balances technicity, Simondon also discusses how '[a]esthetic thinking emerges at the neutral point between technics and religion, at the moment of the division of primitive magical unity' (Simondon 2011 [1958]: 408). He confirms that 'this is not a phase but, rather, a permanent reminder of the rupture of the unity of the magical mode of being and a search for future unity' (Simondon 2011 [1958]: 408).

This rupture (of which aesthetic and ethical thinking serve to remind us) is 'the vital relational link between man and the world, defining a universe at once subjective and objective prior to any distinction between object and subject, and consequently also prior to any emergence of the separate object' (Simondon 2011 [1958]: 411). Simondon's concern is the process of emergence and individuation from a preformal primitive universe where form and matter are one; as Andrew Lapworth writes, 'Simondon forces us to rethink the subject in terms of its transductive emergence from preindividual processes, and its metastable susceptibility to ongoing transformations' (Lapworth 2016:

1). Through these metastable transformations we can gain glimpses at this preformal universe. As Massumi states:

> The only conceptual tools available are prehumanized by virtue of the models they derive from. But becoming-human only makes sense in relation to a non-human phase-shifting into it. And becoming-human only makes sense in terms of the human phase-shifting out of itself, back into a non-human. If the non-human phases in and phases out, it is conceivable that it phases *through* – which raises the issue of the immanence of the non-human to all of the vicissitudes of the human (De Boever *et al.* 2012a: 21).

Simondon argues that the same value should be attributed to technical objects as to aesthetic ones; that is, he argues against the banishing of technical objects to a world of utilitarianism, of tool and function. Devoid of being able to give it the status of an aesthetic object, those that believe in technology, he argues, bow down to it, idolise it as a sacred object in a way that he says leads to a 'technocratic aspiration to unconditional power' (Simondon 2017 [1958]: 16). This research grew out of a concern to counter this kind of aspiration, and an equal fear that the social dictat towards outcome-based planning, goal-oriented and data-driven decision-making belied the possibility that a technological platform or system could in fact open up transcendental, relational and expansive experience. Both Adam Russell and I shared a desire to take a non-utilitarian approach to developing *Tools that Propel.* The approach we took to developing it was neither instrumental nor about optimising it for market, an approach we believed would iron out the artistic interest in the system and give it a productive functionality for average interactors, rather than making it potentially fascinating or even transformative for *some* interactors with whom it resonated specifically and affectively. *Tools that Propel* and many artistic uses of 'technicity', both appropriations of the affordances of technical objects and challenges to the impact that they have in wider socio-political terms, hover at this 'neutral point' perhaps, exploring the aesthetic thinking that emerges between the religious and the technical modes of being: forever searching for the future 'unity of the magical mode of being' (Simondon 2011 [1958]: 408).

My interest in Simondon and those philosophers and theorists who have consciously or unconsciously been influenced by his work, with similar interests in the interrelationship between entangled forms of matter (or functions) – human, animal, atomic, technological, ecological, political, religious etc. – as productive of new agencies, is precisely this: an interest in their inherently co-existent, entanglement. Indeed, it is for this reason that fear of technology seems somewhat futile. It cannot be a threat to art if it is entangled with art. It cannot threaten liveness if liveness is becoming with it. Simondon's arguments are premised on the idea that '[t]he human being is *among* and *with* machines: His/Her relation to technical objects is not explained in terms of instrumentality but expressed in terms

of community or *being-with*' (Lindberg 2019: 300). The proposition I am making for future digital dance projects, choreographic software, and interactive installations is that they should be predicated on *being-with* technology, and the acknowledgement that human becoming is utterly entangled with that of technology and machines: indeed, we are *becoming-with* technology.

Brian Massumi refers to the recent interest in the writings of Gilbert Simondon as being in relation to the 'epochal shift towards a world integrally reshaped - culturally, socially, and economically - by digital technologies' and the subsequent general acceptance of the 'imbrication of the 'two cultures' [of Science and the Humanities and Social Sciences]' (De Boever *et al.* 2012a: 20). He argues that whilst many people saw this as a move towards the posthuman age others did not, and that what is important to recognise is that:

> where the opposing camps met was in the assumption that what was playing out potentially concerned the very nature of the human, and the conditions under which it changes – basically, how we *become*. Technology had come to be seen to be a constitutive factor in human life – and with biotechnology, in life itself. The question of technology was now directly a question of the constitution of being – in a word, ontology. Or more precisely: because, given the juncture, the question of being had to be approached from the angle of becoming; it was a question of *ontogenesis.* The ontogenesis at issue was constitutively entangled with modes of knowledge and their associated practices, so the problem was as directly epistemological as it was ontological (De Boever *et al.* 2012a: 20).

Massumi points out that Simondon's notion of individuation, on which he wrote his main thesis, encompassed the ontogenetic entanglement of humans and technology. What Massumi refers to as 'technological innovation as a key theatre of thought materializing in matter becoming, in ways imbricated with life transformations' (De Boever *et al.* 2012a: 20) is key to Simondon's thinking. It necessitates careful unpacking to understand its importance not only to the technical approach taken in this research project but also to a greater understanding of the relationship between life, technical objects, the religious (or spiritual) realm, magic, ethics and science with which this thesis is attempting to wrangle.

Invention and Emergence

Simondon suggests that the roles of craftsmen, engineers and technicians define historic changes in the ways that humans have *been-with* technological objects. As Lindberg states, '[t]he first two are specifically contrasted by Simondon to the attitude that he is promoting' (Lindberg 2019: 300). Indeed, Simondon describes a development in terms of human relationships with tools, from a naive but accomplished relationship with them (as a craftsman) to a more developed and reflexive relationship

with them. The relationship the engineer has with the technical object encompasses alienation from it because the machine is just seen in terms of economic value and productivity, but later the technician overcomes both pre-industrial infancy and industrial alienation 'by learning to live with the machines' (Lindberg 2019: 301). Simondon's discussion also concerns how the various elements in a technical object connect. When we reach the stage of living with the machines, rather than acting serially – one thing connecting to another and producing an action – the elements are more entangled. As Susanna Lindberg writes, Simondon believed that '[a] pure technician "respects" the technical object' and that '[t]hrough him/her, the object is "liberated" and even "saved" from its "enslavement" to pure utility' (Lindberg 2019: 302).

As already stated, Simondon does not give life to technical objects; but he does value their relational impact on humans and consider that they are part of an ontogenetic becoming entangled with our very own. He states that 'a simple analogy between the technical object and the living is fallacious, in the sense that, at the moment of its very construction, the technical object is conceived as something that may need control, repair and maintenance, through testing and modification, or, if necessary, a complete change of one or several of the subsets that compose it' (Simondon 2012: 4). Simondon argues that '*the subsets are relatively detachable from the whole of which they are a part*' and states that '[w]hat technical activity produces is not an absolutely indivisible organism that is metaphysically one and undissolvable' (Simondon 2012: 3). Effectively, its parts are open to relationality and deserve consideration, respect, and examination. The technician deals with, examines and tries to understand on its own self-maintaining terms what Simondon calls the schema of concretisation in the object.

Simondon argues that the schema of concretisation is in direct relationship to the cognitive schema; the latter brings into being the *idea* of the new technical invention itself, but can only go so far. A technical object that has reached concretisation involves a coming together of the elements in a new relation to each other, in a way that brings about something that did not preexist it. Essentially, it is the involuntary material encounters of the elements that bring about new affects. Simondon uses the example of the Guimbal Turbine to explain that it was in the new relation that water and oil took towards each other in the system, in this precise relation mediated through the parts within the system, that it became *something in itself*, self-sustaining and concretised (Simondon 2012). As Massumi writes:

> What matters for Simondon is the paradox that, before the oil and the water entered into relation, the respective multifunctionalities were not in effect. They were nowhere. They are not to be found in the past. It is when the relation kicked in that they were determined, by that very event, to *have been* the potential for what has come (De Boever *et al.* 2012a: 25).

For Simondon the potential comes from the future, so that '[t]he respective multifunctional potentials of the oil and the water came into existence at the very instant their disparate fields clicked together into automatic relation. The potentials in the oil and the water for the turbine have been *invented* by the relation's energetic kicking in' (De Boever *et al.* 2012a: 25). It is a recursive causality in which the future acts on the present; this defines for Simondon a key reason why 'the technical object is not the product of a hylomorphic causality moving from past to future' (De Boever *et al.* 2012a: 26). If a technical invention 'does not have a historical cause', indeed if it is essentially 'the bringing into the present operation of *future* functions that potentialise the present for an energetic leap into the new' (De Boever *et al.* 2012a: 25) then it is not about something recognisably existent needing solving in a recognisable way. An inventor has a hunch, shall we say, and through the cognitive schema designs the outline of the object, brings together the elements, but at a certain point it becomes a 'self-conditioning emergence' (De Boever *et al.* 2012a: 26). This seems reminiscent of improvisation, particularly the words used by Susan Sgorbati when she states that in her ensemble practice, Emergent Improvisation, '[a] self-sustaining dance evolves' (Buckwalter 2010: 18).

In our initial conversations before we began practical development of *Tools that Propel*, both Adam Russell and I were concerned by the apparently reductive nature of the digital processing on physical experience; we had discussions around how we could 'acknowledge our digital lives' and allow them to become an intervention in our physical lives in ways that produce new possibilities and conceptualisations of the world. For Simondon 'the technical object is not a material thing but a *functioning*' (Lindberg 2019: 303) and '[t]he machine is a being that functions' (Simondon 2017: 151). Indeed, where Simondon states that '[w]hat resides in the machines is human reality, human gesture fixed and crystallised into working structures' (Simondon 2017: 18) and that '[t]he machine is a deposited fixed human gesture that has become a stereotypy and the power to restart' (Simondon 2017: 151) he sees the machine not as doubling the hand, but as doubling the action that the hand makes (Lindberg 2019). In his arguments for returning materiality (and the idea of it) to data and computation, Nathaniel Stern outlines that

> [a]s computers become more and more complex, and we simplify our understandings of complex thinking in order to get computers to do work for us, we are equating humans and computers as no different from one another. [...] Put insubstantial data and human as information processor together, and we too wind up without matter (Stern 2013: 32-3).

Such a conflation has impacted society as a whole: we have created a prevailing tendency for modular processes, activities with predesigned outcomes (outcomes-based planning in project design), and a culture where success is determined and controlled by quantifiable data. Even if we might not know all the outcomes of our inputs, so many functionalities of computational machines have been predicated

on the knowledge, inputs, and unconscious bias of their programmers too. On the one hand, computational machines can just replicate or magnify humans, distilling all the worst aspects of our thinking and cultural tendencies into their functionality; on the other, they can reduce human complexity, emotion, and expansiveness through their particular circuitry and processing.

Unbeknownst to Adam and myself, we were favouring the possibility of a methodological design approach that was conditioned by *being-with* technology. In doing so, what I have previously considered a dramaturgical approach – of the process-oriented kind – might in fact be seen as a journey from an idea born in the cognitive schema of two entangled human collaborators to the schema of concretisation in which the system itself seemed to condition how it evolved.

> The designer can bring the two disparate fields of the water and the oil to the brink of relation, but the passing of the threshold belongs absolutely to their potential. The designer is a helpmate to emergence. He can put the pieces in place, moving through a linear series of steps progressing from the past of abstract conception to a present on the brink. But the passing of that threshold to invention depends on the potentialization of the elements presently in place as a function of their future (De Boever *et al.* 2012a: 26).

During the process of developing *Tools that Propel* it felt like the system came into being itself. From its first taking form it drove the collaboration between Adam and me, and subsequently, after the system's development (to its current iteration, and the ending of Adam's involvement), it drove my research into its improvisational affects. I saw this as dramaturgical, getting lost so we could find something new (Lepecki 2015), but it is equally understandable as emergence, the potentialization of the elements that were 'presently in place as a function of their future' (De Boever *et al.* 2012a: 26). Equally, as Simondon states '[t]he technical being evolves through convergence and self-adaptation: It unifies itself internally according to a principle of inner resonance' (Simondon 2017: 26). By enabling *Tools that Propel* to make its own cuts in the movement, it did not precisely replicate dance movements despite the fact that their materiality was that of the human body dancing. The effect was not to make any action of the dancer more efficient but bring about challenges and questions to the dancer at an ethical and aesthetic level. Whilst Vida Midgelow argues that a dramaturgical view is something that 'holds that there can be no tabula rasa' (Midgelow 2015: 112), for memory is embodied within the dancer, *Tools that Propel* in its technological functioning is indeed a tabula rasa[26], thereby allowing for

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[26] Whilst I am claiming this from a dramaturgical viewpoint in the interaction with a dancer, I am not claiming that the computational process is not at all predetermined, given the certain biases that are conceivably built into the algorithms, gesture recognition library, and the tracking ability of the Kinect sensor, for example.

new embodied knowledge to emerge in an entangled interaction between it and the dancer. *Tools that Propel* allows the dancer to see and actualise their own embodied memory and that of others anew, over and over again, realising new potential within it. The encounter between dance meaning (or human conception of its meaning) and digital meaning – when perceiving a movement – is fertile ground to develop an evolving dialogue between the interactor and *Tools that Propel.* They must examine the elements – movements – that are outputted towards them, curiously and with nuance, through their bodies.

Absolute Origin

It is with an open attitude to technicity, whereby we play with technological objects to explore what its elements might do or be doing, rather than predetermining outcomes and putting together a technical specification to achieve it, that we will produce new inventions that truly change us or that can affect us in ways that we did not preconceive. This will not happen through fearing technology, nor trying to overcome that fear by subjugating it to our will. Simondon states:

> To accept or reject a being wholesale, because it is a whole, is perhaps to avoid adopting towards it the more generous attitude: namely, that of careful examination. A truly technical attitude would be more refined than the easy fundamentalism of moral judgement and of justice. The distinction of the subsets and of the modes of their relative solidarity would thus be the first mental work that is thought by the cognitive content of the technical mentality (Simondon 2012: 4).

This is not necessarily a technical mentality that fits with the agendas of multinational corporations who monopolise markets. But whilst Apple's image is predicated on the magic within the black box of its hardware, it is cheap cloud computing, open-source libraries and frameworks, and data sets available in the Public Domain that are making it increasingly possible to investigate, play and explore machine learning, for example, in ways that enable the discovery of new potential in the world we inhabit. Simondon was indeed very prescient. Discussing Simondon's notion of technical mentality, Lindberg states: 'No more a "black box," it ceases to be a "closed machine" that refuses all modification, and becomes an "open machine" that can be repaired, transformed and used as material for new inventions: The "authentic technical object" is free to evolve' (Lindberg 2019: 302). We have on many levels reached a time of the authentic technical object, in the ways that artists are using them to question the very nature of technicity, to raise political challenges to technology's hegemonic hold over society and its homogenising effects, to explore the very surveillance it enables, and to make people more aware of its sinister and in many ways dangerous affects on humanity.

Brian Massumi poses some key questions in relation to Simondon's prescient discussions of technical mentality. He points out that the post-Enlightenment was defined by a 'perpetual crisis'

wrangling between a desire for what people perceived as the natural/artisanal and the mechanics and futurity of industrialisation and its impact on society and economics. He questions whether the post-industrial network will see a merging of technical and psychic individuation, a shared lineage between the cognitive schema and the schema of concretisation – that is, an absolute coming together of human thought and invention and technical coming-into-being as wholly and intrinsically one, as a singular ontogenetic process of becoming.

Massumi states that Simondon himself did not pose nor answer this question in his philosophy but argues that 'it is a measure of the effective potential of his own conceptual inventiveness that he came to *its* brink, so far ahead in anticipation, and in a way that furnishes us today with future-facing resources apt to assist us in coming to our own response, as an expression of an ethics of becoming' (De Boever *et al.* 2012a: 35). It is in Massumi's interpretation of Simondon's ethics of becoming that I find further inspiration; it presages the possibility of using technology in ways that open up conceptual boundaries and coalesce with the potentiality inherent in imagination. Massumi asserts that:

> For me, a Simondian ethics of becoming is best to be found not in a next 'posthuman' phase, but in the *non-human* at the 'dephased' heart of every individuation, human and otherwise. What I mean by non-human is the ontogenetic clinching of the pre-individual that catapults it over the threshold of becoming. I mean the individual – that non-decomposable solidarity of occurrent existence – at the brink. Just coming eventfully to be what it will always have been, at a level where it has, as yet, no content, no meaning, no structure, only past-conditioning future-facing. The really ideal 'absolute origin', as a function of which every quantum of individuation effectively ends where it causally begins, so as to interlink emergently all individuations in that vast network of transductive more-than-oneness that is the process of Nature (De Boever *et al.* 2012a: 36).

In his description of the 'absolute origin' Massumi imagines here a circularity – what we see in Simondon as a recursive causality – where time is not linear and progressive but opens itself out to find potentiality within itself. Technology does not get confined to human perception of what is possible but is also at the brink – the 'threshold of becoming' – changing with us, changing us, becoming something in itself. As such, this opens up the possibility to envisage the invention of technological systems that we interact with without knowing how to; indeed, it challenges the very 21st century obsession with knowing what we will learn before we learn it and proposes exactly the opposite, that we stand together human and non-human and *become*, perceive and know in ways that we cannot predict. In situating *Tools that Propel* in relation to an ethics of becoming, this thesis explores the idea that the system reconfigures the body's understanding of itself in such a way as to reunite it with a pre-structural 'absolute origin' (Simondon 2016 [1958]; 2012), bringing it back to the brink time and again so it can perceive and embody its relation with the world anew.

FROM REAL-TIME INTERACTION…TO REAL-TIME INTRA-ACTION

Massumi writes that '[t]here is no 'one' but always a one *moreness*: a 'more-than-one', everywhere energetically in potential' (De Boever *et al.* 2012a: 33). The way that *Tools that Propel* creates and categorises movement vocabulary in collaboration with the dancer reflects this notion of 'more-than-one' rather than the 'one'. This maintains energetic potential and the always-possibility-of-something-more whilst also through the very process of determining *what a movement is* in the first place and offering it up for embodied examination enables 'discover[ies] of structure' and 'provisional resolution of incompatibilities' whilst not destroying the potential itself (Simondon 2011 [1958]: 411). The '*moreness* […] everywhere energetically in potential' (De Boever *et al.* 2012a: 33) links Simondon's philosophy to ecosystems aesthetics which Andrew S. Yang describes in terms that resonate strongly with the fundamental concept of metastability. This thesis is about the diversification of new forms, and Part 2 explores exactly how that happens in the very specific system (*Tools that Propel* in use) within the larger systems (dance, improvisation, choreography, choreographic software, society, nation, world, universe, for example). Furthermore, it explores how this specific system-within-system asks you to look to what Yang terms '*the middle of the thing we are in* - the active and complex middles of creation rather than the subatomic beginnings or the hyperbolic ends dominated by extreme scales and force' (Yang 2015: 176).

But let us relate this back to interaction design. Brian Massumi differentiates between 'interactivity and relation' (Massumi 2011: 46). He states that inter-action is 'just that: a going back and forth between actions, largely reduced to instrumental function', arguing that '[t]he lesson of semblance is that lived reality of what is happening is so much more, qualitatively. It includes an 'uncanny' moreness to life as an unfolding lived relation in a world whose every moment is intensely suffused with virtuality' (Massumi 2011: 46). As such, he uses the word 'relation' to 'refer to the full spectrum of vitality that the dynamic form really includes, potentially, abstractly self-expressed in its semblance' (Massumi 2011: 46). I use the word relation in this thesis as Massumi does; concerning myself with the dynamism of relationality, and the potentiality that can be discovered within it. But as interaction is the word that is used in more colloquial parlance, or even industry understanding of performative modes and futures, I do not want to replace it entirely with relation throughout my discussion. As such, I have decided instead to replace 'interaction' with Karen Barad's energising term 'intra-action' from here on in (Barad 2007). It invokes not a 'back and forth' but the sense of different bodies affected by and affecting each other, and their fundamental 'ontological inseparability' as 'agentially intra-acting components' (Barad 2007: 33); importantly for this research, it suggests the possibility that the agency – and the thought-action – occurs through and within their entanglement. It might not be particularly different in

implication and rebuttal of 'interaction' to Massumi's 'relation' but to me it evokes a sense of movement which feels important.

Of course, here, in questioning the back and forth implication of interaction we might question the use of the term 'dialogue' at various points throughout the thesis. In one way, we are right to do so: there is a problematic tendency or aim of dialogue to reach a conclusion – an agreement of sorts – and I am not sure that is the aim of *Tools that Propel*, nor in fact always desired. I use the word dialogue because I am constrained to linear language in my documentation of this research, and such a constraint necessitates a direction, a turn-taking, and the proposition of one idea (thesis, anti-thesis etc.) at a time. It is worth noting that whilst Simondon differentiates himself from Gregory Bateson and cybernetics partly because of its dialogical nature, Bateson did construct some beautiful and inspirational attempts to problematize the linear nature and concluding-objective of dialogue through his metalogues (Bateson 2000). I feel drawn to both: the rejection of dialogue as too organised, too much about turn-taking, too constrained for the fleshy, intuitive, preverbal complexity of the body dancing in and with the world, and also the embrace of dialogue as a relatively clear metaphor for the possibilities inherent in two bodies (human and digital, however entangled) gesticulating to each other in their own ways and finding a new language in which to converse.

METHODS

The individuals who have contributed to this work cannot entirely be disentangled vis-à-vis everything they have contributed. So too I consider the methods within this methodology to be an ecology of practices that rub against each other, affect and are affected by each other, and evolve together in accordance with each other. The various methods I will discuss within this vein are 'collaboration', 'studio practice', 'performance', 'documentation' and 'writing'. However, it is important to recognise that whilst they are considered in isolation they are not remotely siloed in actuality.

Collaboration

I think of collaborations in this project in terms of injections of energy and information that give rise to new potential in the system (and system-within-systems) and the collective individuation. I would argue that it is through this process that we somehow overcome the antithesis between the artisanal modality and the industrial modality that Simondon discusses (Simondon 2012). There is neither the human-as-information – the gesture of the work embodied in the work itself, with the energy coming from Nature – that he identifies in the artisanal. Nor is there the separation between two or more informational roles – inventor and worker, for example – the former isolated and alone, never functionally involved in his invention, the latter put upon and subjected to the demands and structures of industrialised

labour conditioned by the very machines they operate – that characterises the industrial modality. I argue that together – and here I include the component parts of *Tools that Propel* – we were reaching towards the affective modality, everything relational and affecting each other in an inseparable becoming.

As *Tools that Propel* emerged in the unknown terrain between Adam Russell and me, it shaped us and our thinking. The more we evolved it the more it shaped our collaboration and the direction of our independent but interrelated research. Equally, what struck me as interesting in working with Adam was how he thought through the code he wrote. It was not thought that was then translated into code. So sometimes I could not be part of that thinking. Similarly, I thought through using the system itself, through my body and what I intuitively experienced or understood through that. Discovering what felt important and what might be possible as we went along, we explored how each iteration of *Tools that Propel* affected a dancer's decisions within improvisation; how far it sustained their engagement and pushed them to evolve their choreographic decisions; encouraged them to 'break habits' and explore new movement variations; challenged their rhythms, patterns and beliefs about what could constitute a dance movement; and how intuitive it felt to improvise with and build a relationship with the system.

This thesis also examines how the components of the system itself, including dancer, sensors, projectors, computer hardware, algorithms, code etc. are parts of a distributed agency which demand that the creative discovery is made in an unknown space between them. They too are part of the entangled collaboration. The technology is freed from being a constraint, asked to shape the disorder of the creative process, and acts as 'an input of energy...that allows for a re-ordering or re-differentiation of a system's components' (Yang 2015: 169). Yang's case for staying 'present *in the middle of the thing we are in*' (Yang 2015: 176) suggests to me a looking to the middle of a creative process, without trying to predict, preconceive or determine the outcome, thereby making possible a discovery of new potential within it.

Yet equally, it is possible that it is also the dancer who acts as an 'input of energy […] that allows for a re-ordering or re-differentiation of a system's components' (Yang 2015: 169): when we start up *Tools that Propel* all that we see is the reflection of the room; nothing can happen without the input of something from a dancer's body, their entry into the space, their embodied movement. The system until then has reached an equilibrium; tension reduced, the energy dissipated. Yet, on entering the system the dancer is providing the constraint, the structuring theme (in Arnheim's words) which allows a new form of order to start to emerge. Equally, the system is providing this in relation to the dancer's vocabulary and notion of what they can do. It works both ways round. Hence the notion of an ecosystem perhaps – the re-differentiation of a system's components, depending on what system we

are looking at. The system could also be the disorder of the room (which has its own non-structured order), in which people meander, sit, watch, and discuss, waiting for something to happen.

Studio Practice, Interviews and Recorded Discussions

The research within this thesis draws on practical use of *Tools that Propel* across two and three-quarter years. The first three quarters of a year represents the time that it took for its development and its first outing as an earlier iteration as an installation at the Radiant Gallery in Plymouth during the Digital Research in the Humanities and Arts conference *Data Ache* in September 2017. In October 2017, Adam Russell and I took part in the Digital Artist Residency as part of the Wrong Biennale (the wrong 2013-21) and spent a week in a studio with 7 undergraduate dance students from Falmouth University (Yi Xuan Kwek, Maria Evans, Brandon Holloway, Holly Jones, Becca Moss, Katherine Sweet and Keir Clyne). This week was instrumental to the development of the system as a choreographic improvisation tool. In collaboration with these dancers we explored the system's functionality and introduced the ghost effect whereby the past movements overlaid the present real-time projection of the dancer moving in space. This was the last time the system was developed technically, due to a divergence in the research interests of myself and Adam.

The research in this thesis emerged out of a sustained explorative use of the system in this final (but perhaps unfinished) state over two subsequent years, during which I have worked within studio sessions improvising with the system myself, facilitating sessions with dancers and dance students, observing them, interviewing them and facilitating discussions. Following the Digital Artist Residency, I worked primarily with three dance students who had become particularly interested in the system: Maria Evans, Yi Xuan Kwek and Brandon Holloway, who were also later joined by fellow student Zach McCullough. *Tools that Propel* was also used by second year dance students Sofie Hub-Nielson and Euan Hastings in a choreographic study after they experimented with it during a four-day workshop within their 'choreographic collaborations' module on the BA in Dance & Choreography at Falmouth University in November 2017.

Each of these undergraduate dance students were interviewed after their time using *Tools that Propel*, that is either after the 7-day Digital Artist Residency which was directed by myself (working in collaboration with Adam), or after the 4-day workshop within the BA module, in which they had free reign to use the system as they liked. I cite from these semi-structured interviews in the text within Part 2 and also use edited snippets from them within the videos. The four students, Yi Xuan Kwek, Maria Evans, Zach McCullough and Brandon Holloway who continued to work with me in occasional studio sessions (totalling approximately 10 days) across nearly two years after their initial exploration with the system have contributed to the research findings within recorded studio discussions, also used within

both the text and videos, and through comments that I have documented in my notebooks. Yi, Maria, and Zach also took part in individual semi-structured interviews after the creation and performance of *Body of Memory* (see below, but note that this was an additional 3-weeks that they worked with *Tools that Propel*), along with Euan Hastings who had to drop out of the piece due to an injury. These interviews are also used within the thesis, in both the text and the videos.

Along with the practice-research that took place over sustained periods of time with the students at Falmouth University, *Tools that Propel* was also used by participants taking part in the Critical Facilitation workshop led by Sheila Preston at the International Community Arts Festival summer school in Barcelona in July 2018 (ICAF 2021). These participants were theatre, dance, and arts facilitators experienced in working with a range of different types of community groups internationally (predominantly but not exclusively within Europe) and they discussed its potential value within community practice from their points of view and with reference to their brief exposure to its functionality. This workshop is only referenced in relation to my notes taken at the time. Furthermore, *Tools that Propel* was trialled by two professional dance companies – Company Wayne McGregor (December 2019) and Company Van Huynh (December 2018) – and with community participants at Cardboard Citizens, a company which makes theatre with and for people with lived experience of homelessness. Discussions were recorded during each of these workshops (Appendices C, D, and E) and are drawn on at times during the text in Part 2, though a substantially larger contribution is taken from the students from Falmouth University, in particular Yi Xuan Kwek and Maria Evans whose insights are particularly entangled with the development of my arguments. The amount of time I spent working with the students from Falmouth University in this research process saw me both trusting and valuing them as artists. Our collaboration has led to their significant input into the thesis in which their voices, articulating their experiences of using *Tools that Propel* and the ideas provoked by it, are given substantial space and time. Throughout the discourse, from here on I will refer to these dance students as 'participant dancers'.

Performance

Body of Memory was a semi-structured improvisation piece which unfolded in dialogue with *Tools that Propel*. Following three initial weekend sessions in May 2019, it was made across a three-week creation process in September 2019. Working with two versions of the system set at right angles to each other within a black gauze installation (see Figure 4), the piece was developed by myself as concept and process director working with dancers Maria Evans, Yi Xuan Kwek and Zach McCullough, lighting designer/improviser Jess Smith, and composer/sound designer Matthew Collington. I have chosen the term concept and process director here rather than choreographer as I did not determine or select any

of the movement used within the piece.[27] *Body of Memory* was semi-improvised and was developed during a process that I led, drawing on my previous experience creating professional and community works in theatre and dance as a director, choreographer, and facilitator. But the aim of the project was to allow the piece to emerge and evolve through the affordances of the system, the configuration of the installation and the various elements within the performative and architectural structure. I will discuss the nature of my process direction within Chapter 5 but suffice it to say that whilst it was an experiment that yielded a degree of knowledge and insights as a research process, it also stands as a case study of a particular artist (myself) using *Tools that Propel* in one particular way to create a dance work. It is my contention that other artists might use *Tools that Propel* differently and see other potential in its use within performance. I have considered its role as a form of dramaturg, holding the unfolding piece, disrupting preconceptions and dialoguing with the dancers, within a space that also yielded performance-creating properties.

Figure 4: Black gauze installation for *Body of Memory*, with two systems of *Tools that Propel.* Audience could move and watch from all sides and dancers used three performance spaces (two behind the screens and one between them, seen here).

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[27] I have not used the term 'concept and process director' in the credits that remain on the filmed document of the piece, as given my intention at the time to remount the piece beyond its research context I chose there to use 'director' to reflect industry-recognised roles. Equally, the credits describe *Tools that Propel* as a choreographic development system, but I now choose to use 'choreographic improvisation system'.

Writing as a Practice of Not-Knowing

In considering the value of writing as one of the many practices that make up the knowledge within this thesis, I am struck by this passage from Carrie Noland's *Agency and Embodiment:*

> It was while watching a graffiti writer that I first began to perceive how agency might work. [...] I knew at that moment that this singular performance had something to teach me, that it was offering a response to a set of questions I, and many others in my field, had been formulating with an urgency that had not diminished over the years. How does individual human agency exert itself despite the enormous pressure of social conditioning? What *is* human agency? Does it in fact exist? If so, where does it come from? The libido? The soul? If not, and we are no more than products of social conditioning, then why do we not simply repeat what we are conditioned to do? If our agency is governed by *systèmes de signification* (in one account) or anonymous power structures (in another), then why do variation, innovation, and resistance occur? Why do scripts differ and meanings evolve? In short, why aren't humans more like machines? (Noland 2010: 1).

Pedagogical experts often argue for the importance of 'knowing' what you are going to learn before you are taught it (Erikson and Erikson 2019): presumably the power of this for students lies in the security and containment of information; the ability to be able to place the knowledge they may acquire somewhere. But I think sometimes the power of ideas and insights is that they may not land then and there, but are accumulating, time-travellers even, and might only come into focus accidentally, in accordance with something else that unexpectedly triggers them. It is often in the failure to be named, to be exactly, precisely mapped, that new ideas emerge.

Participant dancer Maria Evans once suggested that it would be choreographically interesting to be able to see only the shape of the overlap between past and present bodies (rather than the entire body-in-its-environment from the past overlaying the entire body-in-its-environment in the present). I did not immediately understand what this would produce in her choreographically. I was trying to know before it was knowable; trying to predict based on prior knowledge. This is an attitude that is reductive within this process of erring and getting lost that, following André Lepecki, I am advocating here. It is impossible to be able to perceive what such architecting of the bodies she had envisaged on screen would actually do for her cognitively, kinaesthetically, dynamically, or compositionally if she had the chance to intra-act with it. Maybe nothing. Maybe something extraordinary. In asking the computer to create these shapes – in collision with our bodies and our movement decisions – we would be asking to be pushed further into a space of not knowing, a space where choreographic agency could be affected because there was less recourse to social-conditioning about what these bodies mean, what

they can do, what weight of history they bring with them from the past to the present and the future of dance. This never happened, largely because technological development of the system stopped when Adam and I moved our research in different directions. But it is my own attempt to stymy discovery and embrace of the unknown that interests me here.

But I did not set out to write this, like this. My own words above – 'in the failure to be named, to be exactly, precisely mapped, that new ideas emerge' – were triggered by the image of the graffiti artist defying the social conditioning of language and meaning, and also the memory of writings on computationally-facilitated affective spaces and technological failure creating affect by artist-philosophers Erin Manning and Nathaniel Stern respectively (Manning 2012; Stern 2013); these triggered the memory of Maria Evans' proposal for a development of *Tools that Propel*. In this way, I succumb to the possibilities of not knowing what will emerge when I sit down each time to start the creative act of writing. There is a plan, of sorts, but then there are the ideas that emerge in the words. The knowledge and insights that I encounter as I plough forwards, and the eventual galloping of horses as the dramaturgy of my narrative unfolds of its own accord, takes off, unstoppable: as I meet the demands of the work within its own material universe (Peters 2009). I revisit my words, of course, and edit, and therein, perhaps I pretend to have known what I would write. But in writing as a practice I do much of my thinking. It is, like dancing, and indeed like reading (whether theory or fiction, such as we'll see in Chapter 5), a mode of thought, and as such, the very act of 'writing up' my thesis is also part of my research methodology.

Notes about Language and Thought

As already stated, many of the arguments within this thesis are based on use of *Tools that Propel* by participant dancers from Falmouth University and their observations in semi-structured interviews and workshop discussions. I have chosen to transcribe their words as spoken, with pauses, ellipsis, hesitation, 'likes', 'kind of', and any other such embodiments of thought and idiosyncratic articulation left in. This is because these words, pre-verbal sounds, and ellipsis, are in themselves annotating their experience; they are a form of 'markmaking when marks are an extension of thinking' (deLaHunta *et al.* 2015: 1), as they wrangle with the articulation of their improvisation and learning with *Tools that Propel*. This decision stems from an interest in the way that thinking is embodied in the languages that we use; how new languages embody new thinking (for example, that emergent in the gap and interrelationship between the digital agent's and the human agent's distinctive way of annotating the movement material); and how difficult it is to transcribe one language and thinking into another (here, from the modality of speech to the modality of writing).

Dario Llinares argues that when speech is transcribed and edited for written contexts it is the 'immediate, synaptic firings of electricity that produce vocal expression out of thought' that are lost (Llinares 2020). He states that these 'possess an improvisational vitality in the space of human conversation, which when committed to text loses the context, emphasis, intonation and textual that the materiality of the voice imbues' (Llinares 2020). The improvisational nature of speech might well be pertinent for discussing the improvisation provoked by dialogue with a digital agent. For Brian Rotman, writing as a technology propounded the singular, disembodied 'I', configured within the linear, serial Western written text. This self is split off from the bodily – gestural utterances, guttural sounds, elisions, and breath – that is not contained within the discreet components that are singular words with pre-configured signification (Rotman 2008). On the one hand, I am returning the bodily to the representation of Yi, Maria, and the other participant dancers' ideas on paper, but it is also more complex than this. These participant dancers are trying to translate into spoken language a movement-based experience, which, unlike Western linguistics, is neither unidirectional nor fragmented into discrete units of signification. But, on top of this already difficult task, they are also attempting to describe how they and their choreographic thought-actions are affected by their embodied intra-actions with a technological system which disrupts their perception of time as linear, and as such, shifts their construction and conscious understanding of reality.

In the encounter with their own ghosts the dancers are experiencing a simultaneity of embodied thought and markmaking, which is both reflective of dance on stage, with multiple performers carrying out different choreographic thought-actions at any one moment in time, but also perhaps representative of the human experience in which multiple bodily processes and perceptual interrelationships with the human and non-human world co-exist and co-perform. Brian Rotman argues that digital, virtual, and networked technologies have created a paradigm in which the third self exists – he calls this the 'para-self' (Rotman 2008). He asserts that 'for at least the last half millennium the very concept of a person has adhered to that of a 'lettered self', an individual psyche inextricable from the apparatus of alphabetic writing describing, articulating, communicating, presenting, and framing it' (Rotman 2008: 2): the advent of the third self challenges who we are and how we express ourselves. With the growth of new media and technologies of reproduction in the 19th century 'the alphabet's hold of factual description and memory was broken by photography' (Rotman 2008: 2) and virtual and networked media has of course shaken up dominance of the written word and its shaping of human subjectivity yet further. In doing so, Rotman argues, these technologies are actually returning parallelism and simultaneity to human construction of experience. Moreover, through their ability to capture movement, touch and non-verbal and un-signified sounds, they can bring the pre-speech and pre-written embodiment of human thought into the communication and mediation of this experience. Within the constraints of the written thesis, I am staying as true to this as I can in inscribing the

participant dancers' double remediation of the thinking embodied within the already-mediated experience of dancing with *Tools that Propel*: that is, the remediation of it into speech and from speech into text. Ellipsis, ums, hesitations, and 'likes' might well be a way of representing the rich and as yet not-articulable potential reverberating in the gap between the digital agent's approach to categorising and annotating their movement and their own annotations of its recordings.

Documenting Practice

In her essay 'Materiality, Immateriality and the Dancing Body – The Challenge of the *Inter* in the Preservation of Intangible Cultural Heritage' Sarah Whatley rightly identifies an apparent crossroads with regards the direction of travel that practitioners and researchers have often taken with regards dance and technology (Whatley 2015). She describes how on the 'one hand dancers and choreographers, in conjunction with researchers, are thinking deeply about how to organise dance content online so that the viewer/user can "dig" into what might be an archaeological process of excavating a dance', 'allowing artists to capture and distribute much more of the process of making and choreographic thinking, thus encouraging viewers to experience the less tangible aspects of the dance making process' (Whatley 2015: 83). On the other hand, she argues, 'dancers have incorporated more and more advanced technological possibilities in their practice at the time of making new work, with the physical dancing body increasingly absent from the live event' (Whatley 2015: 83).

Whatley focuses on performative events that are rooted in or draw from conventions of dance as a theatrical form but which '*interface* and *interact* with digital technologies'. Despite the focus on archiving that she attributes to the development of widely available digital technologies, she argues that these very performance events that *interface* with digital technologies 'tend to evade "capture" in conventional ways (video, audio, notation, photography and so on)' (Whatley 2015: 84). She states that 'they are not easily archived in a form that offers any real sense/access to the "work" as it was intended to be experienced' (Whatley 2015: 84). Discussing them as 'hybrid endeavours' – whether because of their fusing of human and machinic identities, or because they tend to cut across traditional boundaries of performance-making – she argues that they 'are always in a state of becoming rather than existing as fixed events or objects' and as such 'tend to be absent from our collections of cultural heritage' (Whatley 2015: 84).

This presents a problem for practice-based research of any kind, but arguably that much more so for digital work that is designed to be experienced live and that contains recording within its materiality; when it is recorded for documentation purposes there is a double remediation (even if the first is not in fact a remediation but a digital materiality). The Covid-19 pandemic stymied original intentions to present the practice part of this PhD thesis live; the installation performance *Body of Memory* has been

fragmented and dislocated – at least for now – in the disparate and dispersed bodies of three participant dancers who have returned to Singapore, Southampton (UK) and Crewe (UK). Equally, *Tools that Propel* is in process; it is probably best experienced personally, intra-actively, affectively, but it still requires set-up by myself or Adam. The richest legacy is perhaps the understanding that has emerged from it and the code which could be released open-source for further transformations and becomings.

In view of these challenges, I resolved to create the series of videos that sit alongside the thesis. Suitably, (except for Chapter 5 where they are made from the edited footage from four cameras recording a run of *Body of Memory*[28]) the video footage is born of waste material (in my mind). They represent new potential that splits off, diversifies, splinters, defecates from the action of using *Tools that Propel.* As stated earlier, every time the system is used it produces session recordings: these show two side by side screens, the one on the left revealing what the dancer is actually doing in the studio, the one on the right revealing the composite of their projected image in real-time and in memories brought back by the system in relation to their real-time movement. This latter is what the dancer themselves is seeing and intra-acting with. These videos, along with every individual 'memory' or 'class' that is tracked and recorded, are outputted, and saved by the system. That's a lot of potential, born of apparent waste: energy that appears to dissipate but resides for new transformations. Yet it is when these recordings are watched alongside the voices of the dancers grappling with their embodied understanding of their encounters with *Tools that Propel* that this potential is, in this particular case, realised. It also brings the voices of the dancers, albeit it disembodied voices, to the heart of the thesis, not in translation, the 'I' of the spoken word further dislocated to the 'I' of the written, but a more authentic capture of their thinking (except that it is re-contextualised and just presented as curated clips) through the practice of speaking, complete with pre-verbal gestural utterances and ellipses. It is a return to the origin, to renegotiate understanding through becoming, through transformative affect. As Rotman states:

> Becoming silent, acting mute is becoming infant, and as such is understandable as part of a willed accession to the state of pre-speech, a kind of return to our renegotiation of the past, except that what is involved in such a move is not a 'return' or any kind of regression, but a reconfiguration of the present by altering its genesis, its supposedly

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[28] The videos of *Body of Memory* are documents of the performance, but not truly representative of it; the darkness of the performance setting, the projections and the shifting lighting states, made it very difficult to film. Whilst they are indicative of Sarah Whatley's point about digital works evading capture and being difficult to archive (Whatley 2015), I have chosen to include them in an attempt to give some access to the work from the audience viewpoint.

necessary and irrevocable linkage to that past by re-originating itself
(Rotman 2008: 49).

Just as *Tools that Propel* links us to the past by its constant reperformance of it, allowing our re-origination of it in turn, so too do the documenting practices of this thesis: writing, sound recordings, and video recordings. This thesis is an attempt in the present to make sense of the research that has been done in the past; it is re-originating itself over again as the thought-actions provoked form part of the entangled becoming that is the matter and meaning of dancing with *Tools that Propel.*

Becoming Research Design

This thesis predicates its knowledge, and the methodology used to bring it into being, on the supposition that an experience which did not pre-exist its techno-ontological emergence as part of the entanglement that is *Tools that Propel* cannot be hypothesised. Therefore, the methods used here were not explicitly chosen in terms of their instrumental relation to achieving the aims of this research project. This thesis is about the experience of dancing with *Tools that Propel* and what that affords us in terms of understanding how digital systems can reveal new ways of inhabiting the world, and how a commitment to entanglement as a design approach can create the potential for this to happen. Reflecting Norman K. Denzin's argument that '[l]anguage and speech do not mirror experience' but 'create experience and in the process transform and defer that which is being described' (Denzin 2013), none of the methods were chosen to represent the experience of using *Tools that Propel* but emerged, and built upon each other, as the most appropriate way of teasing out the knowledge that seemed manifest in its becoming. The methods form part of an entangled methodology and perhaps even a recursively causal research design. Together, they form and have formed the subject and object of enquiry, the data, and the communication of findings: the knowledge in this thesis would not be manifest without any one of them, and they all intra-act. The system could not have been developed or used without collaborators, so it made sense to ask the collaborators for their expert opinion on their experience of it. This was an experience which did not exist prior to the specific entanglement of all the phenomena that come into being through and within it: it is defined by its metastable equilibrium and full of shifting potentials. The process of working with *Tools that Propel* in the studio raised questions about its potential in performance; indeed, the live stream requirements of the digital residency, which brought together the participant dancers for seven days, also raised questions about how it related to audiences. Hence the performance project *Body of Memory*. The performance project and the curiosity witnessed in the dancers towards their past/present digital avatars led to a consideration of language and the possibility of experiencing the world differently according to different grammatical structuring of perception. *Tools that Propel* and the experience of dancing with it seems to be as discursive as it is embodied: in its metastability it asks you to experience reality over

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and over again, sending you inwards to the reverberating potential in the middle of our entangled becoming. This too is the story of this research design: the methods intra-acted, sending me to the middle of the thesis' entangled becoming, as it sends you. Denzin states that '[m]eanings are always in motion, incomplete, partial contradictory', that '[t]here can never be a final, accurate, complete representation of a thing, an utterance or an action' and finally, '[t]here is no longer any pure presence, description becomes inscription becomes performance' (Denzin 2013). This thesis is always becoming – in performance even – with its readership.

PART 2

CHAPTER THREE

OPENING UP THE DIALOGUE:

WHO OR WHAT IS DOING THE

MOVING?

If we do not know just how it is that human agency operates, how can we be so sure that the processes through which nonhumans make their mark are qualitatively different?

Jane Bennett 2010

'The body' is not a static 'thing,' but rather an active relation to other forces, matter, and matters-in-process. Both humans and non-human continuity, affect, movement, and relationships are precisely what constitute and differentiate both humans and non-human matter.

Nathaniel Stern 2013

Just how we relate to the computational aides that we create raises questions not only about their function but also the impact that using them habitually has on our own cognitive abilities. Indeed, the co-evolution of technology and humans has been referred to by many critical thinkers as 'technogenesis' (Hayles 2012; Clark 2003; Hansen 2000), a term which as Maaike Bleeker writes, 'does not imply that technology estranges us from our embodied engagement with what we encounter but that it intimately intertwines the perceptual cognitive capacities of our bodies with technology' (Bleeker 2015: 95). As Bernard Stiegler stated in his 'Call for Digital Studies' '[t]he process of ongoing digitization […] raises radical questions concerning the future of the human cerebral organization' (Stiegler 2012). Equally, Mark Hansen writes that just as 'learning to read has been shown to result in significant changes in brain functioning' so too has 'learning to read differently, for example by performing Google searches' (Hayles 2012: 2).

Even whilst Stiegler argues that technogenesis is not something new, with human evolution always having been entangled with the technological (Stiegler 1998), and 'technics underpin[ning] everything – our thoughts, actions, creations, how we speak and live, indeed our very being' (O'Dwyer 2015: 44), there are a number of philosophical questions about our relationship with these aides that are provoked by increasing use of digital technologies in everyday life. These concern the status we give them or that they assert, the level of control we do or don't have over them, and indeed the specific nature of their entanglement with or in relation to our cognitive organisation – whether confined to the cerebral or expanded to the bodymind. These questions are fraught with emotional resonance, including, of course, the ultimate fear of the machine overcoming its inventor, invoked by the tale of Frankenstein's monster. This chapter explores how pivoting between an understanding of *Tools that Propel* as a 'tool' and as a 'collaborator' gives us different viewpoints on ourselves, the world we inhabit and the sorts of new knowledge that might come into prominence through technogenesis.

Yet, the reality is less polarised than this: during the practical engagement of participant dancers at Falmouth University with *Tools that Propel* the distinctions between the system as inanimate, a thing, an object, a tool and the system as animate, live, an agent, a collaborator, started to blur and merge. In so doing, they opened up interesting propositions about our place in the world and the creativity, proliferation of ideas, and potential energy that can be released from an inversion or fracturing of the human-centred paradigmatic structures that uphold our sense of our reality. Indeed, exploring *Tools that Propel* as both tool and collaborator opens up nuances within these positions. It is similar such binaries – between media and performance in his case – that Matthew Causey confines to the past eras of 'multimedia', 'intermedial theatre' and 'transmedia', whose prefixes 'multi-, inter-, or trans-, still construct a logic of supplement that creates hierarchies that are irresolvable and false' (Causey 2017: 428). He declares these hierarchies and binaries challenged by the postdigital context within which 'the

ontologies of the performance and media converge and are experienced as less uncanny and more familiar, less discrete and autonomous phenomena, and understood as a flow, a becoming, and always in process' (Causey 2017: 431). This chapter begins by exploring the binary (or not) of the inanimate and animate within our growing understanding of *Tools that Propel* during the first substantial use of it in a weeklong residency in 2017 with participant dancers from Falmouth University. It explores the relationship of this understanding to questions of agency.

During a studio session on November 1st 2018, participant dancer Yi Xuan Kwek remarked that '[now *Tools that Propel*] feels like an extension of me. . . before we felt like it was an other' (Levinsky 2016-19).[29] This comment led to the examination of *Tools that Propel* in relation to 'The Extended Mind' thesis expounded by Andy Clark and David Chalmers in 1998. Through this theoretical framework this chapter considers how the system becomes part of the 'extended mind' (Clark and Chalmers 1998) of the dancer, and something that 'change[s] the way we encounter, engage and interact with the world', something that 'change[s] our minds' (Kirsh 2013: 3:1). Understanding the dancer's intra-action with the system in this way, the chapter unpacks how the body's choreographic thinking happens across both its embodied cognitive processing and that of the system. It examines how the dancer draws on the external information in the choreographic output on screen – the 'memories' which bring back ephemeral movement previously lost and which blend with or disturb the projection of their real-time self – and how he/she uses the system as an extension to the decision-making processes internalised in his/her bodymind. This comes about when the dancer opens themselves up to the perceptual shift that occurs through symbiosis with the system and the computational affordances which enable them to dig deeper within their habitual movement patterns and explore new movement possibilities affected by the reconfiguration of their previously internalised understandings of time and space.

Equally though, whilst Yi Xuan Kwek's comment suggests a shift in her embodied understanding of working with the system from 'other' to 'extension', the validity of seeing *Tools that Propel* as 'other' demands further interrogation. Here it is curiously acting on the dancer and vice versa. Examining this second theoretical framework with regards the intra-action of the dancer with *Tools that Propel* this chapter also draws on the ideas discussed in Jane Bennett's *Vibrant Matter: A Political Ecology of Things* (2010), to explore how the various 'things' that make up *Tools that Propel* act as agents in their own right, intervening in the dancer's decision-making as much as the skill and embodied knowledge she

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[29] This statement is not from a recorded discussion or interview but taken from my notebooks. The memory of this moment has recurred frequently in my research and played a big part in opening up the field of theoretical enquiries.

brings to the assemblage of distributive agencies acts on them. In doing so it examines how the 'things' that make up the encounter with and operation of *Tools that Propel*, including the material bodymind of the dancer, could be understood as being part of an assemblage of distributive agencies that together allow new thought (movements, traces, decisions) to emerge. In a dialogue between them, new choreographic thinking unfolds; movement shapes behaviour and behaviour shapes movement.

In the process of working with the dancers, it turns out that the idea of *Tools that Propel* – or its affordances – as *other* has not really been superseded by the notion of the system as *extension*, but that experience of improvising with it might be better understood as fluctuating between them. Thus, in rethinking this apparent contradiction between 'extension' and 'other' we might in fact conclude that it is both: that there is a relationship between the system as an extension of self and the system as other, intervening in the dancer's decision-making to bring about new choreographic thought-action. Whilst they do not use the words 'extension' or 'other' within it, an understanding of how these fluctuating modes are born out through the improvisational intra-action with *Tools that Propel* is apparent in the video 'Agency, unpredictability and affect' below. Indeed, it suggests that *Tools that Propel* could be understood in terms of Mark Coniglio's call for systems that can both 'reflect' the performer and 'intervene' in (or antagonise) their action. The functionality of *Tools that Propel* is that it does both - it is a function that has come about quite unexpectedly.
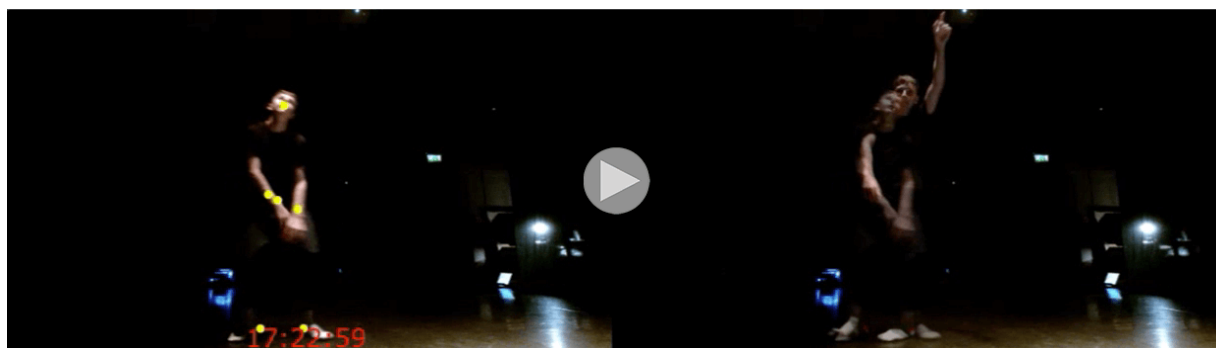
[The video 'Agency, unpredictability and affect' can also be found here:
https://youtu.be/p9ByF6EXN4k]

Given this relationship between extension/other, reflection/intervention, the impact that *Tools that Propel* has on emergent movement and choreographic thought-action might be best understood through the performative new materialist theories of Karen Barad, whereby we discover that agency only comes about through and within relationality. Finally, therefore, this chapter concludes that the 'choreographic agency' that emerges within the intra-action with *Tools that Propel* is neither something augmenting the dancer's agency necessarily, nor a 'thing' in itself, separate and equal to human agency,

emergent in a space between the pre-existing entities that are dancer and system, but something that is only emergent *because of* the particular intra-action of the elements within the technical object. It discusses how *Tools that Propel* (as a system with dancer included) releases or catalyses the discovery of the agency of the unfolding choreography, propelling the dancer to recognise it as something that they cannot control or determine entirely. In doing so, the chapter examines the nature of dialogue when the dancer improvises with the system and interrogates how a feedback loop between what the dancer does physically, and what decisions *Tools that Propel* makes regarding this, increases the choreographic awareness within and for the dancer, as something catalysed by entangled and relational actions.

TOOLS THAT PROPEL OR TATIANA: TO BE (A TOOL) OR NOT TO BE (A COLLABORATOR), THAT IS THE QUESTION

When participant dancer Maria Evans first encountered *Tools that Propel* she referred to it being 'like one of those dynamic abstract paintings where you don't really know what's going on but you have to stand there for a long time and figure it out, then all these shapes appear' (Appendix A; Levinsky 2017). This statement followed her involvement in a seven-day Digital Artist Residency which led to a live-streamed online performance with *Tools that Propel* in November 2017. Other participant dancers gave a variety of answers to the question of what *Tools that Propel* does. In their words, variously, '[it] takes back what you're offering and offers back…whether that's a method of breaking your offering or developing your offering'; 'when it comes to [*Tools that Propel*] your ideas are thrown [*sic*] out the window. […] It helps you explore more ideas. I think it helps you make more choices'; 'it makes you in a sense, like hyper aware of your decisions and like the choices and the consequences, so…it just makes you more conscious'; 'it gives you more opportunities and different pathways to work with'; and 'I think [it] affected my brain a lot more than my body, because it would switch off some things and maybe like subconsciously engage others' (Levinsky 2017). Maria states that

> she's a tool I guess, but not a tool, not the same tool for everyone, so everyone has different tools and takes different parts of her, like some people might want to just challenge it and others might want to kind of like use it, and live in it almost, rather than try and create something from it (Appendix A; Levinsky 2017).

So, it seems that *Tools that Propel* is a tool.

And yet…

And yet, you may have noticed that Maria refers to this tool with the pronoun 'she'. Equally, the participant dancer who stated that '*it* would switch off some things and maybe like subconsciously engage others' started this response with 'personally what I think *she* did to me, which I don't think has ever happened before, when I was playing with *her*, I was never 100% aware of the literal movements that I was doing… ' (Levinsky 2017; emphasis added). Such a casual switch between 'it' and 'she/her' belies the complexity at the heart of this question: to be a tool or ~~not~~ to be a collaborator?

When the participant dancers encountered *Tools that Propel* at the start of the residency they were armed with very little prior information. I simply asked them to improvise with the system – or its external interface, the screen – and see what happened. Within a day, they felt the need to name it, and *Tools that Propel* became Tatiana, and remained so in common parlance for some time afterwards. In the words of one of the participant dancers: 'I think she, what she does, is become another performer and another choreographer… she supported me and pushed me to break my boundaries more with my movement and open my mind a bit more' (Levinsky 2017).

The participant dancers perceived her to have a personality and to their mind, a sense of agency. One stated that 'Tatiana was constantly evolving so we, as dancers responding to Tatiana, were constantly evolving… We were learning more and more from her. And she… did turn out to have a personality that did change through it. I think at one point Becca called her a stroppy teenager' (Levinsky 2017). Another suggested that:

> As we went on and were starting to adopt the mindset of looking at her as a performer, as another performer rather than just a reflection of yourself…rather than just something to overcome, you start to get the sense…you're moving together, not necessarily in the same way but in certain parallels and sometimes those parallels were nice to play with…it kind of feels like a sort of duet thingy that you can share relationship with and […] mould and […] take on different journeys….I think it became more personal if it's possible for something that's non-human (Levinsky 2017).

Here we understand that a relationship is formed with yourself as another performer on screen, rather than with a reflection of yourself; this is an important distinction made here that will be explored, and at times challenged, later in this chapter. Where this participant dancer questions how personal this relationship felt for something that is 'non-human' another argues that whilst 'at the beginning [she] just loved it because it was exciting' there were also 'some days when [they] did not get on' (Levinsky 2017). She states that 'I know we would always refer to it as a person, but that's literally how it feels, some days you don't get on with a certain person' (Levinsky 2017). Finally, the idea of dialogue comes up when one participant dancer refers to the relationship as being 'a conversation, communicating with

each other…it was almost like I'd do something, she'd repeat it, I'd do another thing, kind of just bouncing off each other' (Levinsky 2017).

Tool?

A tool is a thing that enables us to do something we cannot do without it, or at least not as well. As defined by the Oxford English Dictionary a tool is '"[a]ny instrument of manual operation" (Johnson); a mechanical implement for working upon something, as by cutting, striking, rubbing, or other process, in any manual art or industry; usually, one held in and operated directly by the hand' (OED 2022). Or understood more figuratively it can be '[a]nything used in the manner of a tool; a thing (concrete or abstract) with which some operation is performed; a means of effecting something; an instrument' (OED 2022).

The reflection of one's own body on a flat surface in front of you suggests a correlation with a mirror, a *tool* with which we are deeply familiar; it's also a correlation that is upheld by the association in people's mind of studio mirrors (complete with ballet barres) with dance training and practice. The studio mirror is a tool used to check synchronisation between dancers as well as body alignment and position, but it also comes with a certain amount of stigma in the dance world. Against the background of research into the negative and positive impact of mirrors in dance teaching and choreographic work (Radell *et al.* 2014), it has emerged as important to examine the similarities and differences of *Tools that Propel* to the traditional studio mirror. Research by Radell et al. within a ballet context suggested that dance students with less embodied knowledge and training are less self-critical when using mirrors, and indeed feel more positive about their learning when they are using them. The researchers argue that '[m]ore experienced dancers have developed more fully their abilities to observe, evaluate, and constructively use the "kinaesthetic feedback" provided by their bodies, thus fine-tuning their performance over time' and that this might cause them to be more self-critical about their appearance in the mirror (Radell *et al*. 2014: 162). Essentially, this means that lower-level performers do not have sufficient technical awareness to be self-critical when looking in the mirror. Whilst Radell et al. argue that over four separate studies with beginner-level dance students (in 2002, 2003, 2004, and 2011) they 'have demonstrated that at the elementary level the mirror is a powerful tool in the dance classroom that has the potential to impair a dancer's body image and/or classroom performance', they also state that they 'cannot ignore the students who prefer to practice in front of a mirror and believe that they perform better, thanks to the visual feedback it offers' (Radell *et al*. 2014: 164). Whilst the screen-focus is in some ways problematic within *Tools that Propel*, and indeed any previous movement work that I have facilitated has been in predominantly non-mirrored environments, what the system affords choreographers, dancers, and dancers-in-training outweighs most of the negative effects induced by the screen. Moreover, *Tools that Propel* clearly differs from a studio mirror, as becomes

apparent through examination of its particular affordances; exploring what *it does* (rather than just seeing it as a surface to reflect the growing prowess of the human dancer) we see what it affords the emerging choreography within an improvisation with it.

Indeed, if *Tools that Propel*, is a *tool*, then it is a *digital tool*, unlike a traditional studio mirror, which very much belongs to the analogue paradigm. A 'digital tool' might be understood in relation to the OED's definition of *digital* as 'designating a virtual, computer-mediated counterpart of an object that exists in the physical world' (OED 2022) but might also use digital data to do something previously inconceivable in terms of physically existent tools. We might understand this latter idea in relation to Gilbert Simondon's explanation of the schema of concretisation: computation and combinations of different hardware and software enabling new functionalities within their elements and thereby newly perceived possibilities of agential realities. The transforming effect of *Tools that Propel* makes the images projected back of the dancer's individual body sufficiently different to reflections in the studio mirror to mean that dancers are not in fact subject to the same negative impacts, and renders the images into not just a reflection but a creative and productive force as agents in the improvisation. In general, this difference appears to be determined both by the effects of the programming – in terms of the overlaying of past and present images, for example – and the affordances of the hardware in the system – in terms of the lower level of visual acuity in the images and the lag in the projections. What *Tools that Propel* does – if we consider it as a tool that effects something in particular – is give instantaneous feedback, recovering and reminding you of things you have done. But its impact comes about through *exchange*; information does not travel, nor change happen, in a singular direction.

So, let's turn to the definition of 'collaborator'…

Collaborator?

There are multiple conceptions of collaboration and the role of a collaborator, just as there are various philosophical standpoints that determine the nature of a tool in different ways. A cursory look at the same Oxford English Dictionary does not bring much nuance or differentiation to the definition: 'One who works in conjunction with another or others; *esp*. in literary, artistic, or scientific work' (OED 2022). However, without going into specifics about the nature of the collaboration, the instigator of the vision and the hierarchy of contributions, or the degree to which collaborators offer up their skills within roles defined by expertise or not, what we *can* determine from this brief definition is that collaboration necessitates the action of *more than one* (person or otherwise, given that this is not specified) together. Additionally, the definition implies more agency is perceived within a collaborator than a tool; so, let's see how this relates to two technologies developed for choreographic understanding and dance-making, William Forsythe's *Improvisation Technologies: A Tool for the Analytical Dance Eye* and Wayne

McGregor's *Choreographic Language Agent*. We see immediately that the first is called a tool and the second an agent.

Improvisation Technologies, a CD Rom, is designed *to elucidate the dancer's potential arcs, shapes, and trajectories* during improvisation. Discussing how it makes the dancer's imagination visible, as Forsythe says, the technologies are a way of 'taking mental note' while moving (Haffner 1999: 17) – they 'draw the viewer's attention to something that is normally unseen in the studio and in performance' (deLahunta 2015: 223). As stated in Chapter 1, Forsythe's dancers have to hold onto the ideas from the *Improvisation Technologies* in their bodyminds, relying on their embodied memory of them in order to problem-solve with them within the improvisation itself (deLahunta 2015). deLahunta differentiates this to the *Choreographic Language Agent* through which McGregor's dancers 'can manipulate structural relationships that are both syntactic or language-like and visual-spatial' on the computer and build 'further understanding of these manipulations by assimilating them into their movement generation' on the studio floor (deLahunta 2015: 226). As deLahunta argues, unlike the tool (*Improvisation Technologies*) the nature of this agent is that it offers a two-way process, existing for the dancers as 'a page for working out choreographic ideas more *interactively*' (deLahunta 2015: 226; my emphasis). Perhaps it is interactivity that creates a sense of agency then?

We might here look back to Chapter 1 to remember that I argued that whilst the *Choreographic Language Agent* was developed to be an 'independent dance entity, a "choreographic agent"' that would be able to work with choreographic tasks alongside McGregor's dancers in the studio (Leach and deLahunta 2017: 462), *Tools that Propel* appears to have a different kind of agency to this. It is an agency that emerges through the dialogue or relational interchange between the dancer and the system. It cannot do anything without the presence of the dancer and without them offering up their movement, but it can then respond to what they keep offering in improvisation in real-time. The notion of agency occurring through intra-action starts to blur the boundaries between tool and agent, tool, and collaborator.

In his article 'Embodied Cognition and the Magical Future of Interaction Design', David Kirsh recalls Marshall McLuhan's line 'we shape our tools and thereafter our tools shape us' (McLuhan 1964, cited in Kirsh 2013: 3:1). He goes on to give examples – the violin extending our sonic reach, a blind person's stick enabling a physical understanding of distance and space. 'These tools' he states 'change the way that we encounter, engage and interact with the world. They change our minds' (Kirsh 2013: 3:1). He talks about how tools change our perceptions and our actions, and states that our 'future is prosthetic: a world of nuanced feedback and control through enhanced interaction' (Kirsh 2013: 3:2). Here the use of the words 'feedback' and 'interaction' in his discussion of tools complicates the notion that an agent (rather than a tool) comes about through interactivity. They are not here simply things that we use to

do jobs we couldn't otherwise do, or to make our productivity more efficient. They are changing us as we use them: our being in the world is entangled with theirs.

Significantly, Kirsh's article discusses tools within the context of the growing comprehension of 'embodied, situated and distributed cognition' which understands that instead of physical actions being mere expressions of thoughts manifested in the mind alone, thinking also takes place in the body (Kirsh 2013: 3:2) He states:

> In any process, if you change one of the key components in a functionally significant way you change the possible trajectories of the system. Apply this to thought and it means that a significant change in body or voice might affect how we think. Perhaps if we speak faster, we make ourselves think faster. Change our body enough and maybe we can even think what is currently unthinkable […] The implications of a theory of thinking that allows lifeless material things to be actual constituents of the thinking process are far reaching (Kirsh 2013: 3:2).

It is precisely this kind of theory of thinking with which I am engaging here. There is a fundamental question of *liveness* at the heart of this enquiry; yet it is not clear *what* is alive, or rather *with* (and *without*) *what* life can be constituted. What I am curious about in this chapter is where the thinking takes place and between what or whom. Here, for Kirsh, one might understand that it is always about human thinking – changed by the impact of the tool. Like the agent that is the *Choreographic Language Agent*, the human uses the tool and his/her thinking is changed by it; he/she interacts with space, time, self, objects, bodies differently, as they think through their bodies. So how animate might we perceive the tool as being? How much agency (if any) does it contribute? How does it form part of a more complex processual understanding of thinking, in which it does not take place within us (humans) *independently* at all? It seems that the differentiation between tool and collaborator is not so clear, when we start to consider the notion of 'being' (or becoming) within both. So, let us go on now to consider this statement, '[c]hange our body enough and maybe we can even think what is currently unthinkable' (Kirsh 2013: 126) through two different ways of bringing about that change – the system, *Tools that Propel*, as reflection/extension and the system, *Tools that Propel*, as intervention/other.

EXTENDING BODYMIND

In terms of embodied cognition and the expansion of the dancer's mind through the computational tool, the emphasis so often seems to be on the *augmentation* of the dancers' capacities. If we take the notion of 'active externalism' expounded by Andy Clark and David Chalmers, which is 'based on the active role of the environment in driving cognitive processes' (Clark and Chalmers 1998: 7) we have to assume that encountering new sources of information that offer perceptual shifts in our understanding

and experience of the world will bring about new cognitive processing. This means that an encounter or movement exchange with *Tools that Propel* can bring about new choreographic thought-action, at least in the moment of the intra-action.

An understanding of Clark and Chalmers' notion of extended mind reveals that there is not necessarily any difference between the cognitive processing that occurs with computer aides when they are externalised as when they are internalised (as is the case with cyborgs). Clearly this depends on the functionality of the computation, of course. If we take the case of Neil Harbisson, who has an antenna fitted into his head to enable him to 'perceive visible and invisible colours via audible vibrations in his skull' (Cyborg Arts 2020) it seems impossible to imagine this being possible via an external device. Yet, he can also 'receive colours from space, images, videos, music or phone calls directly into his head via internet connection' (Cyborg Arts 2020). This seems to make him a clearer example of what Clark and Chalmers mean when they argue that there is no difference in cognitive processes used by someone sitting opposite a screen and deciding whether to mentally or physically rotate a shape (by touching a button) to see if can fit it into a particular hole (like in the game Tetris); someone doing this entirely mentally; and someone sitting opposite the same screen and task, who has a neural implant fitted that is as fast at processing as the computer, and has to decide whether to perform the task via this or mental rotation (Clark and Chalmers 1998).

Clark and Chalmers argue that humans have always leant on 'environmental supports' (Clark and Chalmers 1998: 8), citing, for example, the use of Scrabble tiles which we rearrange in the process of looking for words (Maglio *et al.* 1999) - we might call these environmental supports *tools*. They state that the 'individual performs some operations, while others are delegated to manipulations of external media' (Clark and Chalmers 1998: 8). These arguments become yet more compelling the more we are subsumed by a culture of dependency on smartphones. These do indeed seem to be part of our cognitive apparatuses: anecdotally, I seem to lose ability to navigate journeys from memory the more often I rely on a GPS navigation app, for example. If we replace at least the second of Clark and Chalmers' (rather obsolete) examples of the calculator and Filofax with a smartphone, we can begin to understand their notion of 'reliable coupling' and its importance to cognition, whereby the environmental support becomes 'part of the basic package of cognitive resources that [one] bring[s] to bear on the everyday world' (Clark and Chalmers 1998: 11). As they state:

> These systems cannot be impugned simply on the basis of the danger of discrete damage, loss, or malfunction, or because of any occasional decoupling: the biological brain is in similar danger, and occasionally loses capacities temporarily in episodes of sleep, intoxication, and emotion. If the relevant capacities are generally there when they are required, this is coupling enough (Clark and Chalmers 1998: 11).

Clark and Chalmers make a strong case for the mind extending into the environment, demonstrating that it is not just cognition but also various other activities of the mind such as belief and memory that can be actively performed through external supports (Clark and Chalmers 1998). Further detailed examination of Clark and Chalmer's defence of the relationship between the environmental support and the mind does not feel necessary to support the hypothesis that the dancers' cognition and choreographic thought-action might be spread across their bodyminds and the environmental support of *Tools that Propel*. However, Clark and Chalmer's demonstration of the way that use of a notebook to recall required information, and use of the brain's memory to recall it, both utilise the same *belief* that the information is there, provides a compelling parallel to suggest that it is not just cognition that might be spread across bodymind and *Tools that Propel* but also other mental states too. This could support understanding of how the dancers start to (re)perceive time in intra-action with *Tools that Propel*.[30] (See video Time Past, p.165.) Crucially, what I am interested in here is the flow of mental information from the person to the environmental support and back again; in this case, not with a device that is used all the time, but one that is used throughout the dance improvisation when *Tools that Propel* is involved. It is the body that I am seeing here as extended by *Tools that Propel* – as something that thinks through its feeling, placing, and moving relations with and within the world, as a bodymind.

Extension of imagery, extension of habit

Mental imagery in dance creation is just that – mental – but it is derived from the dancer's experience of external stimuli. Dancers have to hold that information in their bodyminds as they move around it, through it, and with it in the creation of new movement. As deLahunta el al. state

> [w]e can draw on well-drilled habitual pathways and movement patterns in choreographic problem-solving, where thinking remains detached, somehow 'thought-alongside' or we can skilfully pay attention to and through the passage of the movement whilst it is in process, whether in

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[30] Any potential limitations of active externalism do not undermine the relevance of the Extended Mind thesis to the distributed cognition that seems to occur between dancer and *Tools that Propel*, however there have, of course, been various criticisms levied at the core arguments propounded by Clark and Chalmers (and those later developed by Clark). These include, for example, David Kirsh's proposition that cognitive extension is different from cognitive embedding, and that 'real cognitive extension is only ever brief and temporary' (Colombo et al. 2019: 3). Clark and Chalmers themselves suggest that the limits of active externalism might well depend on the level of reliance on the external support – the notebook or the smartphone, for example. This is interesting to note with regards *Tools that Propel* given that the dancer is not dependent on it in order to dance, even though it is dependent on the dancer if it is to enact any agency at all.

response to internal environment or external image, intention or 'affordance', allowing the movement to become 'thought-filled', itself the instrument of cognition (deLahunta *et al.* 2012: 248).

When thought is done 'alongside', or at 'one remove from the moving' they argue 'the solutions suggested by the body are likely to stay within the limits of our habitual movement patterning' (deLahunta el al. 2012: 248). *Tools that Propel* could be thought of as an aide-memoire, bringing into being another mental architecture as an expansion of the dancer's own. It gives reminders of movement and motifs that the dancer has explored before, brought back for more complex and nuanced exploration. Sometimes it brings back movements halfway through the trajectory the dancer might usually associate with that movement, breaking into the flow of another movement, disrupting the train of physical thinking and habitual movement patterning. As such, it also offers a set of visual rules with which to inform and provoke the improvisation and new ways of moving.
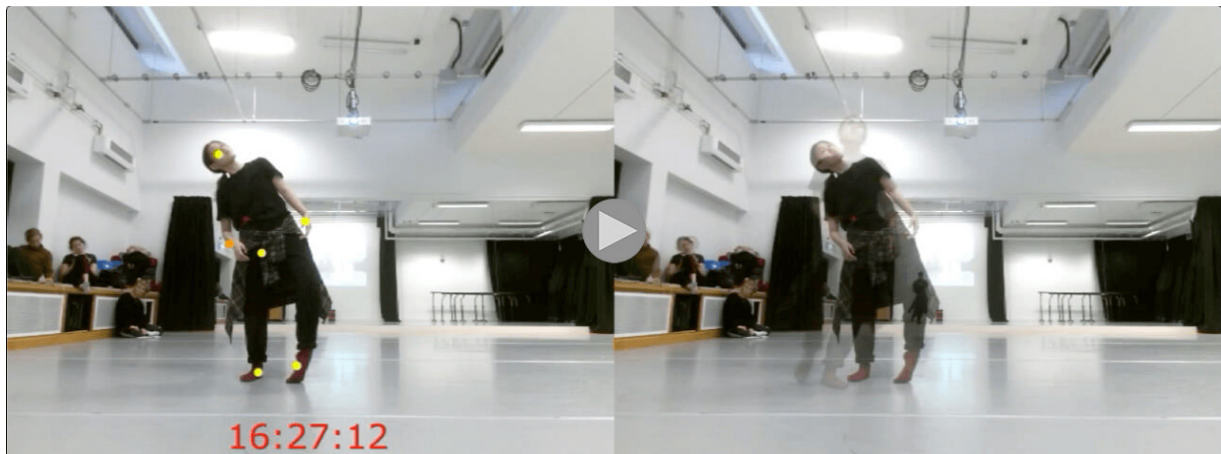
[The video 'Yi Holding Space' can also be found here: https://youtu.be/YB9umbBGXhA]

Reflecting on an improvisation with *Tools that Propel* during a studio session held on 18th October 2018, Yi Xuan Kwek reports that she was walking around looking for spots that were trigger points for memories; then became interested in blending people together; then transitioned into finding free space and uncharted territory, which after a while got quite saturated and led her to look for old memories of people and explore how long she could hold them there whilst subtly changing their movement. She also commented on the incidental capturing of other dancers in the memories and stated that she had enjoyed 'holding the space', bringing back and holding memories which had people moving elsewhere in them, filling the room with their presence. She remarked to the other dancers 'your heat signatures are left there' (Levinsky 2016-19). Through its affordances *Tools that Propel* is triggering the creation of these improvisational rules, acting as part of her cognitive apparatus, and informing her physical thinking; it is extending her bodymind.

Perhaps, however, it could be argued that *Tools that Propel* disembodies the act of thinking, separates it out from the bodymind. In materialising the computational decision-making on screen, seen in the blending of bodies performing real-time and past movements, the overlaying of people and time, does it displace the thought to being 'alongside' the dancer? Might it therefore encourage movement generation along the lines of dancers' habitual movement patterns?

In a workshop delivered with Company Van Huynh on December 4th 2018 at Centre 151 in London two dancers suggested that in some ways it brought them back to their habitual movements rather than enabling them to escape them, because they were trying to make the memories come back and 'collaborate' with them (Appendix C: Levinsky 2018b). However, one of them stated that he found 'the fact that you could go back to certain habits' both 'interesting' but 'also quite challenging because [he] had to force [him]self sometimes to get a habit' as 'you don't necessarily always have habits when you improvise' (Appendix C: Levinsky 2018b). Future research could consider this further with regards the impact of the system across a greater range of dancers. It was noticeable in the Company's warm-up that their practice was somatically-driven and it is possible that the requirement to feed off external information in the moment of improvisation was not something that they were necessarily used to or personally drawn to, though evidentially from the transcript of the post-workshop discussion there is both curiosity in using this environmental support as a stimulus for improvisation as well as a certain desire to control it. Two other dancers at the workshop suggested that working with *Tools that Propel* had opened them up choreographically, making them think about space and composition more in their improvisation: one stated 'I kind of went over to a more choreographic way of looking at it and looking at patterns instead of necessarily a phrase as such' (Appendix C: Levinsky 2018b). The interplay between following internal movement impulses and maintaining a compositional eye can be difficult and it has been observed that participant dancers who have used the system over a sustained period of time, improvising with it in numerous studio sessions, go through a process whereby they learn to succumb to it.

As one participant dancer said in interview, 'I got frustrated a lot, so I would go from frustration to more curiosity... then that would change "Oh it's not going how I want it to go", so it's kind of discovering... that it's not about working out how it does it, just enjoying how [*Tools that Propel*] works with you' (Levinsky 2017).

Maria Evans discusses a revelatory moment in a technique class when she realised the effect that working with *Tools that Propel* had had on her dance training:

> [W]e [were] doing this shifting erm motif, not motif, exercise, where you
> literally like shift your weight, almost like a wave kind of thing. And I was
> doing it and I was thinking this feels so different, I feel so much more in

control and I realised it was because I had played with making Tatiana breathe with me with this same shifting motion and I didn't realise but that that play had almost trained me, it trained me to be able to be able to do this shifting motion with ease in comparison to before I did that. It was because I'd been playing with Tatiana and trying to get her to move with me, and sometimes she did it and sometimes she didn't but also just the persistence of just trying to get something or someone to do it made me train my body in a way that was correct, because I'm looking at myself, and I can see my alignment and I can see how I'm shifting in the space and if it's not quite how I want it (Levinsky 2019c).

Through her own bodily action a dancer can explore and analyse the movements appearing on screen; animating them enables a discovery of the movement's centre, the fulcrum upon which cause and effect sits precariously, the moment of action itself. *Tools That Propel* provides visual and proprioceptive information that develops the dancer's bodily understanding about the effect that a cause will produce. Maria Evans' observation about the impact that repeated motion with *Tools That Propel* had on her ability to carry out a wave motion in technique class concludes that 'it's different from a mirror because a mirror would just show you what you are *rather than what you could be* in some sense' (Levinsky 2019c, emphasis added). One might presume this idea of seeing 'what you could be' is about embodying someone else's 'memory', a movement that Maria wants to do as they did. But it is not just about matching one's own body to a 'technically correct' virtual body, moving back and forth along the trajectory from past to present to future. The connection between the sensing, moving body on the floor and the virtual body on screen enables a sharing of the physical knowledge available in that movement and a development of the dancer's bodily intelligence.

Both observation in studio sessions and interviews with participant dancers clearly show that some interactors discover new possibilities within their own habitual movements re-presented in front of them; they enter a dance in dialogue with them. We might consider here Deleuze's statement in *The Logic of Sensation* that the artist 'enters into the cliché, and into probability […] precisely because *he knows what he wants to do*, but [. . .] he *does not know how to get there*' (Deleuze 2003 [1981]: 96). As an extended bodymind *Tools that Propel* brings an interactor's habits back to them and through the intriguing way those habitual movements are represented through the folding of time and layering of bodies, for example, it encourages them to engage in a deep process of digging into the cliché to find more within it. *Tools that Propel* works to train, or slowly seduce, dancers into practising the vital skills of 'attention and imagination' (deLahunta *et al.* 2012: 248). It does this through dancers' engagement with the overlaying of, and fitting inside, their movement, their own and other people's bodies, editing and evading the projected footage through embodying it, giving it kinaesthetic empathy (Gemeinboeck and Saunders 2017; Reynalds 2012) through the movement of their real bodies on the studio floor, and allowing the perceptual disruption of linear time to open up new possibilities.

Through the Magnifying Glass

Discussing the similarity and differences of *Tools that Propel* to a studio mirror with Maria Evans and Yi Xuan Kwek during workshops in May 2019, Maria stated that 'it's quite different from a mirror in the sense of not just the recorded elements but also you can't really see your face' (Levinsky 2019b). This lack of focus on your own face seems interesting. Is it possible that dancers looking in a mirror are less critically concerned by their bodies than their faces? Maria went on: 'I think maybe then you're just judging your body and not what you look like and I think maybe your face is why we feel so restricted in the mirror' and Yi corroborated this by stating 'I think with [*Tools that Propel*] you get less concerned about how you look but it's what is actually happening' (Levinsky 2019b).

Maria's further statements, however, suggest that whilst the lack of clarity within the reflection of one's face is important the low visual acuity might actually pertain to other parts of the body, reducing a focus on specific limbs and thereby drawing attention to the whole body and how it is moving: 'Because when someone looks in the mirror, I don't know, you can just see that they're, when they're moving, you can just see that they're looking at their face. [...] Rather than looking at like, they're probably looking at some elements but [*Tools that Propel*] allows you to look at yourself entirely as a dancer rather than peripheral limbs in some sense' (Levinsky 2019b). Interestingly, Wendy Oliver's research into the impact of the mirrors on dancers' body image suggests that indeed one useful attribute of working with mirrors is the ability to check specific body parts (Oliver 2008). However, she warns against the mirror's potential to 'become an instrument of disciplinary surveillance' and argues that it can 'overshadow proprioceptive feedback' (Radell et al 2014: 165). Yet for Maria and Yi, *Tools that Propel* seems to bring them back to 'how the movement feels' rather than overshadow it, as demonstrated by the following exchange:

> Maria: [...] you are not really judging *how* you are playing. Because if you're just stuck in a memory then you're not watching what your invisible self does so you're playing in almost like a free, it's almost like you're playing with what your mind and body are doing together rather than judging what your body's doing.
>
> Yi: Because you don't care about what your body's doing.
>
> Maria: Yeah, as long as you're trying to make the memory or something.
>
> Yi: Yeah, you care like to the extent of making the memory, of interacting with the memory, that's the main focal point...
>
> Maria: Whereas I think if you were to look in the mirror your focal point would be how this position looks rather than how it feels (Levinsky 2019b).

As Yi states, the key difference perhaps lies in the computational capability of the system to not only reflect what you were doing but bring back images of you doing 'similar' movements in the past: 'It's the element of time that collapses here but with the mirror it can't. I think that's the biggest factor of difference between a mirror and this recorded screen, the projected screen' (Levinsky 2019b). This is perhaps obvious, but it is the insights we can gain regarding why this collapse of linear time is so stimulating for the dancer that are important. In searching for the memories at times the dancers' attention is focussed onto inhabiting and playing into and out of their past selves rather than judging them. Yi states that 'as like movers […] you're working with your body and you're very like, in that, self-reflective all the time, I don't know, that's something that I've realised and it gets very difficult and very like unclear trying to dive into all those reflections and trying to like figure out what you can do' (Levinsky 2019b) and argues that with *Tools that Propel* 'in a quite literal but also quite figurative way you see more clearly what you want to achieve' (Levinsky 2019b). A key question here concerns the difference between what a mirror and what *Tools that Propel* are reflecting back.

Yi Xuan Kwek sees her avatar reflected back not as herself but as her partner. 'But also like the concern of looking at a screen and staring at yourself, […] if what is projected has transformed to become your partner then you're no longer looking at a screen, you're watching your partner…and it makes sense to watch your partner as you dance with it, and I think then that problem isn't there anymore' (Levinsky 2019b). Yet the shift from direct reflection to partner does not explain the lucidity that Yi acquires where she 'see[s] more clearly what [she] want[s] to achieve' (Levinsky 2019b). This is summed up in Yi's metaphorical description of *Tools that Propel* as '[k]ind of like a magnifying glass. You just look and you go straight in and you see it rather than like a mirror where you see the whole thing, it just magnifies whatever needs to be seen' (Levinsky 2019b).

Performing Tools that Propel

Expanding the capacities of the dancer through the extended bodymind might suggest a one-way direction of travel. But by examining the displacement of formerly non-machinic functioning within the dancer (memory, mental imaging, and peripheral vision, for example) to the functioning of this computational system, and in relation to this, the expanded capacity and skills we see within the dancer in return, we can get a clearer sense of the performative skills going into the creative act of thinking in dance. We can see that in turn these shape the machine's behaviour (and its choreographic output): some of these inputs by the dancer might be understood as compositional awareness, intention, attention, movement articulacy, kinaesthetic energy, and empathy – the same skills and qualities it is helping to elicit in them. Through these, dancers generate an interplay with the system, inventing new movements, manipulating old ones, and testing its decision making; they are keeping it 'on its toes' by

moving the visual output, its choreographic decisions materialised on the screen, by inhabiting the 'ghosts' and by offering up movement for its tracking eye in order to keep it in play.

If we are looking at *Tools that Propel* and the dancing bodymind as what Andy Clark calls 'human-technology symbionts', that is 'thinking and reasoning systems whose minds and selves are spread across biological brain and non-biological circuitry' (Clark 2003: 12) we might argue that the decisions made by the thinking body, the bodymind, as part of this 'human-technology symbiont' are perhaps made in the acquisition of new performative skills, knowledge, and articulacy, ever evolving with and *inseparable from the system* itself; that new movement awareness, thinking patterns, and processes are made with the system, and shape its behaviour from within the extended bodymind that is made of both.

If we consider this in relation to Heidegger's theories of tool-being in relation to presence-at-hand and readiness-to-hand (Heidegger 2007 [1927]), we start to see both a similarity and a fundamental difference in conception of being perhaps. Regarding tool-being, Graham Harman states that '[a]s a rule, the more efficiently the tool performs its function, the more it tends to recede from view' (Harman 2002: 21). He cites Heidegger's statement that '[t]he peculiarity of what is proximally ready-to-hand is that, in its readiness-to-hand, it must, as it were, withdraw [*zurückziehen*] in order to be ready-to-hand quite authentically' (Heidegger 2007 [1927]: 99). There is a difference he states, between the action or function of a tool, it's tool-being, and its reality as an object. The function of the tool is absolutely invisible even if the tool never leaves our sight. What seems important is that for Harman this is about the being of tools distorting as they come into relation with another being. Its being is never therefore fathomable; it is always withdrawn because it is only ever perceived through a relational encounter with it at which point it becomes distorted. We might consider that in the extended bodymind that is the human-technology symbiont of *Tools that Propel*, human and technology are distorted, changed to each other – as they perform together. But they are also inseparable from each other in this performance; and importantly, this inseparability comes about through the 'agent' (the dancer) 'spread[ing] into the world' (Clark and Chalmers 1998: 18).

Working with *Tools that Propel* in the early stages it quickly emerged that there was something important about the fact that the room itself and the people themselves are reflected back without any filters. We played with filters during the week of the Digital Artist Residency (masking the dancer, changing backgrounds etc. – see video 'Trying Background Removal', p.84). From the interviews with participant dancers my perception is that bar one, who found them to be creatively stimulating, all others would take them or leave them, and in fact found the reality of the room to be very important (Levinsky 2017). Maria Evans stated:

I quite liked working with just the raw basis foundation of it. Just so then
it was kind of like a journey like together so in that way it I guess it felt like
a relationship we were moving on together. Like I think if I was, if you were
to put me in a room with the white one with the, when you appeared in,
I'd be like this is too much (Appendix A; Levinsky 2017).

There seems to be something in the reflection of the room that feels supportive. One might consider that this is because it *reflects* the room as the dancer knows it, like a mirror. A participant dancer said: 'I kind of like it the way it is... It's very real in the sense that it can just like capture and reflect what you've, what you're doing in this time and space now, and then it brings back certain things you were doing like a little while before. So like, I don't know, I like that connection to reality' (Levinsky 2017). It enables the physical and the virtual dancers to be in the same space together.

Another participant dancer stated 'I think it's because you're not really used to seeing yourself on screen so it's nice to see the first reality of it' (Levinsky 2017), which strangely (given it is using a relatively new technology, digital film) suggests a preformal primitive return to the brink, before any separation between subject and object, referrer and referent; the screen is so often understood as part of a mediating force, constructing a reality through a veil or filmic frame, making it interesting that for this dancer there is not a separation perceived between this dancer's body and its representation on screen. She sees it as *a reality*. Here we understand that reality is not something untouchable, intact and fully consistent, separated from the layer of representation that mediates or describes it. The reality that this participant dancer refers to is formed *through her intra-action with the system,* encompassing her material being, and the materiality of the system, including its machinic functioning and its physical hardware. As such, perhaps it is not an object, this reality, looked at indirectly, from afar, as a result of the affordances of *Tools that Propel,* a transforming mirror, to borrow the phrase from David Rokeby's seminal interactive installations (Rokeby 1995); the reality that is formed of intra-action suggests a realism that is not about things or entities, but a 'realism toward *phenomena* and the entangled practices of knowing and becoming' wherein '[*p*]henomena, according to [Karen Barad's] agential realist account, are neither individual entities nor mental impressions, but entangled material entities' (Barad 2007: 56). It does not exist separately from this phenomena that is dancing with *Tools that Propel*.

With *Tools that Propel,* reality is experienced through performance – not necessarily theatrical performance, though here, in this thesis we are discussing that kind too – but through a performative approach wherein, like Barad, we are 'moving away from the familiar habits and seductions of representationalism (reflecting on the world from the outside) to a way of understanding the world from within and as part of it' (Barad 2007: 88). We look to the centre of the thing we are in to find something new; to allow a new emergence. There is a flattening of the hierarchy that subjects

everything to human perception and objectifies things in accordance with the human subject's rationale, use and representional formulation of reality.

A performative approach might include the practice of erring and discovery (Lepecki 2015), the activity that brings about seeing or understanding something from a new angle or perspective, the *doing*, not just the looking from a distance. There are important resonances here with the work of André Lepecki on process-oriented dramaturgy; he argues for the power of 'err[ing] as to drift, get lost, go astray' in the process of making a work of performance or dance and the underlying premise that the dramaturg works for and with 'the work-to-come' (Lepecki 2015: 53). This method of dramaturgy he sees as a kind of 'destruction method of a kind of presumption of knowing' and something that 'allow[s] that the logic of the piece that is about-to-come becomes actual, concrete' (Lepecki 2015: 53). But Lepecki's dramaturgical theory aligns the dramaturg with a saboteur, deliberately challenging other creatives and performers through mischief, disjuncture, and difficult questions (Lepecki 2015). Likewise, where Barad's performative approach of agential realism might suggest an entanglement that precludes preexisting entities prior to the phenomena, there might be a saboteur embodied in *Tools that Propel*, something that *others* the dancer to themselves. There appears to be something for the dancer about seeing themselves objectively – as an object, estranged, or as a thing perhaps looking back at them – that enables them to discover something new in themselves and in their movement. To see themselves without knowing themselves. To play in a space of *not knowing*. This in turn shifts and changes the movement they do so that the emergent choreography is revealed as having agency, dictating, manipulating, teasing in the space between them and the system.

THING-POWER

Jane Bennett writes of W.J.T Mitchell's discussion of 'things' within *What do pictures want? The lives and loves of images*. The title of Mitchell's book itself suggests the perception of things – images in this case – as having psycho-spiritual attributes, and indeed when Bennett cites his explanation of the difference between objects and things this becomes clearer:

> objects are the way things appear to a subject – that is, with a name, an identity, a gestalt or stereotypical template […] Things, on the other hand, […] [signal] the moment when the object becomes the Other, when the sardine can looks back, when the mute idol speaks, when the subject experiences the object as uncanny (Mitchell 2010: 156).

Bennett goes on to describe the notion of 'thing-power', which she writes 'bears a family resemblance […] to what Henry David Thoreau called the Wild or that uncanny presence that met him the Concord woods' (Bennett 2010: 2). This '[w]ildness' she argues, is 'a not-quite-human force that

addled and altered human and other bodies' (Bennett 2010: 2). In this word 'addled' we meet the ability of things to distort, change, and alter other bodies. Bennett states that thing-power, like Hent de Vries' notion of 'the absolute' which he defines as 'that which tends to loosen its ties to existing contexts' (Vries and Sullivan 2006: 6), is something that seeks to 'acknowledge that which refuses to dissolve completely into the milieu of human knowledge' (Bennett 2010: 3). But where thing-power departs from the absolute is that rather than focussing on human knowledge and the limits (or potential extensions) of its boundaries, 'tending to overlook things and what *they* can do', thing-power 'aims to attend to the it as actant' to borrow Latour's term meaning a source of an action, human or otherwise (Bennett 2010: 3; Latour 1996). Indeed, this understanding of *the absolute* and *thing-power* reaches beyond (or back to before) representation, brought about by the separation of subjects and objects. It returns us to the brink, to the pre-individual magical world, discussed earlier with reference to an ethics of becoming. It proffers the possibility of ongoing transformations, a metastable equilibrium, and a route to the potential energy within the assemblage of distributive agencies, within a vital materiality where humans and non-humans alike have dynamism, vibrancy, life, and *matter*. It asks us to look, indeed to experience again, to reconsider our place within the world differently and become again (more ethically, more responsibly). Bennett believes we should choose the notion of 'vital materiality' over that of 'environment' because the latter is 'defined as the substrate of human culture' whereas '*materiality* is a term that applies more evenly to humans and nonhumans' (Bennett 2010: 111-2). She states that one advantage of using this notion is that:

> Vital materiality better captures an "alien" quality of our own flesh, and in so doing reminds humans of the very *radical* character of the (fractious) kinship between the human and the nonhuman. My "own" body is material, and yet this vital materiality is not fully or exclusively human. My flesh is populated and constituted by different swarms of foreigners. The crook of my elbow, for example, is "a special ecosystem, a bountiful home to no fewer than six tribes of bacteria.... They are helping to moisturize the skin by processing the raw fats it produces.... The bacteria in the human microbiome collectively possess at least 100 times as many genes as the mere 20,000 or so in the human genome." The *its* outnumber the *mes*. In a world of vibrant matter, it is thus not enough to say that we are "embodied". We are, rather, *an array of bodies*, many different kinds of them in a nested set of microbiomes. If more people marked this fact more of the time, if we were more attentive to the indispensable foreignness that we are, would we continue to produce and consume in the same violently reckless ways? (Bennett 2010: 112-3, citing Wade 2008)

We are reminded of the intervention in our lives that has come about through Covid-19; a forced recognition that our bodies are fallible, connected, inseparable from the viral bodies around us, and getting in us and between us; the alarm bell that has (partly) woken us up to the reality of having to intra-act with our habitat differently in the future. But why is any of this interesting vis-à-vis *Tools that*

Propel? My interest in Bennett's vital materiality stems from the way that she is investigating the power of *things* to shift the political playing field. Whilst this thesis does not directly suggest that dance itself is a political playing field, I am arguing that *Tools that Propel* (or dancing with it) shifted the dancers' way of thinking. In conjunction with the concept of digital intervention underpinning its development – that is that the technological affordances of the system would be used to challenge the dancer, intervening in their decision making – practical use of *Tools that Propel* yielded the idea that all the components (dancers, Kinect sensor, projector, computer, algorithms, room, mirror, space, time, body, memories etc.) form an assemblage of distributive agencies which act to catalyse the *discovery and recognition of the choreography 'as "not ours" but rather "animating" us',* unfolding with its own logic (Stengers 2012; emphasis added). *Tools that Propel* enabled the participant dancers to see themselves and their bodies in the world in a different way and created a new sense of agency for them going forwards. The thing that is *Tools that Propel* brought about a shift of perspective, a shift of the position of the player in the world.

So, to go back to things as actants. According to Bennett's reading of Latour,

> [a]n actant is neither an object nor a subject but an "intervener", akin to the Deleuzean "quasi-causal operator." An operator is that which, by virtue of its particular location in an assemblage and the fortuity of being in the right place at the right time, makes the difference, makes things happen, becomes the decisive force catalyzing an event (Bennett 2010: 9).

She states that '*[a]ctant* and *operator* are substitute words for what in a more subject-centred vocabulary are called agents' (Bennett 2010:9). This is key; we are able to understand the technical object – or assemblage of technical and non-technical objects – as having agency without calling them agents, without necessarily resorting to anthropomorphic understanding of their roles in terms of human substitutes...collaborator, performer, choreographer, dramaturg perhaps. She goes on to state that '[a]gentic capacity is now seen as differentially distributed across a wider range of ontological types' (Bennett 2010:9), which suggests here that there might be capacity for agency within the human dancer, within the system (*Tools that Propel* and its various components), and within the agency of the developing choreography/improvisation. Understanding this as 'agentic capacity' – something that is able to occur – means that it resonates with the idea of agency coming about through the intra-active process (Barad 2007), even if agential realism precludes the pre-existence of ontological types prior to their intra-action.

Bennett states that thing-power

> draws attention to an efficacy of objects in excess of the human meanings, designs, or purposes they express or serve. Thing-power may thus be a

good starting point for thinking beyond the life-matter binary, the dominant organizational principle of adult experience (Bennett 2010: 20)

Here we come back to Simondon's advocacy for ontogenesis within technical objects (when we move beyond conceiving of technicality only through the technocratic mentality of human supremacy). In his discussion of technical mentality and processual becoming, he argues for the coming into being of the authentic technical object; the cognitive schema taken over by the schema of concretisation; the unexpected, unforeseen, functionality of the invention becoming beyond the act of invention itself (Simondon 2012). Yet, Bennett continues, the disadvantage of the term thing-power 'is that it also tends to overstate the thinginess or fixed stability of materiality, whereas [her] goal is to theorize a materiality that is as much force as entity, as much energy as matter, as much intensity as extension' (Bennett 2010: 20). We come back in time to Simondon's notion of metastable equilibrium, so prescient of thinking like Bennett's here.

The binary of life-matter is of course connected to the proposition – that there might be a difference between the action of life (to be) and the action of death (not to be) – in the first section title of this chapter ('Tools that Propel or Tatiana: to be (a tool) or not to be (a collaborator), that is the question'). Yet, of course, it is arguable that they are the wrong way around. Tatiana as 'collaborator' was apparently about life, given a name because she seemed to have life, seemed to be more than a machine and to have a personality that was bound up in her unpredictability and apparent decision-making. Conversely, as suggested by my use of Hamlet's famous lines, *Tools that Propel* as a 'tool' would be something inert, only an object which extended human capacity, and without its own agency perhaps. With this in mind, should my title be the other way around? 'Tatiana or Tools that Propel: to be (a collaborator) or ~~not~~ to be (a tool), that is the question.' Either way, the crossed out 'not' begins to suggest that I see a state of 'being' in both.

A dance between things

Perhaps there is method in the madness that is the accidental reversal of the state (life/death) implicit in the order I gave tool and collaborator in the title. Was there something fundamentally wrong about us giving the system a human name? By defining the system's agency in terms of the human, were we limiting what she/it might do to our own agency? Or the agency of the choreography or improvisation that evolves between the human dancer and the system? When I discuss 'choreographic agency' this does not presume that this is something to be acquired, to augment human agency, so much as something separate from and equal to human agency. Or perhaps indeed it is something that comes about only through the intra-action of inseparable entities in the phenomena that is dancing with *Tools that Propel.* If, as Deleuze writes, Alice adventuring in Wonderland is becoming larger as she is becoming smaller, that is she becomes 'larger than she was', so she must also 'become smaller than

she is now' (Deleuze 1993: 39), then being is not fixed, there is no present; it is always a becoming. Agency (as a measure of life) is always metastable, always in flux. There is no binary in play because there is always new potential and new forms being generated.

Yet how does the dance between things play out in actuality? If we come back to the observation made by Yi Xuan Kwek that *Tools that Propel* once had felt like an 'other' whereas it now felt like an 'extension' of her, what particular insights did considerations of the system through the lens of 'other' lead to? *Tools that Propel* appears to look back at the dancer and to be making decisions. It feels uncanny: reflecting the 'reality' of the room but presenting the dancer's body as estranged and housed within another's; projecting their current self in their previous movements and those of others before them; offering a collapse of the linear trajectory of past and present; and blending matter and memory in both the virtual and physical realms. But who or what is doing the moving?

Rather than the 'agent' (the dancer) 'spread[ing] into the world' (Clark and Chalmers 1998: 18), here we can understand the objects of the system themselves as having the capacity for agency. We might understand them as Bennett does when she writes about actants as interveners, not restricted to being a subject or an object, but able to act, to operate, to cause effect (Bennett 2010). Looking at the system this way, then the components of *Tools that Propel*, as 'actants' or 'interveners' impact on the dancer's bodymind as much as the dancer acts, intervenes, operates on them, through the 'things' that make up her own performative skill and embodied knowledge. In collapsing the hierarchy between subject and object, human and machine, we begin to understand the dialogue that takes place – the 'dramaturgical conversation' as Mark Coniglio calls it (Coniglio 2015: 274) – between them, and that the new thinking (materially traced as choreography unfolding on the floor and on the screen) emerges out of this, also a 'thing' with its own agentic capacity.

Sometimes the presence of a particular apparatus within a space set up for a particular activity is more about people's expectations and preconceived ideas about what 'goes with' the engagement with that activity, particularly where there is a notion that it is out of reach, virtuosic or glamorous. It could be argued that these expectations operate as affordances of the apparatus in their own right. We might understand these historical, fictional, theoretical expectations within the assemblage to be as agentic as any other of the material things that they are projected onto (Bennett 2010). There is a fluidity in terms of the 'fixed stability of materiality' (Bennett 2010: 20) meaning '[h]umanity and nonhumanity have always performed an intricate dance with each other' (Bennett 2010: 31). In this way, the assemblage of agencies that is the dance studio, and its mirrors, with dancers within it, or the assemblage of agencies that makes up an improvisation with *Tools that Propel,* encompass not only those apparatuses but the cultural meanings and associations they carry with them and as such the imprint of their own previous, potential or metaphorical use.

The idea that learner dancers often expect to have mirrors present in the studio for the 'full', 'legitimate', or 'quintessential' ballet experience (Radell et al. 2014: 163-4) resonates with the encounters that workshop participants at Cardboard Citizens appeared to have with *Tools that Propel*. With reference to the research studies they discuss, Radell et al. state that lower-performing dancers, or those with less embodied knowledge, might have had the feeling that the absence of the mirror from the room made the experience less 'complete', and argue that this was reinforced by statements such as '"[i]t was fun seeing myself look like a ballerina"' recorded in exit questionnaires (Radell et al. 2014: 163). Similarly, when using *Tools that Propel* at Cardboard Citizens, a UK theatre company working with and for people with lived experience of homelessness, it seemed to provoke a preoccupation with movements that participants associated with films and particular characters in films – the materiality of the screen evoking these associations and conditioning the type of creative play. This meant that one participant reported exploring a range of movements from music videos he'd 'seen on telly', and films such as 'El Cid or Ben Hur or Jason and the Argonauts' exploring the 'way they have their little voyages' and another stated that '[w]hat [he] was doing was doing Bruce Lee' (Appendix D; Levinsky 2019a). Having a screen and an awareness of the camera through the live feed produced a different kind of mental model than that of the dance mirror for these participants; being on screen seemed to inspire them to want to reproduce something filmic through their movement choices. It is possible of course that such a reaction might have been catalysed through a simple live feed and without the computation that condition the splicing of past and present images in the video output. But what is apparent is that the mental model produced by the quality of filmed reflections rather than mirrored reflections, whether or not the dancer appears to be facing a mirror in terms of the directionality of the image facing them, is also contributing to the creative experience of using *Tools that Propel*: it is part of the assemblage of distributive agencies acting on each other.

Indifferent to dance

But let us return to the question of movement and the differences between human and machinic categorisation of movement. The conceptual frameworks that form their assessment of movement are different. *Tools that Propel* segments it in ways that are utterly indifferent to meaning, prior relations or associations, its expressive quality, its energy or arc and trajectory. There is no historical, representational, or cultural meaning embodied in its understanding of it. Yet, in many ways it is the relatively arbitrary way that the system parses movement to differentiate it that has led to a creatively rich sense of disruption and unpredictability. Participant dancers have stated that *Tools that Propel* will 'do something unexpected and it's an invitation, it's an opening' and that a 'memory' of yourself onscreen leads to 'listening to your own mental process […] it's enough stimulus to make you think differently' (Levinsky 2017). They've suggested that 'when it comes to [*Tools that Propel*] your ideas

are flown out the window. [...] It helps you explore more ideas. I think it helps you make more choices'; 'it makes you in a sense, like hyper aware of your decisions and like the choices and the consequences, so...it just makes you more conscious'; and 'it gives you more opportunities and different pathways to work with' (Levinsky 2017). The system determines the end of a gesture in one of two ways – either on the first frame at which the estimated probability that the current motion is the same as one of the previously stored classes exceeds some threshold, or on the frame at which the duration of the current recording exceeds some defined maximum (typically 5-8 seconds). Whilst a dancer might perceive new movement phrases to be similar to existing classes, the system might not – they are always added as new classes based on a single example phrase even if the dancer has (re)performed 'newer' iterations of it. Different orders of introduction of movement material will result in different classifications: it is dependent on history in its segmentation of gestures even if in its subsequent blend of past and present it challenges sequential perceptions of time. Furthermore, as new gesture classes can also be created when the live movement exceeds a maximum duration (a few seconds, usually between 5 and 8) without the system displaying a previously recorded memory, then the classes are also extremely timing-dependent; slight variations in pace might result in very different 'cuts' between classes.

Tools that Propel is, as Adam Russell has termed it, quite 'psychopathic' in its decision-making and apparently flagrant disregard for meaning. But this inability to apply any other more multimodal sense to the movement – unlike the 'practical multimodal experience evidenced in dance expertise' in all its richness and nuance (DeLahunta *et al.* 2012: 250) – is part of what makes it 'other' and warrants curious appraisal of its qualities, affordances and agency from a non-subject-oriented perspective. As Sofie Hub-Nielson, another participant dancer from Falmouth University, commented in a studio session on October 10th 2018, *Tools that Propel* encourages dancers to use what she termed 'human movement', which is movement that is not normally used in dance but at the same time portrays and uses the human body (Levinsky 2018a). It is its indifference to meaning, narrative, and prior relations that shifts what is perceived as dance. The dancer can offer whatever he or she wants to the system, to the tracking eye, but the factors by which it determines value do not adhere to either representational, historical or embodied conceptions of what constitutes dance. Hub-Nielson stated that she found it interesting that a computer could push the natural human body forwards towards our frame of reference as we are dancing, rather than a non-natural or technological rendering of a body. We are faced with material reality, however indirectly we reach it. The recognition of the agency of the technological components involved in the assemblage that makes up dancing with *Tools that Propel* – seeing them not as objects to be used or overcome or extended out into, by and from our subject-oriented perspective, but able to act on us, even from their indifferent existence in the space – actually allows the interactor to journey deeper into the human rather than farther away. Maria Evans who described the reflection of the room as 'raw' and talked about going on a 'journey [. . .] together [. . .]

a relationship we were moving on together' said: 'I think it helped me accept myself more [. . .] just kind of accept the way I move in a strange sort of way' (Appendix A; Levinsky 2017).

The dance between 'things' opens up new perspectives, possibilities, and intrinsic insight into and understanding of the nature of our material being. It is this 'opening up' of the centre of the moment and place we are in, coming about through the distributive agency between the dancing body and *Tools that Propel* that builds compositional awareness, attention and intention within the movement decisions carried out in the dancer's bodymind; and as these skills and qualities are applied by the dancer to their improvisation with the system, the 'opening up' gets deeper.
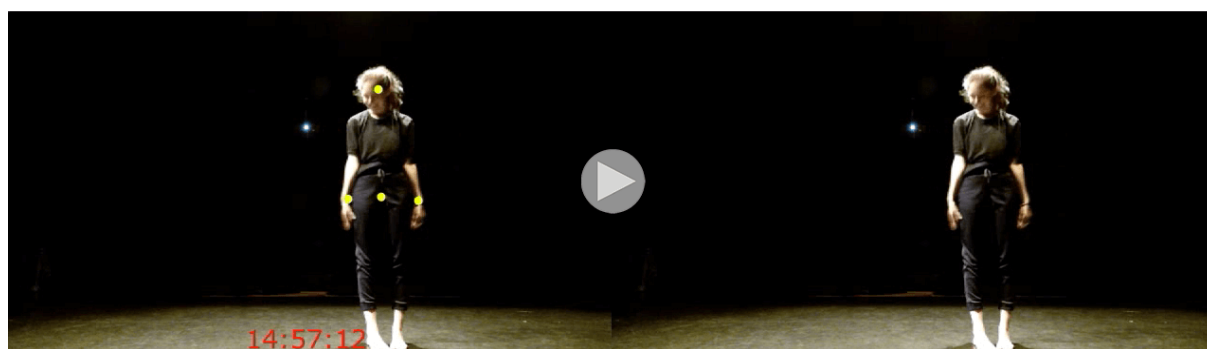
[The video 'Not Knowing' can also be found here: https://youtu.be/emaSo5tBxPY]

OPENING UP THE GAP

What is strange about this notion of 'opening up' is that it implies a gap, or a hole, or a space between things, perhaps, that is opened up. We might consider this in terms of the gap between the physical body and their digital other – on screen, in virtual form, or even in a sonic materialisation, as discussed with regards other interactive installations in Chapter 1. It might be the gap between the physical body and their mirrored reflection, a literal measurable space in the studio (the 4m distance that the Kinect can track a body, for example) and a difference in perception of their matter; one a fleshy body, with organs, sinew, muscle, blood and bones, the other a glassy flat image.

The gap perhaps gets wider with *Tools that Propel*, as the reflection jumps through time. This is different from a studio mirror which is purposed to reflect the (moving) bodies of dancers as accurately as possible, leaving no magical space for creative interpretation, nowhere for a tussle between subject and object to take place. Yet Radell et al. report that research in 2003 into the use of mirrors in the dance classroom with regards the impact on technical improvement showed 'a greater increase in performance levels for the non-mirrored class in the performance of the *adagio* phrase' (Radell *et al.*

2014: 162). They concluded that mirrors slowed down improvement in the learning of slow phrases such as the *adagio*; phrases that left time for students to look at themselves. Of course, this research pertains to the transmission of the more disciplined and codified knowledge that is embodied within specific ballet phrases and *Tools that Propel* has not been designed to aid this kind of technical learning. Yet, it opens up interesting questions about how the speed of visual information changes the act of focus, and the impact that looking at one's own body has on one's ability to move and absorb embodied knowledge. The 'flickering' of past memories that occurs at times with *Tools that Propel* when dancers are using faster movement – something we have sometimes referred to in our studio as 'visual noise' – suggests at times that it doesn't work as well with such qualities and dynamics. Yet sometimes participant dancers have also found that they can become attuned to the information they are receiving and that it is also just about listening more closely.

In effect, in contrast to the results of Radell et al. discussed above, the system works best when there is indeed space given, or created, for the dancer *to look at themselves*, or rather look at the dimensions, choices, and possibilities coming up on the screen reflecting them in the past and the present. The act of looking becomes an act of listening. Where this research by Radell et al. suggests that the development of embodied knowledge is an internal act, something that happens when the dancer-in-training is focussed on feeling the movement articulation of their body in space, *Tools that Propel* can develop an aesthetic understanding of the space they occupy to aid their increasing embodied knowledge as physical decision-makers: essentially as choreographic agents rather than choreographic vessels. I argue that it is in the gap between their embodied perception of their bodies in the space and the system's reflection of this that such agency occurs. Moreover, I argue that the gap is between how the dancer perceives movement and how the machine does.

Yet if we take the OED's first definition of the word 'gap', it suggests a break in something whole, rather than a space between separate discontinuous objects: 'Any opening or breach in an otherwise continuous object; a chasm or hiatus' (OED 2022). If we take any of the theoretical frameworks I have thus far evoked in relation to *Tools that Propel*, there might be a sense of continuity across the system that they each describe – the agent with their extended bodymind, reaching out into the environment, or the assemblage of distributive agencies acting on each other – even if what occurs within the gaps (if there is one, for one might argue that there is none in the notion of extension) is different each time. Perhaps it might be better to think of the gap or the opening up as something that fluctuates; a loosening and tightening of the 'alluring knot' of Massumi's 'good' problem? (Massumi 2015: 204). '[T]wist[ing] itself around its loose ends to tie itself into an alluring knot' the problem at the heart of the functioning of *Tools that Propel* – what is a movement, what is this movement, is this movement the same as that movement, what is the difference, how do(es) I/you/it/we interpret it – is inconclusive

but enticing, compelling, shifting, teasing, frictious, and revealing of new possibilities and routes to follow.

What therefore if we go back to that difference of matter between the physical body and its image in the mirrored reflection? Ultimately, they are both made up of atoms and both matter. They are in relation to each other, and it is only through this that this particular phenomenon exists at all. If this reality – or indeed the reality of dancing with *Tools that Propel* – like any other reality 'is composed not of things-in-themselves or things-behind-phenomena but of things-in-phenomena' as Karen Barad writes, then there are no fixed ontologies, no pre-existing things with any innate agency prior to intra-action (Barad 2007: 140). Barad writes:

> The primary ontological units are not "things" but phenomena - dynamic topological reconfigurings/entanglements/relationalities/(re)articulations of the world. And the primary semantic units are not "words" but material-discursive practices through which (ontic and semantic) boundaries are constituted. This dynamism is agency. Agency is not an attribute but the ongoing reconfigurings of the world. The universe is agential intra-activity in its becoming (Barad 2007: 141).

Like the movement, where does one material or ontological entity begin and end – there are no boundaries or outlines on bodies. Could it be that we are simply defined by that we are not? We are inseparable from all that is around us?

It depends on the angle from which we look. Where Kirsch talks about the blind man's stick as an extension of the blind man, the opposite point can be made of course, whereby the person holds the 'stick loosely to sense its features, in which case the stick is the "object" of observation' (Barad 2007: 154). Barad cites Niels Bohr, the physicist-philosopher from whose work her agential realist approach is developed, who argues that when the stick is held firmly 'we lose the sensation that it is a foreign body, and the impression of touch becomes immediately localized at the point where the stick is touching the body under investigation' (Bohr 1963a [1929 essay]: 99, cited Barad 2007: 154). She states that the 'stick cannot usefully serve as an instrument of observation if one is intent on observing it. The line between subject and object is not fixed, but once a cut is made (i.e. a particular practice is being enacted), the identification is not arbitrary but in fact materially specified and determinate for a given practice' (Barad 2007: 154-5). Barad advocates for a '*relationality between specific material (re)configurings of the world through which boundaries, properties, and meanings are differentially enacted* (i.e., discursive practices, in [her] posthumanist sense) *and specific material phenomena* (i.e., differentiating patterns of mattering). This causal relationship between the apparatuses of bodily production and the phenomena produced is one of agential intra-action' (Barad 2007: 139).

What is important is that 'objects, faces, space, size, distance, and depth perception are meaningless to a person who has never seen before. Clearly, we do not see merely with our eyes. Interacting with (or rather, intra-acting "with" and as part of) the world is part and parcel of seeing. Objects are not already there; they emerge through specific practices' (Barad 2007: 157). So, despite the apparently visual nature of the intra-action, we hark back to the 'listening' that also goes on with *Tools that Propel*, as the dance is co-constituted. It is a listening that we know from other experiences of such a bodily listening in practice – whether through intra-action with (or as part of) the world we inhabit, the architectures we design and exist within, the tools we couple with, or through improvisatory dance practice without *Tools that Propel* or other digital systems. So, beyond the reflection of our bodies visually, the avatars there on the screen, there is a form of reflection in this enactment of a practice and thereby an augmentation of our bodies too. Even whilst the challenge, the subversion (sabotage?) of our sense of time, for example, is indeed an intervention and a diffraction.

Tools that Propel as a diffracting apparatus

It is in Barad's discussion of diffracting apparatuses that I see a correspondence with how *Tools that Propel* materialises choreography, meaning and potential. For Barad, apparatuses 'are not merely assemblages that include nonhuman as well as humans. Rather, apparatuses are specific material reconfigurings of the world that do not merely emerge in time but iteratively reconfigure spacetimematter as part of the ongoing dynamism of becoming' (Barad 2007: 142). Barad writes in detail about the discoveries and theories of Einstein and Bohr regarding the behaviour of waves and particles going through a two-slit apparatus, the wave creating a diffraction pattern and the particles landing mostly directly opposite the slit they went through. She writes about the surprising result of electrons which, although small particles, in fact demonstrated a diffraction pattern and hence wave behaviour, contradicting classical physics knowledge. Einstein and Bohr discussed a way to see which slit the electrons were going through, to see in fact if they were somehow going through both at the same time, and if they were behaving as a wave and a particle simultaneously. They came up with the idea of a theoretical design for a which-path device that would be able to determine which slit each electron went through before hitting the detection screen. The idea was that they would place a diaphragm on springs which would be displaced if the electron went through the upper slit; there would be a transfer of momentum from the electron to the diaphragm meaning that they could measure the displacement. But Bohr determined that if they did this then the interference pattern of the electrons would be destroyed: '[t]hat is, if a measurement is made that identifies the electron as a particle, as is the case when we use a which-path detector, then the result will be a particle pattern, not the wave pattern that results when the original unmodified two-slit apparatus is used' (Barad 2007: 105). Indeed, after wrestling with this problem for some time, he recognised that consistent results were created

regarding 'the "dual" nature of matter and light' when a 'given apparatus was used' (Barad 2007: 105). Barad reveals how

> [o]ne apparatus consistently manifested one kind of behaviour, and a mutually exclusive apparatus consistently exhibited another. Bohr argued that if we are clear about what we mean by the notions of "wave" and "particle", it would be impossible to find electrons behaving like particles and waves simultaneously. In fact, Bohr insisted that if it were possible to obtain which-path information and maintain the wave (interference) pattern, physics would have a real crisis on its hands because this would call into question the possibility of a logically consistent theory. For Bohr, the crucial point is the fact that wave and particle behaviors are exhibited under *complementary* – that is, *mutually exclusive* – circumstances. According to Bohr, either we can find out which slit an electron goes through by using the which-path apparatus, in which case the resulting pattern will be that which characterizes particles, *or* we can forgo knowledge about which path the electron goes through (using the original unmodified two-slit apparatus) and obtain a wave pattern - we can't have it both ways at once (Barad 2007: 106).

Barad's own theory of apparatus and how they are 'productive of (and part of) phenomena' (Barad 2007: 142) provides for a fascinating read. But what is important to understand here is that '*the nature of the observed phenomenon changes with corresponding changes in the apparatus*' (Barad 2007: 106). This is 'contrary both to the ontology assumed by classical physics, wherein each entity (e.g., the electron) is either a wave or a particle, independent of experimental circumstances, and to the epistemological assumption that experiments reveal the preexisting determinate nature of the entity being measured' (Ibid.). Indeed Bohr's theory of apparatuses, and Barad's beyond this, is fundamentally predicated on the measurement of interaction and the possibility (or impossibility) to determine and therefore account for it in measurements: 'Bohr argues that because concepts, like "position" and "momentum", for example, are specifically embodied, mutually exclusive experimental arrangements need to be employed simultaneously (which is by definition impossible) to determine all the required features of the measurement interaction' (Ibid.). Following a compelling account of how the photon from a light gun used to measure speed (say of a tennis ball or a car) becomes 'part of the agencies of observation' when measuring position (which requires an apparatus with a fixed position), whilst at the same time constituting part of the object of observation when measuring an object's momentum (which requires an apparatus with a moveable platform) (Barad 2007: 114), we understand that 'what constitutes the object of measurement is not fixed' and 'can't serve as object if it is to perform its intended duties as part of the agencies of observation' (Barad 2007: 114). If we consider this with *Tools that Propel* (taking this idea analogously, rather than empirically), we might argue that when the system determines what a movement is, it is an agency of observation, tracking and recording a movement and determining whether it has seen this before or not. Yet when it brings back a memory according to

its similitude to a movement the dancer is currently performing, and the dancer moves in accordance with the memory, then it becomes part of the *object* of observation: 'there is no inherently determinate Cartesian cut' (Barad 2007: 114). Yet, if we take the movement itself, then when it is captured and categorised as a particular class (or memory) it becomes momentarily fixed as an object of observation, but when it is brought back it is agentially involved in the movements the dancer does on the floor; it moves with him/her/them. This means that it is acting on and acted on all at the same time in a constant process of becoming. It is both digital intervention and digital reflection at the same time, enabled by the affordances of the digital system to enable movement to be both an object and agency of observation at the same time, and to enable time, for example, to be experienced as simultaneous and linear at the same time. Barad writes that:

> The specification of the conditions necessary for an unambiguous account of quantum phenomena is tantamount to *the introduction of a constructed, agentially enacted, materially conditioned and embodied, contingent Bohrian cut between an object and the agencies of observation.* That is, although no inherent distinction exists, every measurement involves a particular choice of apparatus, providing the conditions necessary to give meaning to a particular set of variables, at the exclusion of other essential variables, thereby placing a particular embodied cut delineating the object from the agencies of observation. So for every given apparatus, there is an unambiguous resolution of the distinction between the object and the agencies of observation (Barad 2007: 115).

Yet here, in a system like *Tools that Propel*, with its metastable equilibrium, the resolution is always in flux, and it is through this that an engaging and self-sustaining improvisation evolves.

[The video 'Facing Yourself' can also be found here: https://youtu.be/Rmr44pBkHLA]

CONCLUDING KNOTS

In this chapter I have interrogated the experience of the participant dancers improvising with *Tools that Propel* with reference to two apparently opposing critical frameworks, exploring whether the movement emerges within the dancers' own extended bodymind, that is through humantechnological symbiosis, or in dialogue with the system's 'otherness' as part of an assemblage of distributive agencies acting on each other, embroiled in a dramaturgical conversation. I propose here that it is in the interplay between both conceptualisations of the relationship between the human-body-in-movement and the computational decision-making that new choreographic thought-action occurs. This interplay might be understood as being between computation as an expansion of the dancer's capabilities and computation as an unpredictable, surprising and sometimes disturbing intervenor. However, I have also questioned the notion of the intervenor, by suggesting that, like Barad, we might understand dancing with *Tools that Propel* as a phenomenon with no preexisting ontological existence and with no fixed ontological entities involved in this entanglement either; indeed, that everything becomes in its entangled relationality.

Undeniably, I am at times considering the *differences* between Barad's performative new materialism and Bennett's vital materiality with only a cursory glance. Gamble, Hanan and Nail (2019) disentangle the salient differences cogently, and Schneider (2015) discusses why new materialist theories correlate so well with performance and dance studies in particular. Recognising the differences, and apparent contradictions at times, both Barad and Bennett's writings have helped to tease out greater understanding of the embodied knowledge within *Tools that Propel*, enacted by its use in improvisation and in the choreographic and discursive material practices that become with it. Whilst this might not be entirely in keeping with Barad's arguments for a rigorous diffraction methodology, in which she herself looks at multiple theories through the filter of each other, it is perhaps in keeping with her statement that 'diffraction is not merely about differences, and certainly not differences in any absolute sense, but about the entangled nature of differences that matter' (Barad 2007: 36).

Barad discusses the disentangle-ability of intra-acting material agencies, and their co-existence as phenomena (Barad 2007), and contrasts this to notions of distributive agencies in assemblages, as per Jane Bennett's political ecology of things (Bennett 2010): yet both see agency as something that comes into play through relationality. It's just that Bennett's relational force is created through things that have inherent existence as things prior to their intra-action, and for Barad there are no preexisting entities before their entangled state, only agencies that emerge through it. In correspondence with Simondon's notion of the technological object having reached the schema of concretisation, wherein its elements reveal new affordances in relation to each other which means that it becomes self-

sustaining, I see *Tools that Propel* as a technological apparatus through which we can study entangled agencies and their affects, and within which the concepts discussed in this thesis are embodied. Barad discusses such diffraction apparatuses in terms of the philosophical-physics of Niels Bohr, from which much of her agential realism has evolved, and states that '[t]hese technologies are inextricably intertwined, as are the issues they bring into focus: the intra-activity of becoming, the ontology of knowing, and the ethics of mattering' (Barad 2007: 36). The phenomena that is the entangled state of material agencies that emerges through use of the apparatus – the choreographic agency – is inseparable from its intra-active performance. Indeed, 'in an agential realist account, matter does not refer to a fixed substance; rather, *matter is substance in its intra-active becoming - not a thing but a doing, a congealing of agency. Matter is a stabilizing and destabilizing process of iterative intra-activity*' (Barad 2007: 151). Barad argues that '[a]gency never ends; it can never "run out"' and indeed, that '[t]he notion of intra-actions reformulates the traditional notions of causality and agency in an ongoing reconfiguring of both the real and the possible' (Barad 2007: 177): this is something that will be explored further in Chapter 5. Following this conceptualisation of agency, it is in its ongoing materialisation that the choreographic agency emerges when dancing with *Tools that Propel*, through the entangled intra-action and a shifting ontological emergence of the phenomenon that is *dancing with Tools that Propel:*

> '[A]gency is a matter of intra-acting ; it is an enactment, not something that someone or something has. It cannot be designated as an attribute of subjects or objects (as they do not preexist as such). It is not an attribute whatsoever. Agency is "doing" or "being" in its intra-activity (Barad 2007: 178).

With Bennett there is something strangely 'other', or spiritual – accessing the religious phase through the metastable equilibrium of the system, if we consider this in relation to Simondon's philosophy outlined in Chapter 2 – in the idea that it emerges between all the 'things'. Also, it is not just matter that she considers part of the intra-action, but energy somehow. Equally, the vitality that emerges in this matter or energy speaks to the notion of the 'ecstasy' that is experienced with great works of art when there is a push and pull between the subject and its frame (Coniglio 2015). Of course, this chapter is ultimately positing a non-binary, and fluctuating position between subject and object, but there is still a push and pull going on within the intra-action with *Tools that Propel.* There is also an element of reflection; as the dancer sees themselves reflected both in the past and the present, something that simultaneously acts to 'other' them in terms of their self-conception and experience of themselves in the world, and to augment their physical ability to dance themselves through time – backwards and forwards and against linear notions of causality – and in space – within their own and others' bodies.

Through examining the relationship between the dancer and *Tools that Propel*, this chapter has also explored the performative and embodied know-how that the dancer is revealed to bring to the intra-action and suggests that this know-how might also be specific to the intra-action itself. Whilst movement does indeed shape the system's behaviour, this very behaviour shapes the movement too; in this entanglement, it is not always clear who or what is doing the moving. If there is a sense of agency perceived in *Tools that Propel* and/or brought about by improvising with the system, this is not because of an intentionality on the part of the programming. Agency is felt in the feedback loop evolving between the dancer and the system; expanding, ricocheting and pulsing with and because of all the collisions that occur between the mode of thinking enacted by the fleshy dancing matter and the mode of thinking enacted by the computational system.

Tools that Propel is not just a tool in the sense of extending the capacity of the human, nor one which is built on a mental model we already associate directly with dance training or choreographic making. Yet, it is a tool that supports or provokes or catalyses a process of unknowing, or erring, in order to allow the discovery of potential new realities. In this sense, it is not a collaborator or partner that is an equivalent of a human who reflects back an understanding of the paradigm in which you are making the work, conditioned by the same cultural and social heritage as you, but one whose very 'thing-ness' (ontologically preexisting or not) makes it an actant or operator capable of challenging your preconceived decisions. Its particular materiality, thing-ness, agential reality or functionality as Simondon would define it, produces images that are familiar but unfamiliar. In the uncanny an effect is produced which propels the growth and discovery of new movement. The choreography unfolding in the improvisation has its own agency, it too has vital materiality, and it becomes through its entangled relationality.

Chapter Four

RECURRENCE, RETURN, REPERFORMANCE, AND REPETITION: ROUTES TO THE UNKNOWN POTENTIAL THERE WITHIN

...time must be grasped twice, in two complementary though mutually exclusive fashions. First, it must be grasped entirely as the living present in bodies which act and are acted upon. Second, it must be grasped entirely as an entity infinitely divisible into past and future, and into the incorporeal effects which result from their bodies, their actions and their passions. Only the present exists in time and gathers together or absorbs the past and future. But only the past and future insist in time and divide each present infinitely. These are not three successive dimensions, but two simultaneous readings of time.

Gilles Deleuze 1993

An untimely work sets itself apart from the historical: ...without future or past, she has only a becoming, a middle by which she communicates with other times, other spaces.

Gilles Deleuze 1993

n many ways, digital technologies and the proliferation of data creation and storage enable and perpetuate a fragmentation of time, and thereby a discontinuity of the present and the future from the past. Ramsay Burt discusses French historian Pierre Nora's thesis 'that modern society consecrates what he calls *lieux de memoire* – sites of memory – to compensate for the fact that social formations based on collective memory no longer exist' (Burt 2003: 37). The loss of spontaneous memory, he has argued, leads to the creation of archives and the fear of destroying anything. 'Instead of placing individuals in modern society in a continuous relation with the past, this institutionalized historiography creates a sense of discontinuity and fragmentation' (Burt 2003: 37).

However, John Frow critiques Pierre Nora's ideas on the relationship between memory and history because of its emphasis on embodied and social memory over recorded and archival history (Bennett 2003). Tony Bennett has written that '[f]igurations of memory that locate it within the body inevitably imply a devaluation of other forms of remembering as inauthentic, and therefore politically debased, coinage' (Bennett 2003: 40). Dissecting the opposing ideas of Nora and Frow, he writes:

> For Nora "true memory" is that which has "taken refuge in gestures and habits, in skills passed down by unspoken traditions, in the body's inherent self-knowledge, in unstudied reflexes and ingrained memories." By contrast, Frow argues that the passage of memory through history renders it 'archival' in its reliance on the materiality of writing and representation (Bennett 2003: 41; citing Nora 1989 and Frow 1997).

Here the notion of a present which is continuous with the past, the one flowing always into the other – lived moment by moment, taking *memory* with it in the bodies that carry it – is contrasted and distinct from the notion of the past as discontinuous from the present – *history* archived in its material records. But as Deleuze states above: 'time must be grasped twice' (Deleuze 1993: 43). Surely memory is captured and stored in both of these ways, as continuous and discontinuous, as movement and stillness perhaps; and it is partly through the intersection between the two that we negotiate our becoming? '[F]uture and past, active and passive, cause and effect, more and less, too much and not enough, already and not yet' in fact always '*both at once'* and full of potential that way (Deleuze 1993: 45). If we collapse time, to experience it not only as linear and successive, but also as simultaneous can we discover that potential more easily?

Tony Bennett suggests that when there is a preference given towards embodied or ingrained memory, and/or the social or collective memory of specific groups and movements, over historical records of the past, it creates a binary that 'diminish[es] the political significance that ought properly to attach to the analysis of the different institutional and technological forms in which memory is socially organised' (Bennett 2003: 41). There are many other researchers for whom all encounters with recorded – and apparently official – history is and should be conditioned by criticality; that is, what

occurs in relation to its use in the present should bring about new perspectives or raise questions with regards who and what has been left out of the archive.[31] Burt starts his essay 'Memory, Repetition and Critical Intervention' with a reference to what he calls 'Foucault's genealogical approach' (Burt 2003: 34), whereby it is genealogy itself which both 'exposes a body totally impregnated with history and the process of history's destruction of the body' (Foucault 1977: 148; cited in Burt 2003: 34). Our bodies are marked, inscribed, worn by our lived experience, a history that occurs each moment as the present turns to the past. But so too are they subjected to the forces of history (and how social memory is told, organised, manipulated and maintained) and the ongoing ramifications brought about by this in terms of power, control, surveillance, discipline and colonisation. For Burt, Foucault's approach allows for an 'interface' between what he calls 'factors that are internal and specific to the practices of theatre dance with their histories of conventions and traditions' and 'the formation of embodied subjectivities' with their own histories (Burt 2003: 34). This, he argues, creates ways for 'choreography and performance [to] become sites of resistance to normative regimes of discipline and control' (Burt 2003: 34).

As I stated in Part 1, *Tools that Propel* gently probes at political questions concerning the role new technologies can take in society; it is not explicitly made to critique societies of discipline and control, even whilst it does in some ways re-appropriate the affordances of surveillance and tracking technologies for the creative potential of the intra-acting individual. Yet, it is in the disruption of – and challenge to – hegemonic views of what constitutes dance, and a dance movement in particular, that this thesis does concern itself. Indeed, this chapter explores the point where embodied memory *meets* archival memory, that is memory that is recorded and representational. Yet, in doing so, it examines how it is in the relation to the material capture, documentation, and retrieval of memory (or movement data) as film footage (the memories brought back by *Tools that Propel*) that our bodies, full of embodied memories, are discovering new potential and realising future choreographic thought-action. I might here align myself with André Lepecki's arguments in 'The Body as Archive' that reenactment of past works is 'not [necessarily] a desire for reproductive adherence to an original, but [born of] the deep understanding that every origin is always in a deep state of turbulent becoming' (Lepecki 2016: 130). Of course, where I explicitly differ is in my approach which places at its centre the question of how technology is part of this becoming. With the technical apparatus at our fingertips, widely available and affordable, dance creation processes increasingly utilise recording technologies. We can keep everything as recorded footage; every performance, rehearsal, and improvisation if we so choose. Yet, how do we annotate, order, or sift through that ever-created archive? And how do we derive meaning

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[31] With reference to dance, for example, look at Franko 1989, Schneider 2001, and Santone 2008, for example.

from it? What if computation can transform the *process* of archiving and accessing movement so that it produces new bodily knowledge and enables us to see ourselves in relation to the world differently?

This chapter explores these questions in relation to the ability of *Tools that Propel* to disrupt linear constructs of time, and to use this disruption to access and negotiate with the archiving of movement in ways that produce new choreographic understanding. Specifically, it is an examination of the affects brought about by the computational affordances of *Tools that Propel* which fold the past into the present and what happens when the 'living present in bodies which act and are acted upon', as Deleuze writes, intra-actively involves the past (Deleuze 1993: 43). In the first instance, the chapter will look at what it means for the past to repeat, return and reperform in the present, and how this in fact enables the dancer to look to the middle of the movement and the emergent moment within the choreographic improvisation. It discusses the use of *Tools that Propel* with preexisting repertory, exploring how it enabled the dancers to understand core elements within the movement they were investigating with their bodies; through the intra-action with the system's digital archiving process which helps the dancer to access embodied knowledge stored within the 'representations of performances' found on the internet, they engage with past repertoire in ways 'that will regenerate choreographic ideas' (Bleeker 2017: 209). This first part of the chapter explores how it is through the acts of re-performance and repetition, brought about by the system, that 'new potential becomes available' and '[n]ew territory opens up inside the old' (Rothsfield 2016: 19).

Leaving behind the specific focus on past repertory and investigating the relationship the dancer builds with their own (and others') past movement more widely, the second half of the chapter explores how an/notation, a practice which is historically associated with the preservation and analysis of the past (in term of choreographic works), might intra-act with the present moment of movement, becoming an impetus to make new choreographic decisions and (re)shape bodily knowledge. It examines *Tools that Propel* as a real-time an/notation tool for improvisation; in doing so, it interrogates how bodily knowledge can grow as the dancer negotiates the gap between their live physical movement in the studio and its reemergence as a virtual document from the past. I will argue that one answer to how we derive meaning from the digital an/notation and archiving of movement lies in the gap between the approaches of the digital agent and the human agent collaborating with them when it comes to categorising and an/notating the movement, and in the dialogue that this gap provokes.

A PERCOLATOR OF PAST AND PRESENT

In December 2016, the initial idea for the system that was to become *Tools That Propel* involved a game which invited intra-actors to do something *other* than what the tracking system 'thinks' they are doing; challenging them to evade its reduction of the *now* into an *archived repetition*. The theoretical design was an installation with a large projection screen that mirrors by 'removing what it knows' from what it sees, propelling the intra-actor to ask: 'how do I make myself come back?' This eventually became a version of the system which stopped the live projection of the intra-actor when it believed it recognised her movement and replaced it with recently recorded footage of either the intra-actor, or of someone else who had used the system before her, doing movement it perceived as similar to that being currently tracked. The effect was uncanny; intra-actors could not always discern whether the projection was reflecting back their present or their past.

Despite initial concerns that the system might invoke novelty for novelty's sake, with intra-actors attempting to be original enough to bring back their live projection, testing of early iterations found that intra-actors were as interested in inhabiting the past movements – that which had become *archived repetition* – as they were in evading them. They could investigate the archived movements using their live bodily movements, tracked by the system, as if scrolling through the footage back and forth with different speeds and dynamics. Subsequently, we developed the computational system further so that instead of cutting between past and present (real-time) movement it now *overlays* them.

If the last chapter grew out of Yi Xuan Kwek's equivocation between the system as 'other' and the system as 'extension', this one responds to her statement that *Tools that Propel* is 'like a diary […] always like reflecting and thinking' (Levinsky 2019b). This description extends the metaphor beyond the aide-memoire – the sort of diary that keeps your life in order and reminds you where you need to go and when – into the (cultural) memory-deposit realms of Ann Frank, Adrian Mole, Bridget Jones and other diarists and writer-characters whose (Dear) diaries become spaces of discussion and exploration, acting as secret friends whose lack of judgement enables a process of personal exploration and becoming.

Where many of our digital devices bring about a sense of efficiency, organising our lives and giving us constant access to information and knowledge through the shared storage space of the internet and ever-increasing apps, the simple mechanism of reflecting the past through the movement of the present in *Tools that Propel* works against the constant process of moving forwards into the future. Participant dancer Maria Evans has stated that *Tools that Propel* 'helps you because you look for more in what already exists […] It's what exists in you already […] so it kind of makes you feel like you're finding something more out of something that you didn't think was necessarily amazing yet something

amazing comes out of it through the reflecting' (Levinsky 2019b). Reconsideration of what is already within us and around us allows the proliferation of potential forms and actualised ideas.

Tools that Propel was designed to enable *play* through the use of technology that often enable outcomes; the play that is facilitated by the system seems to provoke reflection and questioning within the creative act itself and to make this enquiry into a productive force. Deleuze has stated that '[i]t does not interest me where someone ends up. A man may also end up mad. What does that mean?' and argues indeed that '[i]t is in the middle where one finds the becoming, the movement, the velocity, the vortex. The middle is not the mean, but on the contrary an excess' (Deleuze 1993: 203), and in returning to the past movements whilst enacting their present ones dancers intra-acting with *Tools that Propel* are delving inwards, to the middle and the excess, where the unspent potential resides. Commenting on Deleuze's statement, Rothfield argues that '[t]he notion of an emergent excess produced from the middle rather than before or after suggests a different conception of creativity. That which is new arises because the old has *become destabilised*' (Rothfield 2016: 19). I will examine how the recurrence, return, re-performance and repetition of past movements form part of a creative enquiry – in the improvisation and the discovery of choreographic material, and also in the dancer's exploration of themselves in motion. Rather than simply acting as reminders for the dancer or the audience (navigation points on a journey through time and space) recurrence, return, reperformance and repetition might be harbingers of new potential, ensuring that the 'gap' between the physical body and the virtual body from the past is reverberating and fertile.

Watching a dancer work with *Tools that Propel* we witness a *recurrence* of past movements that entangle with the dancer's live improvisation through the digital intervention. The dancer is confronted over and over by a *return* to their immediate past. There is a *reperformance* on screen of past movements, captured digitally and given life again by the actions – accidental or deliberate – of the physical dancer moving in the space in front of the Kinect sensor and camera. *Tools that Propel repeats* movements a dancer improvising with it has done before, and/or ones that other dancers have done with the system, recognised as similar enough to what is being performed in real-time. In this *repetition,* the dancer is reminded of their immediate past, the movement and creative potential embodied within them, and prompted to look deeper within what they have within them, what they have already done, and what more they might do with this.

Recurrence, *return, reperformance, repeat, repetition…*what is happening for a dancer and an audience when these occur? How far does our understanding of their meaning in relation to actions in the physical realm pertain to those in the digital? With reference to practice undertaken with *Tools that Propel* which explored these words as conscious components and stimuli of the material created, what do these words mean in relation to and as catalysts of the intra-active encounter unfolding between

the dancers and the computational affordances of the system? I examine the past as something to be continually mined and re-appropriated as new forms through improvisation (Peters 2009) – the material of our bodies in movement storing new kinetic, creative, expressive potential, a 'knowledge bank' as dancer Yi Xuan Kwek called it, that can be continually dug up, stirred, and picked amongst (Levinsky 2019b). *Tools that Propel* here becomes an 'archaeologist's tool' for dance-creation, digging amongst the materiality of the body and the unfolding choreography, giving access to a temporality which like archaeology's 'is not primarily linear, from past to present, but turbulent, past and present percolating in the building of ways of life' (Pearson and Shanks 2001: 10)

A Lexicon of Interruptions to the Present

Recurrence. If something recurs, in what time does it take place? It has to have existed in the past for it to recur in the present. Perhaps it is a message from the past, a trigger, a prompt, a stimulus, a postcard, a Facebook memory. In this case its locus becomes the past; but its direction of travel is towards the present, always in fact an arrival. With *Tools that Propel*, the recurring movements on the screen trigger recurring movements in the dancer's body (if they choose to embody the recurrence, even fleetingly). But once it exists in the present, is it a new phenomenon? A separate dislocated fragment of discontinuous time: defined here by its embodiment in this moment in this space in this time (*now*). This would presume that every second was a beginning perhaps; that every movement the dancer made was discontinuous with the trajectory that led to its existence, its physical utterance. But it is not. It reflects the past occurrence. The locus of the movement becomes the present, with its direction of gaze towards the past: indeed, if we recur to something then we are referring ourselves back from the present to the past. Yet our direction of travel is always somehow into the future, what we will do with that past recurrence. Perhaps the locus is both the past and the present and it is part of a continuous defragmented time and space (memory). *Tools that Propel* in its fragmentation of movement into classes – discreet gestures that can be compared against each other – counters this defragmented continuous, and always simultaneous, time and space; it disrupts the continuity and wholeness of it, and yet in doing so it brings consciousness to the dancer of the prior existence of the possible importance of the recurring movement within the whole and the possibility of its return.

Return. When we press return on a keyboard the cursor goes to the start of the next line: a new beginning. It doesn't presume that the same words and syntax will unfold across the line. It is a restart. It is full of the potential of what could come next. It does break up the time and space of our reading and writing however. It brings a certain structure that is recognisable, comforting perhaps. A place that we know, even if we do not know what might come next. The return of an image that we recognise but do not know – that is, do not know right now, right here, in this moment when we are moving. It is full

of the familiar and the unfamiliar. Lepecki argues that the '[t]urning and returning' to past works, danced by past dancers, is a significant mark of experimental dance (Lepecki 2016: 117). Return is a start of a journey we can go on as we dance, a rebeginning, from something recognisable – disconcerting because perhaps we do not know whether it is in the past or the present, a recorded memory or real-time projection – to somewhere unknown. When Rebecca Schneider discusses reenactments of past works she articulates a state between animate and inanimate, a 'constant (re)turn of, to, from and between states of animation' (Schneider 2011: 7). Indeed, in the 'turbulent state of becoming' (Lepecki 2016: 130) we are brought back to the brink, to become again, with these returns. As we explore the possibilities inherent in the returning image with which we can move, quite literally editing it with our bodies, we animate the inanimate by lending it our kinetic potential and material force; re-performing it.

Reperformance. This is defined by the Oxford English Dictionary as 'the action or an act of performing something again; a second or subsequent performance' (OED 2022). To think about reperformance we have to consider performance itself and if we take definition 4c in the OED, then its existence as '[a]n instance of performing a play, piece of music, etc., in front of an audience' prompts the question: is it indeed something that can be done again, *reperformed*? By doing it again it is a new instance and therefore something different. Live performance is predicated on its *live*ness; and in that liveness exists the absoluteness of the present moment, the doing of the act *now*, in this space, witnessed or even partly brought into being by an audience. If the performance does not exist in anything other than the moment of its being then it cannot be reperformed. When it recurs, when it returns, it is different, even if this might sometimes be imperceptible to the untrained eye: as Lepecki states, even in the daily reperformance of a piece in repertoire, 'any once-again already introduces all sorts of micro-differences' (Lepecki 2016: 116).

But *Tools that Propel* reperforms the moment exactly, and in the possibility of filling this reperformance with the motion and kinetic energy of the performing body in the physical now are we negating the differences inherent to liveness? Arguably, in the digital capture of the movement and the ability to bring it back according to the live movements of the intra-acting dancer, in the now, with only a millisecond's lag we are encountering reperformance differently. Through the dancer's body we can *explore the difference* in the reperformance; the gaps between what is exactly recurring – through the bringing back of past footage – and what is being embodied again in the physical realm. Through physical thinking possibilities emerge in this gap, the 'non-exhausted creative fields of "impalpable possibilities"' as Lepecki calls them, citing Brian Massumi's words from *Parables for the Virtual: movement, affection, sensation* (Lepecki 2016: 120, citing Massumi 2002: 91). With *Tools that Propel*, the dancer can explore the movement's reperformance and the differences therein through the new

perspectives brought about by the computational decisions determining when it starts and how it ends – the logic of the movement arc. The dancer is prompted to repeat and fill the movement with their own reperformance. Reperformance on screen meets reperformance in the body, and like Andy Warhol's Marilyn series, shifts with every repeat.

Repeat. Repeat. Repeat. Repeat. There is something very linear about the notion of the repeat. Like a print, a stamp, a command. It is a little like recurrence, but with less sense of its past existence. It reflects formality and structure. It feels static, like the movements that came back and repeated on a loop when we first made *Tools that Propel* with a more basic gesture recognition library, moosegesture.[32] *Repeat.* It feels flat. A material existence before the recurring, returning, reperforming movement of the memories is activated through the choreographic thought-action of the dancer working in dialogue with *Tools that Propel*. It is the immaterial in the system; without movement to give the digital stamp materiality (Kozel in Dixon 2007). I do not think repeat is what *Tools that Propel* does. But in the accumulation of repeats perhaps we discover the reverberating potentiality of repetition.

Repetition. This is full of possibility; it exists as a mode that can be chosen. Deleuze writes that 'the role of the imagination, or the mind which contemplates in its multiple and fragmented states, is to draw something new from repetition, to draw difference from it' (Deleuze 1994 [1968]: 76). Lepecki states that 'any present event at the time of its (re)actualisation is both past and future; all reenacting is therefore a fusion of the unique and of that which, in the unique, is repetition' (Lepecki 2016: 133). Repetition is the offering of a formal and structural constraint that can send the mind back and inwards, to the meat in the middle, the place of becoming, the 'excess' (Deleuze 1993: 208). Why the repetition? What is the meaning of this return? Is there difference in this performance? In this reperformance? Why has it changed? Did we notice the change? Do we feel anchored, comfortable with this repetition?

We can navigate through the repetitions as compass points. Director and improviser Keith Johnstone states that:

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[32] The very earliest version did not use the same type of multimodal gesture recognition language as it currently does, but instead used 'moosegesture', a mouse gesture recognition module for Python which could only recognise movements as being on an X and Y axis and therefore reduced all curves to straight-lines. This meant there was a huge discrepancy between what you were doing and what it thought you were doing, and your movements were intercut with strange recurrent loops of totally disconnected movements (that it thought you had been doing in the real-time improvisation). Even in this there was a potentiality for new ideas offered, provoked by the disruption to your flow and a mining of repetition and broken movements, juddering in tiny loops.

> the improviser has to be like a man walking backwards. He sees where he has been, but he pays no attention to the future. His story can take him anywhere, but he must still 'balance' it, and give it shape, by remembering incidents that have been shelved and reincorporating them [...The audience] admire the improviser's grasp, since he not only generates new material, but remembers and makes use of earlier events that the audience itself may have temporarily forgotten (Johnstone 2012: 116).

Repetition of performance moments; movements; forgotten, brought back: it gives us a map to orientate ourselves in a voluminous experience. Repetition is common within choreography, as it is within musical compositions; we return to images, motifs, movements, patterns, and pathways as a way of anchoring a piece, providing a scaffolding for the audience to hang onto, as we evolve it and allow it to develop through the duration of the performance. In this we recognise that it is easier to go forwards in linear time – precariously, not knowing what will happen – if we have some anchorage in the past; in movements, motion, configurations, and compositions we have seen before, that we *know* somehow. Even if we do not understand what they mean at first, their repetition and reoccurrence start to create a greater sense of meaning, for audience and performer too. But the time presented is still linear; any one performer is either performing movement we have seen – a re-performance of a movement, never exactly the same, either by accident or design, but repetitious none the less – or a new movement we have not seen, now generated and existing in our collective memory, ready for reperformance if desired.

In a live body, we cannot see the performance of past and present movement at the same time. Nor, as a performer can we experience it or wrangle with a non-linear configuration of movement (timewise) and creative decision-making within ourselves. As we improvise, our body memory easily forgets what it created in the present moment, now past. Yes, of course this is part of the improviser's skill, as expounded by Johnstone, but this is an embodied skill to be learnt over time. *Tools that Propel* reperforms our immediate past movements and those of others overlaid with our present; new opportunities occur in this collapse of linear time. It also surprises us with the material it reperforms. The dancer sees their real-time bodily movements on screen, blended with the past. The constant return of one's own past self in, overlaid, in relation, inside one's own present, short-circuits the linear march of time, and forces a focus and attention on what could possibly be there in that moment of becoming in a way that allows new possibilities to emerge.

This repetition is not always comforting. Sometimes it is disturbing, and this sensation is also productive. If the motif has returned again, there is a need to reinterpret it, to find new meaning in the reperformance of past movements. And if the past keeps returning, a choric interlude, what is the significance of the material that is not repeating? The deviations. What is more important – the

repetition or the deviation, the structure or the chaos? They are both reverberating with each other in metastable equilibrium.

Like the use of repetition to anchor an audience in the choreographic structure, meaning starts to be generated in the reperformance of the gesture, movement, motif (unexpected motifs, determined by the decisions of the machine) and rather than trying to escape the past, the dancer working with *Tools that Propel* digs further into it in their present existence, as the improvisation unfolds; the past becomes continuous with the present and takes us into the future. With repetition, there is the possibility of circularity; a middle where we are neither in the future or the past, or perhaps we are in both. With circularity, we are encouraged to enter the 'middle where one finds the becoming, the movement, the velocity, the vortex' (Deleuze 1993: 208).

[The video 'Time Past' can also be found here: https://youtu.be/s26XdSVBT8s]

REFLECTIONS ON AND OF CHOREOGRAPHED REPETITION

On 11th May 2019 I start a period of research and development workshops with participant dancers Yi Xuan Kwek, Maria Evans, Zach McCullough and Brandon Holloway. The focus of this work is on exploring *Tools that Propel* not just as a tool for process and learning but as an agent within performance. In the improvisational tasks undertaken the initial work is focussed on an examination of the words 'repeat, return, reperform and relay'.[33]

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[33] Whilst this is an accurate documentation of the focus of the work in May 2019, in the process of negotiating and examining the enquiries unfolding from within this practice I replaced these terms with those discussed in the Lexicon of Interruptions. Relay is not an action that seems particularly pertinent to the affordances of *Tools*

In the first improvisation, loosely designed to re-familiarise the dancers with *Tools that Propel* after a period of some months, I ask them to focus on these terms and the idea of taking over from each other's imprint. I witness Yi Xuan Kwek consciously look for the images of Zach McCollough, and Maria Evans before him, within the memory bank and screen space of the system. In the interaction between Yi and the system, we are watching a compositional process in which we are witness to the need to return to motifs to anchor the dancer and find propulsion to move forwards. Zach states that it makes him very analytical about his movement choices, asking himself 'what can I do next, what can I do differently' and describes a 'constant state of returning and assessing different options' (Levinsky 2016-19). Yi Xuan Kwek talks about needing to 'find out where [the others] were'. She states that she was 'watching their movements and trying to remember key things […] and wanted to play with them' (Levinsky 2016-19).

Later, watching Zach McCullough negotiate with the system it occurs to me that sometimes the past invades our present in surprising, annoying, unfounded or unpredictable ways. He walks slowly across the space from stage right to stage left and encounters versions of himself recently performed which seem out of place. A raging bear overlays his perpendicular walking self. He is working as a choreographic thinker with a kind of complex mirror. He digs into a motif that he is exploring, one hand on his head. The screen plays it back and he takes it further, amplifies it, finding more within it. I ask him about this moment and he says that he was 'trying to find pathways but saw the screen as a field, as a spectrum of energy, of intention, and [he was] trying to create ghosts from within that…different ghosts would be different energies' (Levinsky 2016-19).

The dancers talk about re-bodying each other. When working with duets on screen a single dancer replaces two intertwined bodies, finds them in the duet through the positioning of their own singular body, but feels out of place in relation to the memory. This is unpredictable. Sometimes the tracking dots get split across two bodies, the Kinect struggling to find one skeleton in the middle of the tangle of two; sometimes it is clearly tracking one person in the duet. As such a single dancer improvising in the physical realm brings up memories of two bodies in the virtual; and sometimes it is hard to work out their place in the collective bodies, with no real route to any of the reperformances. One of them says that they asked themselves 'how am I going to be there in those memories, what am I doing there?' They say that they are trying to reach out and be intertwined too, asking 'if I was a third person where would I go?' (Levinsky 2016-19).

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that Propel, even whilst it was a provocative component in the improvisational tasks in terms of the turn-taking that took place, and the replacement of each other in using the system.

An interlude: working with Company Wayne McGregor

This question acts now as a reminder of a workshop that I did with Company Wayne McGregor dancers and *Tools that Propel* at Studio Wayne McGregor on 27ᵗʰ November 2019. Towards the end of the session one of the dancers suggested that if the tracking dots could be split across two people it would be interesting to see the legs of one person and the torso and upper body of another on the screen (Appendix E; Levinsky 2019d). With the current hardware used it is not possible to ensure that the tracking dots remain across two people – indeed the system is confused when they do – but this is certainly an interesting thought for future development. Of course, like the suggestion made by Maria about only seeing the part of the bodies that overlap, referred to in Chapter 2, we cannot predict what kind of affect it would have on choreographic thought-action.

Perhaps more importantly, I realise that the concern of that workshop was with how they might use the system to pick up choreographic ideas from each other's signature moves, or from a bank of movement that they created over the time of improvising (Appendix E; Levinsky 2019d). One dancer was particularly interested in the liveness of the system, which she stated was what made it unique, because she likes improvising. However, she said that she wasn't interested in herself on screen but in finding others and using them as triggers (Appendix E; Levinsky 2019d). For coding purposes, the movements recorded and categorised by *Tools that* Propel are called 'classes', yet in common parlance they have been called 'memories' since early in the system's development: they reappear from the past, triggered by something in the present. Another dancer, towards the beginning of the session said that she had given herself the rule that she would only pick up things from memories that came up of other people, not of herself.

A task was set up by Associate Director Odette Hughes. This was an experiment about how *Tools that Propel* might be used in a creation process to generate material off each other. The system was 'fed' by each of the dancers first contributing memories to it (that is, it captured movements from their improvisation with it).. One dancer then improvised with *Tools that Propel* whilst the other dancers had to create material by capturing movement (repeating, taking physical notes) only from what they saw come up as memories on screen rather than from the live person working with the system. I increased the maximum memories it builds before 'forgetting' one from 12 to 40 and kept it at this as it did not seem to slow the system down in any significant way. Whilst feedback from this task was that they found it difficult to capture movement from the memories as they seemed to flash up for such a short time or jump from one to another, it is interesting that the company wanted to use the system in this way. A question also came up about 'pathways' and whether it recorded pathways or just poses or movements in one place (Appendix E; Levinsky 2019d). It is not recording poses but movements of 5-8 seconds in duration, and if that movement is travelling it will record it. However, because of the

complexity of their movement it was changing between movements very quickly – constantly redetermining the likeliest movement/memory that they might be performing.

A big frustration for the dancers was the need to retrieve memories according to screen space first and foremost; that is, if a movement is performed on stage right it will not be brought back if they are then stage left, however exactly it was reperformed by the dancer. As one company member remarked, why would she want to return to that spot to discover that movement? However, they also identified that they very quickly learnt where they could access some older memories that they might want to use. Earlier in the research process Adam Russell and I had discussed the value of potentially changing how movements were identified as similar, considering accelerations and relative joint angles, for example, as parameters to do this. One of the original reasons we used 2D camera space positions instead of 3D physical space was to maintain interactive frame rates, and whilst there is potential for future research in pursuing different ways of comparing movements, the use of screen space gesture classes had unexpected benefits. Whilst there are questions over its functionality with more virtuosic movement, these benefits in many ways are the affordances to which this research is largely concerned. As gesture classes are primarily differentiated by position in the visual frame we get a mirror-like quality in the wall projection. It is this that allows dancers to use screen space as an index into past configurations of the studio space, looking for traces of prior activity.

Repetition as a choreographic device

Back in time, at the workshops at Falmouth University in May 2019, I ask Yi Xuan Kwek and Maria Evans to choreograph a short section of movement that would later be subjected to the deconstructions and interventions of *Tools that Propel*. I am focussing on exploring repetition as a choreographic device – I want to explore what happens to repetitions in the material itself when they confront the decision-making of *Tools that Propel*. It is not so much a question of testing the accuracy of the system; I am as interested in its inaccuracy and the gap between what *it* thinks is the same and what *we* might consider a repeat.

I have been inspired by a statement by Martin Nachbar that 'to find out the puzzling differences, you have to be the same' cited in Ramsay Burt's discussion of Nachbar's reenactment of Dore Hoyer's cycle *Affectos Humanos* (1962-4) as *Affects/Rework* (2000) (Burt 2003: 38). As such, I ask Yi and Maria to create a sequence which explores small and intricate repetitious movements and synchronous movements in chorus lines aka the Rockettes. Once they have created this movement, I ask them to dance it three times in front of the Kinect and after three times through to respond and play with the interventions and decisions of *Tools that Propel*. Yi says that '[i]t got like really playful and [...] normally with [*Tools that Propel*] it feels like you are doing like a huge water colour and being really serious and

planning where to put the water and everything and you really have to commit to it, but this just felt like you were just drawing squares. But not just random squares, but squares in a, obviously a piece of art but clean and playful…it's codified in a way but not in a bad way' (Levinsky 2019b).

The act of repetition gives a reperformance of the movement on screen and the dancer does not have to think about what they are doing, as they move into and with that simulacrum. Maria says that '[i]t was just quite freeing. I think sometimes when you're playing with it it's, it's weird how having material made it more freeing. But it almost gave us both a language to communicate with each other' (Appendix A; Levinsky 2017). Yi says, 'I think because of the recording and the memories the live thing is almost transparent and what you see is just the recorded thing that you are playing with. So, like the actual thing that is happening is not as clear and is not what you are focussing on […] you are just concentrating on looking at what is the shape that you are making in the now, like what you are looking like now, but with this reflection […] you don't care about what your body's doing […] you care like to the extent of making the memory, of interacting with the memory' (Levinsky 2019b).

TRACE

As the present passes into the past - continuously - traces of it are left behind. Sometimes these are visible, material, tangible, and sometimes they are not. Dance itself is in theory always ephemeral, 'continuously plung[ing] into pastness' (Lepecki 2004: 4). Judith Dunn describes its 'impermanence' and suggests it 'disappears as you see it', seeing this as 'an opportunity as well as a problem' (Dunn 1998: 152). That which is seen on stage, or that experienced on stage as performers, is in theory disappearing, replaced always by the new present moment as time flows forwards. Except that it does leave traces, in the bodies of the dancers, in the environment it marks, the air that is breathed. The repetition in Yi and Maria's choreography as they deconstruct and reconstruct it in relation to the decisions of *Tools that Propel* is creating visible traces through time, in physical space and virtual screen-space. Yi states that '[i]t's back to that trace thing again but in the sense that the trace provides for you a sort of knowledge bank for you to keep diving in and like researching and filling up your own gaps that you think you have…' (Levinsky 2019b). Maria suggests that *Tools that Propel* 'kind of cancels out that overwhelming presence when you're with someone in the space, like when there's two people, because you've always got something to go back to. You've always got material if you're stuck' (Levinsky 2019b). Referring to the use of pre-choreographed material with the system, she continues 'you get that sense without thinking about the logistics of [*Tools that Propel*] because you know it's already going to be there…so rather than thinking this is where it's going to be, this is where I'm going to do it, rather you just do it, you don't have to worry about whether it's going to show up on screen because it probably will' (Levinsky 2019b).

The recurrence of a past movement by *Tools that Propel* is a challenge to the ephemerality of performance. It is indeed a challenge to the 'instance' of performance. As Maria has described *Tools that Propel*, '[i]t gives like a concrete image in that sense of what you've done, like normally everything, it just disappears from you' (Levinsky 2019b). It enables the developing skill in an improviser to use events that have already past perhaps. Yet as a 'great learning tool' the nature of *Tools that Propel* as a 'mediator [and] reflector' (Levinsky 2019b), facilitates a clarity that Yi Xuan Kwek suggests she finds difficult without it as she develops as a dancer: 'it always feels like as movers you're working with your body and you're very like, in that, self-reflective all the time, […] and it gets very difficult and very like unclear trying to dive into all those reflections and trying to like figure out what to do but then I feel like with [*Tools that Propel*] in a quite literal but also quite figurative way you see more clearly what you want to achieve' (Levinsky 2019b).

The pre-choreographed material provides a boundary of sorts to the potentiality of what might happen, what might (re)occur on the screen. Knowing that there is a form of fixed vocabulary means that it was available peripherally as extra information which could break the movement that the dancers were embodying, break their trajectories, proffer reoccurring motifs, cut up according to the algorithmic determinations of the system, which could stimulate their choreographic decision-making.

Watching Yi and Maria I think *this is specific to Tools that Propel.* The way that they are playing with this movement feels specific to what this configuration does. I don't feel like it would have happened if I'd just asked them to improvise with the material they had created, without the reflections and interventions of *Tools that Propel.* I think they would have gone off on a journey to somewhere/something else, losing the core of that original material. With Tools that Propel, what is interesting is that it reminds them to find more within *that* material, to go to the *middle of it* rather than always beyond it.
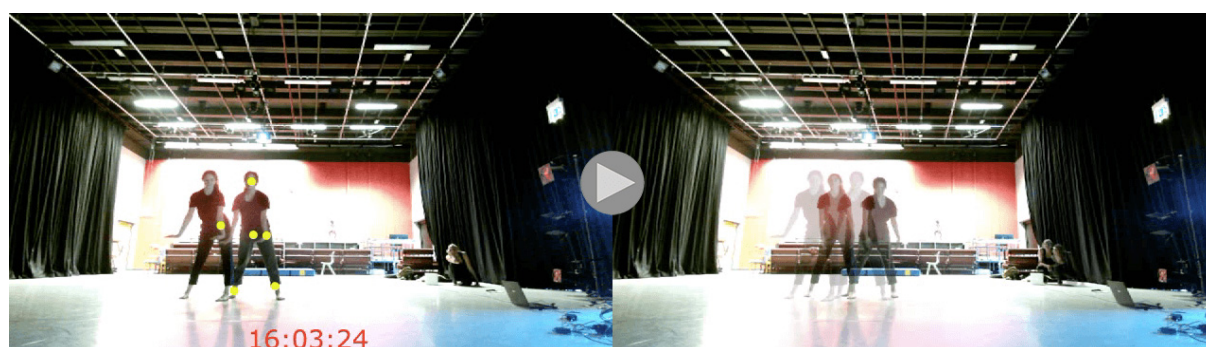
[The video 'Chorus line – repetition and reperformance' does not include voices. It can also be found here: https://youtu.be/ckxd5Vg6YdM]

Raiding the archive and dragging it into the present

Ramsay Burt states that 'the tradition on which the canon rests is no longer a living one but a curious historical archive to be raided and looted' (Burt 2003: 36). In some senses, this proposes a discontinuity with the past, as something separate, to be looked upon and examined from the vantage of the present (at least if we understand archive in such a way); but it also presents this archive as rich pickings to feed the creation of new works. Here Johnstone's improviser is not just collecting up and reusing his or her own past moments, movements, utterances, actions but those of the canon, raiding a collective knowledge bank.

Tools that Propel was partly conceived in response to the archival focus of so many digital dance initiatives. Projects such as Siobhan Davies' *Replay* and the *Digital Dance Archive* for example, respond to the affordances of digital technologies to capture, store and make readily available (according to a range of different categorisations and search criteria which open up access to dance knowledge) an artform which is essentially ephemeral, hard to document, subject to complicated notation systems that few can write or interpret, or to living archives housed in the body memories of rehearsal directors travelling from company to company to teach repertory. Yet the focus of these projects, and archives in general, always seems to look backwards, even whilst as Maaike Bleeker argues the digitalised reordering of the archived material 'affords new objects of knowledge to emerge, and of dance to be known in new ways' (Bleeker 2017: 205). Burt suggests that 'it is through perpetuating the myth of the new – the aesthetic break with the past that pushes back the boundaries of experience – that modernist art represented the values of a society committed to material progress and technological innovation' (Burt 2003: 36). In the use of technological innovation to harness, curate and make available the past work of a specific choreographer, or wider repertory in general, these projects are celebrating the past and not just celebrating novelty. Yet it could be argued that they are perhaps constraining the potential of the new technologies to the role of further strengthening the gates and gatekeepers of contemporary dance. Indeed, even the apparent democratisation of dance teaching and learning through YouTube and such platforms, circles inwards, the heterogeneity afforded by the internet possibly leading to homogeneity of a creative artform; forwarding the notion that dance and choreography is something with codified languages and forms to learn and embody, as opposed to a way of expressing, communicating – thinking within and through action – in the present moment. They make the archives more available, there to be 'raided and looted', but do not often facilitate any ways of bringing that past into the embodied present, of discovering something new within the loot. *Tools that Propel*, we proposed, would use the creation of an archive and the act of archiving to propel the future; that is, new actualised ideas within improvisation.

Of course, the creation of a new movement vocabulary within the computational processing of *Tools that Propel* in which it archives movements according to categories (classes) it determines as it is danced, tracked and captured might align it with modernism, with its the emphasis on novelty and progress as something better than what has preceded it (Burt 2003). Yet when the past images reperform, reoccur, or return, the dancer seems drawn to them; their virtual repetition facilitates a perpetual process of looting and raiding one's own immediate past creations. The dancer then finds impetus from looking to the core of them. What is important here is that it is the computation that is dictating which movements the dancer returns to. The machine's intervention indirectly questions any notions of meaning, aesthetics and taste which have been culturally determined.

If we consider memory and archives more broadly than either dance or digital dance creation, then we can see that the documentation and recording of history is not very democratic and is of course largely curated by those in dominance and power. Dance itself as an artform has largely been conserved by those propagating particular codified techniques and the choreographies created using them. In correspondence with all art forms, the archives are, as Julie Louise Bacon calls them, 'unstable' and 'implicated in the configuring of social order', meaning that many dancers and dance forms who were unduly marginalised or even displaced within the annals of dance history (Bacon 2013: 80).

Dance history and practices can be seen through parallel (and interlocking) lenses of hegemony and resistance. We might here think about attempts of dancers to model themselves in a choreographer's style, and the constriction and restrictions that they might subject themselves to do so, versus the potential resistance and creativity that can be opened up instead in the space between what their body naturally does (and can do) and that which is modelled on an ideal image constructed by a choreographer. It is for this reason of course that many contemporary choreographers work through task-based processes these days, drawing on their dancers' own movement responses. Similarly, *Tools that Propel* is not built on any predefined grammar of movement, but creates its own as it goes along, in relation to what it 'recognises' as already existing within its model or not. It can capture and entangle itself with the first-person account of any intra-actor, whatever their movement, whatever their embodied knowledge and embodied identity. It gives back in relation to what it is given and it does not 'curate' according to preconceived cultural norms or expectations.

Equally, however, *Tools that Propel* is utilising tracking technologies that in more sophisticated forms surround us every day and subject us to a culture of surveillance in our pedestrian spaces. What *Tools that Propel* does however, is turn that tracking and surveillance on its head; giving the dancer access to their recorded movements as a creative resource in real-time. In fact, the potential for resistance and subversion towards hegemonic tendencies is built back into the tracking which is usually

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inherent in control; and in doing so there is the possibility to define oneself within this and become in relation to it, through difference and repetition.

Bodily negotiations with the past

Over the course of two weekends of research and development work I ask the dancers to learn short sections of past repertory from YouTube. We are wrangling with the canon and they resist, even as they are curious. Burt compares Martin Nachbar's reworking on the *Affectos Humanos* cycle to the creation of Jerome Bel's piece *The Last Performance.* Contrary to the access that Nachbar had to Hoyer's choreography through the body of a retired dancer, Waltraud Luley, in her 80s, after an 'arduous process of getting permission to dance the cycle' (Burt 2003: 38), Jerome Bel had three performers learn three solos by Susanne Linke from video, 'without any contact with one another and with no attempt to develop a common movement style that had any connection with Linke's way of moving' (Burt 2003: 37). Burt argues that these artists were amongst many in the mid to late 1990s who were making a 'determined, conscious interrogation of their debts to the past in order to find what was new and different about the present' (Burt 2003:37).

Yi Xuan Kwek, Maria Evans and Brandon Holloway who are here for this weekend's sessions feel nervous, I think, believing they do not have the requisite technique to take on Merce Cunningham, for example. Burt writes that both *The Last Performance* and *Affectos/Rework* 'drew attention to the difficulties of transmission of the embodied memories of solo dancers who worked outside institutional structures' (Burt 2003: 38). Lepecki writes that Luley told Nachbar that 'he had the wrong body' for Hoyer's cycle. I reassure the dancers that I am not asking for precise faithful reconstructions of the material. If anything, I am adhering to the power of reenactment for what Lepecki calls 'an affective mode of historicity that harnesses futurities by releasing pastness away from its many archival "domiciliations", particularly the author's intentions as commanding authority over a work's afterlives' (Lepecki 2016: 124). We are deliberately choosing to embody choreography that we have found online for research purposes only, without permissions. We are not planning on performing it; I am interested in what happens when they dance this past material in relation to the decisions of *Tools that Propel.* I'm literally curious in the (probably quite random) decisions that the system will make in relation to this archived material and what kind of new insights might come about through this. *Tools that Propel* is going to be part of a reenactment process that explores the reverberations and creative opportunities in small differences, repetitions, and revisitations, helping to 'unlock, release and actualise' the works'

many possible actualisations and divergent potentialities, 'which the originating instantiation of the work [might have] kept in reserve, virtually'[34] (Lepecki 2016: 120).

Yi, Maria and Brandon set about learning short excerpts from choreographic repertoire we find on YouTube, the go-to public archive of past dance works on the internet; it is a strange process watching pieces on a screen (a smaller laptop one this time) and then trying to work out the choreography in their bodies. Maria Evans learns a solo from Pina Bausch's *Vollmond* (2006); Yi Xuan Kwek a section from Merce Cunningham's *Biped* (1999), a section from William Forsythe's *Blake Works I* (2016) and then the following weekend, a duet from William Forsythe's *Artefact II* (2008) with Zach McCullough. Brandon Holloway embraces the contractions and modernist expression of Martha Graham's *Night Journey* (1947). I watch as they try to find these movement sequences in their bodies. They are negotiating with the past, either recent or more distant; it is a past that they are part of, far less discontinuous with their own present than they seem willing to admit. They are a new generation of dancers and choreographers, exploring their own movement languages, but their bodies house the traces of these choreographic thinkers, layered like sediment through the training they have undergone and different, evolving physical languages they continue to encounter through technique classes. These dance students' bodies reveal Foucault's view of the body as an 'inscribed surface of events (traced by language and dissolved by ideas)' (Foucault 1977: 148; cited in Burt 2003: 34), yet I am not sure it is just a surface inscription. Certainly, their bodies incorporate the past through its traces in their technical training and resist it as they move forwards as creative thinkers: but it seems to do so in every atom of their materiality and this matter seems to be *doing* the incorporation and the resistance. Karen Barad argues that for Foucault 'power is not the familiar conception of an external force that acts on a preexisting subject, but rather an immanent set of force relations that constitutes (but does not fully

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[34] Where I have used the terms 'many possible actualisations and divergent possibilities' Lepecki in fact writes 'many (virtual) com- and incompossibilities' referring to Leibniz's terms to describe the continual invention of the monad. Lepecki cites Gilles Deleuze's explanations of these terms: 'compossibles can be called (1) the totality of converging and extensive series that constitute the world, (2) the totality of monads that convey the same world [...] Incompossibles can be called (1) the series that diverge, and that from then on belong to two different possible worlds, and (2) monads of which each express a world different from the other' (Deleuze 1993: 60; cited in Lepecki 2016: 120). My replacement words are chosen, despite the simplification in meaning, as it does not feel appropriate to go into this here. However, we might understand this in terms of the earlier discussed primordial universe, and the moment before the phase separations and individuation occurred. We are brought back to the brink each time, ready to become again. In the com- and incompossibilities we get the more-than-oneness of a work's original potential.

determine) the subject' (Barad 2007: 63). Yet, she states that 'for all Foucault's emphasis on the political anatomy of disciplinary power, he fails to offer an account of the body's historicity in which its very materiality plays an *active* role in the workings of power' (Barad 2007: 65). Essentially, conceiving of matter as 'merely an end product rather than an active factor in further materializations is to cheat matter out of the fullness of its capacity' (Barad 2007: 66) and what I am witnessing is not just history acting on their bodies, or history present in their bodies in its material traces, but a materially-entangled pedagogical process of the participant dancers developing their own choreographic bodies.[35]

I remember an improvisation that starts with Brandon exploring a section from Martha Graham *Night Journey* with *Tools that Propel* and ends with Yi, who has no embodied knowledge of the original choreography herself, joining him. She intra-acts with the moments of it performed by him and offered back by *Tools that Propel.* In a discussion recorded during the weekend of May 18th/19th 2019, I say to the dancers: '[t]his sense of exploring this history and this past was very palpable [...] and I thought that you found loads within the material and that came from your sort of absolute commitment to putting that in your body and exploring and then very nuanced and engaged relationship with what was being offered through that' (Levinsky 2019a). I turn to Yi, who has expressed a feeling that she didn't know what she was doing, and state: '[y]ou think you didn't contribute but you did and what it was that I think you contributed, that I really enjoyed [...] was this idea that someone had committed something to this investigation of the past and what that gave them creatively for going forwards, [and] then you almost became like a ghost figure wandering in to explore that as well but through [Brandon]. Like you didn't have access to that past further back to Martha Graham, you had access through him and through *Tools that Propel*' (Levinsky 2019a).

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[35] I note that the phrase I went to at first was 'choreographic voices' but this is indicative of the hierarchical importance given to vocal and textual articulations of ideas. Perhaps we should use the term 'choreographic bodyvoices' to conjure, like with bodymind, an understanding of bodily articulation that involves embodied ideas. Instead, though, I choose to give weight to the fact that the choreographic body is articulate in its own right, without analogical use of terms derived from vocality.
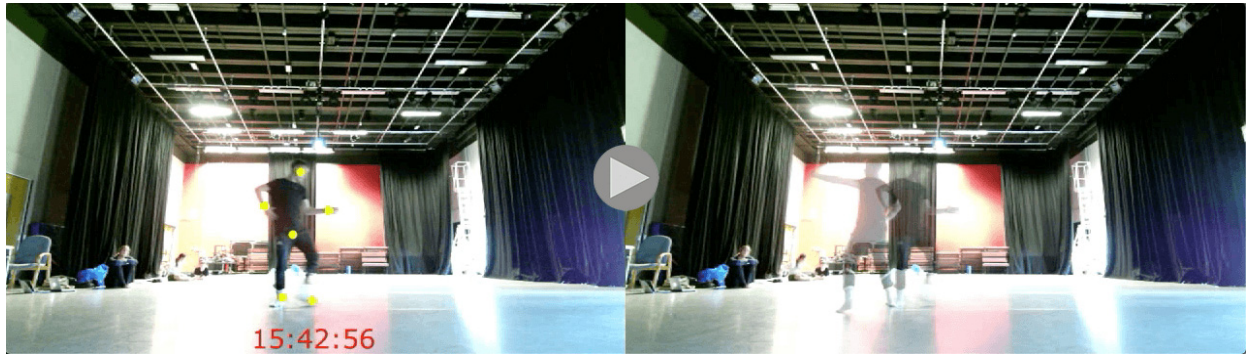
[The video 'Playing with the Repertoire – Graham's *Night Journey*' does not include voices. It can also be found here: https://youtu.be/GkEr-S9eBFI]

With *Tools that Propel*, the dancers are exploring traces of the past. These traces include those archeologically available for exploration in both the YouTube videos and in their own bodies, with the sediment of technique classes that will have been influenced – at some point along the way – by the particular contortions, supports and scaffoldings of these choreographers' languages. They also explore the traces that they are creating and bringing back through the system as the present becomes an immediate past during the improvisation. But there is also a kind of recursive trace from the future, which comes into being within this present-time negotiation of these traces from the past; it is the future of the past choreography, and it comes into being as it acts on the past traces and finds new potential within them.

Yi says 'I think it's quite interesting because like each style we put in you can really like see the different focal points almost. Like this one is like a very slight shift of the pelvis is like voom, you like explode, whereas for other styles maybe it's more like arms or legs or whatever. It's just like boiling it down almost to like what it is and like what you put [in] your body' (Levinsky 2019b). There is a moment when a memory seems to jump out of Brandon's pelvis, as he pushes it forward in his evocation of Graham's *Night Journey*. Yi continues 'I was wondering what was making them jump. Not them. Your memories jump. And then like literally it was just Brandon doing that [moves pelvis forward] like with his pelvis and he just like, his avatar just jumps up and I was like holy shit' (Levinsky 2019b). Brandon corroborates: 'I did it first subconsciously and then I did pick that up; I realised that I was taking the Graham quality into my pelvis. I found that even when I was in new positions I realised I was moving a

lot from the pelvis and the core'[36] (Levinsky 2019b). Maria says that working like this with *Tools that Propel* 'kind of gives you like a chance to absorb like another choreographer's movement. Like Brandon was so in, he was so committed to Graham and then as soon as Yi stepped in and she and you just carried on developing it was almost like you let go of the detail, not the detail, like you'd maintained the essence, you'd absorbed yourself into it. So, it became Brandon moving...' (Levinsky 2019b). Yi says: 'It's kind of like how we always talk about technique as not just movement [...] you need to make it your own, that's what I was thinking about at the end of yesterday, how do we make this, how do you adopt it and transcribe it into your body and make it your own, relevant'. To which Maria replies: 'I think [*Tools that Propel*] speeds up the process' (Levinsky 2019b).
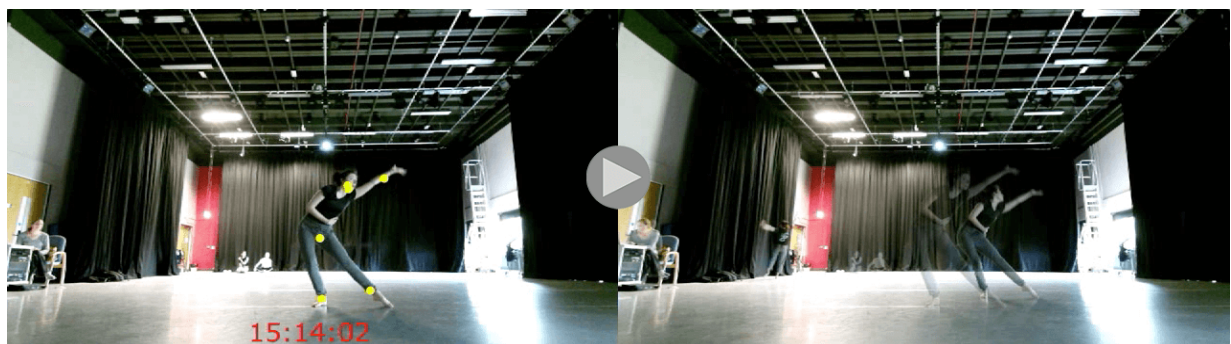

[The video 'Playing with the Repertoire – Baush's *Vollmond*' does not include voices. It can also be found here: https://youtu.be/eY4qFbG0LOw]

I notice too that *Tools that Propel* seems to speed up the dancers' process of understanding the choreographic sequences within the repertoire they are investigating. I think about this and wonder if in fact it speeds up the process whatever that process or learning might be. I remember the two members of the Van Huynh Company who mention that it made them more aware of composition; now as I am writing, I think about Yi Xuan Kwek's statements about becoming more interested in space and time; and I direct you back to the previous chapter in which I have argued it brings about awareness, attention, and intention in the choreographic improvisation. This is perhaps not 'speeding up the process' but certainly it is about focus and intensification.

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[36] It is worth noting here that during the 2.5 years of practice with *Tools that Propel* the system was set to track the pelvis as one of 6 tracked joints. This can be changed and it is worth considering that the current set up might be particularly appropriate for recognising Martha Graham's contractions.

When I spent a weekend working with *Tools that Propel* with a group of participants with lived experience of homelessness at Cardboard Citizens, their awareness of each other as part of the composition came about more quickly than in my experience of working with other groups of participants at Cardboard Citizens without the system. This is anecdotal of course and I am making no empirical claim for this knowledge. But anecdotally, the participants seemed to recognise and use the patterns of movement they were seeing reflected in each other on screen. I say to Yi, Maria and Brandon that it seems to intervene and speed up the process whatever the specific task is and at whatever level your embodied knowledge. This assertion is challenged by the half day workshop testing *Tools that Propel* with Company Wayne McGregor dancers, perhaps.[37]

Reperformance as a route to choreographic core

During discussions between myself, Yi, Maria, Zach and Brandon, questions come up regarding pastiche, negotiation, reflection, exploration, embodying and appropriating material. The dancers retain a certain amount of discomfort with this work. They are unsure how deeply they can connect with this material that they do not feel that they know that well; but it feels like a kind of note-taking process using *Tools that Propel* to explore these short pieces of choreographic repertoire. They are worried that what they are doing feels like pastiche, but then there are moments when they feel like they are really negotiating with the past through this movement.

Yi starts to think about 'intrinsic' versus 'extrinsic' information as a source for movement. This makes me think about Clark and Chalmers' discussions of belief, that is belief or trust that something exists or can be found at a specific location, whether because someone retrieves the location from memory or from a notebook which acts as an external memory (Clark and Chalmers 1998). Yi does not yet trust the extrinsic information that she has sourced from YouTube, yet she does already trust that which she receives from *Tools that Propel*. She states that

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[37] Interestingly, Maria states that 'I think it was really nice when you went back to the duet and you did it again but you had different movement following [...] so when you were playing with the duet movement [it] captured more movement of you playing with that and that playtime was played back when you returned to it so it followed the same pathway but you were doing different things' (Levinsky 2019b). Sadly, this can't have actually happened. Whilst the system is playing a memory it does not make any new iterations of the movement you are doing. This was a question that came up with the Company Wayne McGregor dancers too – they quickly realised that it did not make new memories from their live dancing body when they were working with a memory that it had brought back. This seems to be a vital future development of the system, though brings with it enormous problems in terms of the sheer volume of data that the system would have to manage in the model.

Normally when you [improvise] it's everything that's in you just comes out and you know exactly what it feels like, so then when it's reflected back to you [by *Tools that Propel*] you can engage with it in a very critical manner because it's something you already know. But now it's something that you've like put, gathered from an external source and placed on your own body and now to take that external source as your own and then re-evaluate it again, it's like some whole new dimension. (Levinsky 2019a)

Tools that Propel is here reliably coupled with her dancing body (Clark and Chalmers 1998), but the internet – and the choreographic information that she can retrieve there – is not. Of course, that is because she is not having it played back at her on a big screen; she is required to learn it and embody it before she goes into improvisations with *Tools that Propel.*

Yet this act of notetaking is interesting. Yi cannot be involved in the active process of reinterpreting the original choreography in her body because the 'note' (the YouTube video) is not there in front of her, yet her current movement is – reflected back in notes made by *Tools that Propel.* In taking notes of the dancers' movements is *Tools that Propel* seems to reveal things to the dancers that they take as truths of the choreographic style, but the act of taking the 'note' by the machine is perhaps not what brings about these revelations. It is the negotiation of them by the dancers, their own acts of notetaking. Zach states that 'it's interesting just being in that movement, in that movement style [...] because it's new' continuing that 'it was after the fifth time that we'd done it or something, the exploration of it, how we just dropped bits and sort of forgot about bits that were insignificant for us I think it was, you know what I mean, it was just the finer detail, it was ah, is that needed?' (Levinsky 2019b). Even whilst he adapts it, he asks how much is needed to 'stick within this linear line of Forsythe' (Ibid.). Yi states that 'I think at first we were quite unwilling to like break away from it [...] we just didn't know where to go. But I think slowly as more things got transferred onto there, we could just detach from it and like find another way through it' (Levinsky 2019b). When she refers to 'there' she means the screen of *Tools that Propel* reflecting back at them the information it captures and sorts. She is reliant on it, but also drawn into it, and draws herself into it. It allows her to journey further into the choreographic material, trusting her sense of the unknown.
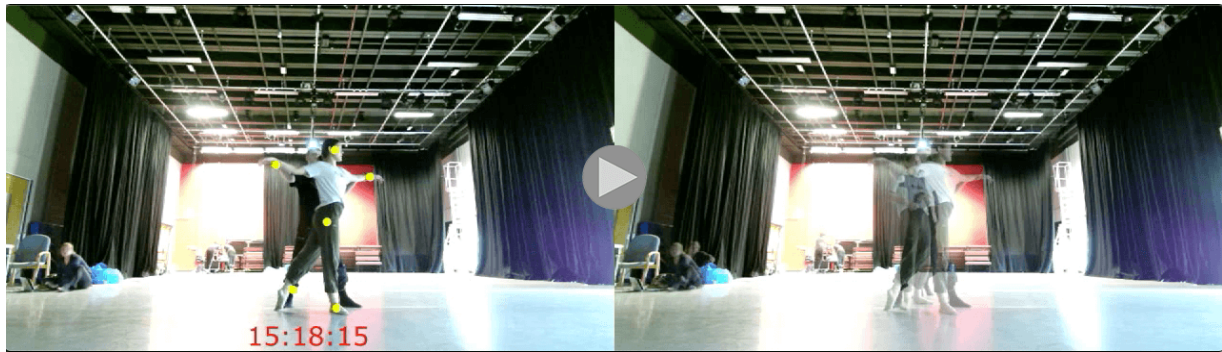
[The video 'Playing with the Repertoire – Forsythe's *Artefact II*' does not include voices. It can also be found here: https://youtu.be/PK9471dDlEs]

This journeying is important. There is a kind of triangulation between the dancer, the choreography and *Tools that Propel* and they are negotiating with each other – journeying through these colliding traces of past and future further into the present moment of discovery. The repetition seems to enforce this need to stay present, to return again and again to the event and to examine it forensically though not just through observation but embodiment and inhabitation of it. Yi says 'it's just really weird, because it allows you to really flesh out something that you don't normally do, something you don't normally see yourself in but now you're seeing it so clearly and like…it's just a projection but it's so real, and then that somehow translates back into how you then approach that knowledge. It becomes more than just representation, it's actually like fleshed, it makes it more tangible' (Levinsky 2019b). It really feels like the dancers draw themselves into and become with the notes taken by *Tools that Propel*.

I use the term 'draw' here in two ways. In the first I mean they are actively pulling themselves into the note, the memory projected at them by *Tools that Propel*: it is an active take on the usual passive expression 'to be drawn into', and yet, perhaps too in the agentic ensemble of the system they are also drawn into it. In the second, I see this pulling into, this entanglement, as akin to the act of drawing – doing it with the body rather than a pencil. In drawing an artist, does not make one line necessarily but examines, explores, finds, embodies the object of their enquiry – that which they have noticed or attempt to draw – through lines that trace and retrace space and time on the paper. John Berger argued that a drawing 'encompasses time', whilst a photograph stops it (Berger 2005[1976] : 70), and the dancers' negotiations with the movements 'notetaken' by *Tools that Propel* is certainly an encompassing of time – in this case, the past, present and future involved in the duration of the act of 'drawing' (the moving into and out of and through the memory, the note), but also the past that is the

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'drawings' taken by *Tools that Propel* in form of notes, and the past that was re-embodied by them when they danced the choreographic repertoire found in the public archive of the internet.

Through their movement, the dancer is exploring the possibility of the 'note' taken by *Tools that Propel*, also triggered by their movement: sometimes this exploration even defeats causality, introducing a spatial sense of time, a sense of intrigue and doubt, that questions its linear nature. I find it moving when the material does not seem entirely natural for the participant dancers. I tell them that it seems particularly exciting when they seem to be having a confrontation with the choreographic material, from the past, and having to negotiate what that is and what it means in their bodies; what that means for them now. But it feels like a confrontation with themselves as well, like a conversation and a discovery about who they are (Levinsky 2019b). They really seem to be drawing with their bodies, and moreover, to be drawing within and through and outside of the lines of the memories of themselves and others that the system brings back – the marks that it has made as it captured something of them in movement.

Anthropologist Michael Taussig describes his field notebooks as 'not just the guardian of experience but its continuous revision as well' and states that it is a 'peculiar and highly specialised organ of consciousness not less than an outrigger of the soul. It becomes an extension of oneself, if not more self than oneself' (Taussig 2011: 25). This takes us back to the system as notebook as diary as extended bodymind as relationally entangled agent. The relationship to the self that opens up in the use of *Tools that Propel* is explored in more depth in the next and final chapter, but now I want to examine this strange space that opens up between the notebook, the documentation and archiving of movement and the movement itself: a space I am seeing as a *gap* between the meaning of movement determined by the machine and by the human dancer. It is a metastable gap, in a system defined by metastable equilibrium and entanglement: it is the site of perpetual potential and becoming.

DIALOGUE BETWEEN MARKMAKERS

The popularity of recording media amongst dance artists owes much to its ability to document movement without the need for complex codified systems: as Hetty Blades writes, in comparison to notation scores, '[r]ecordings provide a more accessible record, which maintains the perceptual presence of the body' (Blades 2015: 26). Where the symbolic representation of movement in notation evokes a *gap* between its existence as graphic signs or written notes and the bodily nature of dance and its implicit knowledge, such a gap is apparently obliterated by recording media and motion capture technologies. Just as 'the alphabet's hold of factual description and memory was broken by photography' (Rotman 2008: 2), the memory of the movement is no longer *described,* as it is within

notation, but *exists within* its technological capture. A video recording of a dance work or improvisation allows it to be perceived as a spectator might. Yet despite its use of video recordings, which offer an 'accessible record' with its 'perceptual presence of the body' (Blades 2015: 26), we are repeatedly returned to this question of movement. What is a movement? How do you distinguish one movement from another? What is the beginning and end of a movement?

Of course, these underlying questions drive the ability of *Tools That Propel* to record, categorise and bring back the dancer's past movements in relation to their current improvisation; in this there lies a shared concern with dance an/notators who have grappled with such questions since the first attempts to inscribe movement. Despite 'discrepancy in notations and differences in transcribing movements' (Kato Westby and Glynn 2018: 81), with some, like Benesh, offering a more pictorial rendition of the body, and others, like Labanotation, analysing human movement to develop a language of abstract symbols that describe its components in a more universal but detailed way (Guest 2014 [1989]), notation systems share a concern with how closely (or not) the inscription of the movement should attempt to map its embodied form. New media technologies' capacity to record movement accurately has removed the need to analyse it in order to document it. But this has lost us access to the embodied cultural thinking of the time in which the documentation occurs. Whilst not necessarily done at the time of performance, digital annotation has brought back layers of thought and analysis to recordings. Introducing the *Performance Research* issue *On An/Notation* (2015), Scott deLahunta, Kim Vincs and Sarah Whatley suggest that 'there are no strict distinctions between annotation and notation as markmaking when marking is an extension of thinking, not merely a recording' (deLahunta *et al.* 2015: 1).

The affordances of *Tools That Propel* situate it at an interstice between digital an/notation and video capture. So, again, a gap is opened up – this time between the digital agent's perception and categorisation of the movement and the dancer's bodily engagement with it. Borrowing the words used by Judith Dunn to describe the 'impermanence' of dance (Dunn 1998: 152), what if this gap could be seen as both an 'opportunity and a problem'? The rest of this chapter takes on the notion of note-taking, introduced in the previous section, or markmaking, as a term that might be more pertinent to dance, as 'an extension of thinking' to examine how improvising with *Tools That Propel* involves the dancer and the system in the act of simultaneous, symbiotic annotation of each other's movement decisions. Whilst there is no document left behind per se,[38] there is a dialogue between two forms and

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[38] Actually, *Tools that Propel* does produce a session recording which shows what the dancer is doing on the floor and the composite screen that they see, that is, the overlaid real-time projection of their movement with

moments of markmaking that are also determined by totally different thinking processes. The computational system, *Tools That Propel,* records and categorises movements according to whether it determines that it has tracked this movement before. Dancers intra-acting with the system negotiate with these memories, and their reperformance, as stimuli to create rules for improvising (noticing shapes, pathways, configurations to explore, for example); to understand more about the movement itself; and as a constant resource to access their own, once ephemeral, and invisible, now recurring and visible, trace in space.

15:12:53
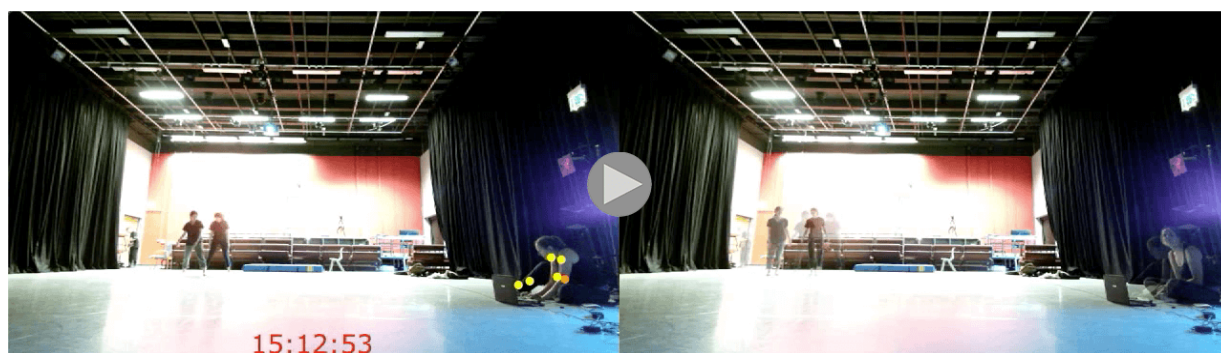
[The video 'Working it out (Brick walls)' can also be found here: https://youtu.be/yKRWSO-TFh8]

Body in the an/notation

Victoria Watts discusses the relationship between the embodied nature of dance as composing in space and its written inscription on paper and suggests a dynamic and fertile exchange between dancer and notation score. Referencing Yvonne Rainer's *Trio A: The Mind is a Muscle, Part 1*, Watts argues that the '[t]he notation score […] operates with multiple frames of reference, and the dance arises in the relation between these as it is pieced together in and through the dancers' bodies' (Watts 2010: 11). Watts states that she 'cannot conjure the dance upon the page' but 'must move into the space, dissemble the notation signs and then reassemble them *in and through* the body before [she is] able to understand what is written' (Watts 2010: 7; emphasis added). For Watts '[t]he notation score does not *represent* the dance' (Watts 2010: 7). So, unlike words on a page which can paint a picture in your mind's eye, summoning the idea of subjects, objects, settings and their interactions, you cannot read and imagine the dance from the signs. The notation score does not 'reveal how the dance looks, feels and sounds'

the recurring memories brought back by the system. However, this thesis is examining annotation as part of what makes up the live exchange between dancer and the system.

but 'provides a set of instructions as to how the dance can, or should, be remade' (Watts 2010: 14). Watts' practice of reading the notation score through her body suggests a form of improvisation in which compositional decisions are made by the dancer in collaboration with the notation marks. The dancer maintains a level of freedom of interpretation – how much freedom might depend on how closely a notation system is tied to a particular dance vocabulary – as her moving body takes up and tries on the shapes and marks from the page, interrogating, questioning, investigating and piecing them together in space. But Watts describes her need to put her 'body into the score' as a '*demand* of the notation' (Watts 2010: 7, emphasis added), which also suggests some level of agency on the part of the notation, or that comes about through the phenomena of her bodily entanglement with it (Barad 2007). Perhaps it becomes a sort of silent interlocutor with whom she attempts to dialogue – body to sign, sign to body.

As I stated in the prologue to this thesis, Tools that Propel must *interpret* the movement data that it tracks in the improvisation to facilitate a dialogue between the choreographic/improvisational decision-making of the dancer and its own determination of distinct movements within the stream of motion. Whilst it does not share its requirement to categorise and document what a movement is with notators or annotators of dance (that is, it does not need to do it to remember the choreography, nor to interpret and share the knowledge within a pre-existing dance work), its ability to challenge an intra-acting dancer's interpretation of movements stimulates them to move differently. They take different choreographic decisions in response to the reinterpretation and reperformance of their movement by the system and they gain greater bodily awareness of their compositional and choreographic decisions within improvisation. It is the dialogue between perspectives – across the gap between sign and body in motion – that opens up the composition. For Watts, dialoguing with notation marks on paper, this leads to understanding the dance in space, in all its rich multimodality. For the dancer improvising with *Tools that Propel*, where the an/notation happens in real-time in relation to what the dancer is doing, it results in new ways of moving and thinking through movement.

What is a movement?

The system's inability to apply any other more multimodal sense to the movement could be seen as comparable to, and as compromising as, the flattening of movement and its rich complexity in time and space to a two-dimensional notation sign. But this gap between the digital and human interpretation of movement is rich and provocative. It keeps asking to be negotiated over and over again, as it evolves in relation to the dancer's movement; it opens up new possibilities for the dancer, but it remains unbridgeable and thus ever elusive. There is a sense of agency in the system – derived partly from its real-time categorisation and re-performance of the dancer's movement – which encourages dancers

to negotiate with it. But it is agency that can only come about in dialogue with the dancer: if no body is sensed by the Kinect then there is no an/notation and no score.

Hetty Blades defines the term 'score' as 'a set of instructions or parameters that document and/or initiate action [...] provide stimulus for movement or instigate the performance of a specific practice or dance work' (Blades 2015: 31). The choreographic objects that she discusses 'problematize this conception insomuch as they do not aim only to document or instigate action, but to encourage specific ways of seeing the work' (Blades 2015: 31). *Tools That Propel* (temporarily) documents movement – the movements of the improvisational dance work currently occurring – in order to instigate further action. The dancers use the reperformance of their past movements as stimulus to create rules for themselves as they improvise. But it also encourages the dancer to see the evolution of their movement differently.

The gap between the digital agent and the dancer's perception of movement is not just about its modality, the possibility of its parsing, its signification, and its dimensionality. What if, rather than focussing on the overlap of notation and annotation, both involving markmaking as 'an extension of thinking' (deLahunta et al. 2015: 1), we tease them apart for a moment? Blades states that the ways in which 'annotations [such as in *Synchronous Objects*] inscribe that which is not perceptually present reveals a paradigmatic difference to notation' (Blades 2015: 32). Whilst *Tools That Propel* parses movements into separate 'classes' – discrete and different from one another – creating as it does so a kind of ever-changing grammar against which new movement can be compared – it also brings the dancer an acute awareness of time and greater understanding of cause and effect in movement, how this might be challenged, and how our interpretation of the physical laws of the universe condition it. It does this by bringing these aspects of the dance to the fore, making them more apparent, even whilst not physically *present* per se: moreover, it does it by disturbing our received understanding of them.

RETURNING TO THE CONCLUDING KNOTS, ENCOMPASSING TIME

In this chapter, we have interrogated how recurrence, return, reperformance and repetition are enacted by *Tools that Propel* and the affect that these enactments have on the improvising dancer, the unfolding improvisation, and the accumulating memories themselves (or not, if we consider the limitation of the system identified – that is, its current inability to record new embodiments of movements when it is playing a previously recorded memory). We have also examined the active role of interpretation in the gap between machinic and human inscription of movement; and we have seen how the very act of dancing, improvising, drawing in relation to the note-taking, markmaking, and memory reconstitution (recurrence, return, reperformance and repetition) of both dancer and

technological system brings doubt and potential re-substantiation, into its becoming. We have seen the gap between them as both an opportunity and a problem, to borrow Judith Dunn's words again (Dunn 1998: 152).

What we discover is that *Tools that Propel* is not propelling us to the end of time, to the future, to something beyond that which we are currently embarked. It propels to the centre of the thing we are in, to the meaty middle, the madness, the excess, the more-than-oneness and the proliferation of new potential (Yang 2015; Deleuze 1993; Massumi 2012). It also supports us to discover the middle – not just of the present – but of the past, and its embodiment in various traces that coincide with present and future. In doing so, we can not only harness the waste there – the unused potential – but also discover vital clues to its force and potential through its reperformance, diffraction and differentiation.

This thesis argues that it is possible to find meaning through the digital processing of movement material, when the approach to interpreting the movement by the digital agent – complete with its synchronicity, moments of failure, and strange non-human decision-making – is symbiotically explored, questioned, recognised and validated through movement responses. Towards the beginning of this chapter I asked whether computation could transform the *process* of archiving and accessing movement to produce new physical ideas and bodily knowledge? Instead of creating discontinuity with the past, with space, with things, can it help us be in a continuous relationship with them? Yi Xuan Kwek talks about how with *Tools That Propel* 'system failure happens and like there's memory loss and things like that so like you won't be able to fully access the past' (Appendix B; Levinsky 2019c). She says, 'it's not a fully well-preserved record of it and you only get like traces of it, and something that you want to say or you want to trigger you won't be able to, and that is quite sad, but it does like give room for new things to emerge' (Appendix B; Levinsky 2019c). What I have proposed is a failure in many ways, for its interest is based *not on solving* the terms on which we create a shared ontological understanding of ephemeral, embodied concepts and relationships – movement, for example – but on *using our inability* (and refusal thereby) to reduce the 'voluminousness of the experience' to a grammar that would produce 'instrumentalized action-reaction circuits' (Massumi 2011: 46). Of course, this is precisely because as Massumi states, when we do then 'what gets foregrounded is the element of nextness in the flow of action' (Massumi 2011: 46). Here, with *Tools That Propel* therefore, this failure – to answer the question of what is a movement – causes small ruptures in the solid structures of our perceptions and received constructions of reality. As Nathaniel Stern states, '[w]hile the computer is always limited in its responses, which are programmed, there are limitless possibilities in how we investigate the space of the situation that program creates' (Stern 2013: 44-5). He argues that '[t]hings like feedback loops, layering of time-based forms, or multiple and proportional sensors can create ever-more affective digital spaces that might highlight the body, interaction, performance, and relation, rather than

technology and its coded replies' (Stern 2013: 45). In relation to affect, and maintaining attention on the participant's movement, Erin Manning discusses the importance of recognising and making felt the failures of technology (Manning 2009). This notion of *feeling* the failure, *feeling* the gap, feels important. Just as there is potential richness in what is left out of a notation score, we might not always want to strive for the greatest degree of accuracy in the categorisation of choreographic information digitally – the discontinuous, the fragmented, the gaps, actually provide a source of defragmentation and continuity with the past: that is, the possibility for the past to recur in ways that surprise us, make us look at ourselves and our movement anew, and offer possibilities of new ideas within them.

As André Lepecki writes: 'it is the archive itself – either as memory (cultural or personal) or as bureaucracy (cultural or political) – that predicates, from the start, its own onto-political performance as one of endless memory "failures" – thanks to its constitutive (and unavoidable) acts of exclusions and misplacements' (Lepecki 2016: 119). The notion of 'onto-political performance' is important here as a bridge to the next and final chapter. There we will explore how performance itself, of dancer and system – through their entangled (mis)communication with each other – is generating new ontologies, and a new language to constitute them, all the time. This is happening through the simultaneous process of making history and archiving it, recalling it and reinterpreting it, little gaps opening up in the alluring knot and closing again as it loosens and recoils. It is happening through the making of marks by dancer and system – becoming intra-actively together – as they encompass time, in all its loops and simultaneity, fragmentations and defragmentations, and all the divergent (com)possibilities.

CHAPTER FIVE
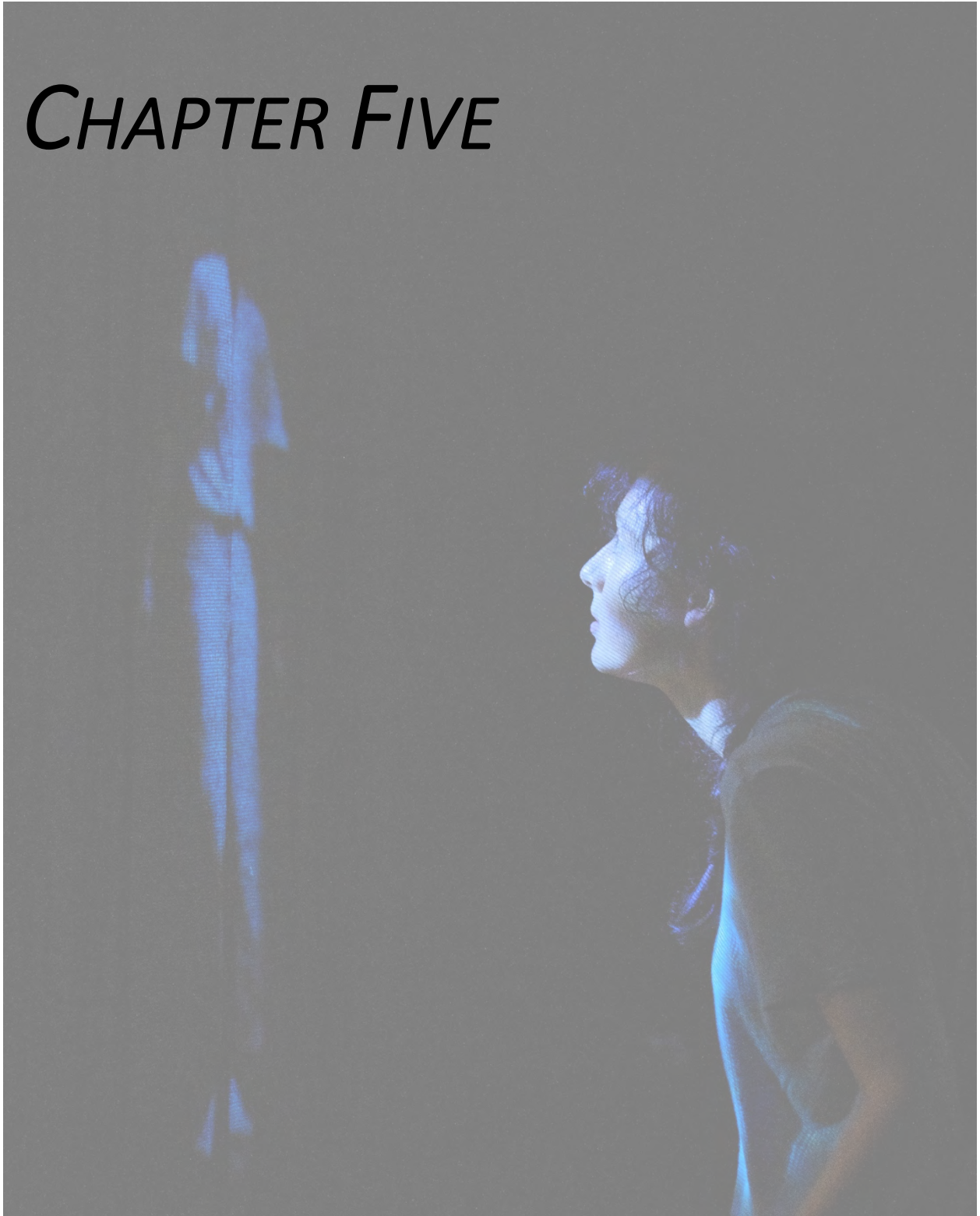
LANGUAGE AND BECOMING:

MATERIALISING SIMULTANEITY,

EXPLORING NEW CONSCIOUSNESS

AND LISTENING TO AFFORDANCES

[T]he universe is agential intra-activity in its becoming. The primary ontological units are not "things" but phenomena – dynamic topological reconfigurings/entanglements/relationalities/(re)articulations. And the primary semantic units are not "words" but material-discursive practices through which boundaries are constituted. This dynamism *is* agency. Agency is not an attribute but the ongoing reconfigurings of the world.

Karen Barad 2003

Perhaps the first question to ask about the psyche in a technologized milieu is not really one of identity and persona, of 'who' the emergent self is, but what and how is this self.

Brian Rotman 2008

D ancing with *Tools that Propel* involves a process of learning a new language when the language is not only unknown but only comes into being in its utterance *between* two interlocutors equally alien to each other. *Tools that Propel* has mirror-like qualities, yet it produces a disrupted reflection, causing the dancer to improvise in a state of unknowing, and to discover new potential in the old. Ghosts from the past appear in the present and intra-acting dancers encounter themselves as *other*, re-presented according to the grammar and logic of the system – and yet the intra-acting dancer is entangled and co-constituting the system, forming part of the functionality that develops both these othered selves and the new grammar, logic, and language of movement emergent between them.

This final chapter is about language and becoming: how a new language is co-constituted, performed even, through the entangled intra-action of dancer and the language machine, *Tools that Propel*. This language that the dancer finds themselves performing and actualising with(in) the system brings with it new thought-processes and consciousness. Yet, this chapter also concerns dramaturgy, and how the questions of language and selfhood become magnified in the installation that actualises *Body of Memory*, a semi-improvised performance piece created in a perpendicular gauze structure with three dancers and two systems of *Tools that Propel*; entanglement within this performative installation demanded that the dancers learn *its* language too in order that the piece could emerge. Connected here by performativity, both the language and the dramaturgy come about in relational entanglement: they exist in the universe – as potential to be realised – and it is through the intra-acting affordances (within and of *Tools that Propel,* in the studio or more complex entanglement of the installation) that they become.

Tools that Propel has operated as the *object* and *agent* of enquiry throughout the research and writing of this thesis. It reveals for the intra-actor an alternate way of perceiving and experiencing themselves in relation to the world – as part of, and constituted by, an entangled relationality (Barad 2007), and looking towards the middle of an ecosystem which is full of creative and proliferating potential (Yang 2015). Karen Barad discusses how different interpretations of the physical universe are derived from different 'choice of apparatus, providing the conditions necessary to give meaning to a particular set of variables, at the exclusion of other essential variables, thereby placing a particular embodied cut delineating the object from the agencies of observation' (Barad 2007: 115). *Tools that Propel* can be understood as an apparatus – a diffractive one to borrow Barad's own term – that brings about new embodied understanding of our entanglement through challenging the variables that are constituted by a separation of subject and object, that amount to a primacy of the human over the non-human as agent of change.

The notions of primary ontic units as 'phenomena' and primary semantic units as 'material-discursive practices' that can continually be reconstituted, reconfigured, reexperienced and reperceived as part of different entangled relations (Barad 2003; 2007) are key to understanding how *Tools that Propel* operates as a language machine and how it both *reveals* and *is* a process of becoming. Barad writes that 'concepts obtain their meaning in relation to a particular physical apparatus, which marks the placement of a Bohrian cut between the object and the agencies of observation, resolving the semantic-ontic indeterminacy. *This resolution of the semantic-ontic indeterminacy provides the condition for the possibility of objectivity'* (Barad 2007: 120). As a diffractive apparatus (Barad 2007) *Tools that Propel* makes 'cuts' in the unfolding improvisation which determine new semantic-ontic units, whose difference to previously conceived ones bring about the dancer's new perception of themselves in relation to the world: they experience meaning and coexistent matter anew. But as well as being a diffractive apparatus, and an agent of enquiry, analysis of *Tools that Propel* and its functionality, as *object of enquiry*, is also taking place through the lens of theoretical frameworks that collapse binaries of life and death, animate and inanimate, subject and object, meaning and matter. Yet, true to entangled relationality, this has only occurred because the system – when all its entangled phenomena intra-act and bring about its specific functionality – opened my bodymind to the existence and potential of such fields of enquiry.

Dancing with(in) *Tools that Propel*, the other or our othered self, the *ghosts becoming beside ourselves* (Rotman 2008), come complete with their own language, mode of sensing and thinking, and a sense of intention towards their physical interlocutor. This chapter explores the affordances of the functionality of *Tools that Propel* as a diffractive apparatus which on the one hand reveals semantic-ontic indeterminacy, whilst on the other, perpetually provides new 'conditions for the possibility of objectivity' (Barad 2007: 120), 'cutting' a constant stream of motion into new semantic units of movement (in which matter and meaning co-produce and are co-produced) over and over again. What happens to intra-acting dancers is discussed with reference to discourse on linguistic relativity that argues that different languages bring about different interactions with the world, according to their specific grammatical constructions and particular relationships between subjectivity and objectivity (Boroditsky 2011), and within the context of Brian Rotman and Maaike Bleeker's notion of gesture-haptic language – in which there is no gap between signifier and signified – that is potentialized through the development of motion capture and other sensing technologies (Rotman 2008; Bleeker 2015). Building on this discussion of how language is emergent within the system, I examine how the 'other' that is formed of our own movements, re-performed according to a constantly emerging grammar of the system, opens up an alternate way of conceiving and experiencing ourselves within the world, contained and held within a different perception of time and space. This argument takes us full circle back to Gilbert Simondon's notion of metastable equilibrium as a way of understanding systems that

are constantly discovering structures, and suggests that an embrace of the multiple selves (and the virtual movements of others) – that which Brian Massumi might refer to as 'more-than-oneness' (2012: 33) – offers proliferating potential in both the creative, performative improvisation through a constant route back/inwards/to the brink of ontological emergence and becoming.

CREATING BODY OF MEMORY AND LEARNING ITS LANGUAGE

Beyond and entangled with this analysis of the functionality of *Tools that Propel* as a language machine, this chapter also constitutes, and is constituted through, a discussion of the dramaturgical role of *Tools that Propel* within the creation and performance of *Body of Memory* and how it was intra-action with(in) the system in the installation that revealed different perceptions of selfhood and enactment of their relationality with the world for the participating dancers. Creating *Body of Memory* over two and a half weeks we had to work in the dark all day every day – it was unlike a 'traditional' creation process in which a piece is developed and rehearsed within a (probably light) studio and 'going dark' is what happens in the tech rehearsal when the production elements are brought in to bring about magical transformations. We entered the strange environment that we had created every day and we allowed the language and grammar of the piece to emerge from that, as we listened to its particular affordances. This is explored later in the chapter when we will also turn to a discussion of the very personal experience of confronting oneself projected back on a daily basis in a dark studio and the encounter of oneself as 'other'. Participant dancer Maria Evans described the challenge of working with *Tools that Propel* throughout the three weeks as confrontational:

> […] you have to confront yourself every single day, in the darkness! Some days I just was like oh, just not today! It kind of reminded me of like when you kind of procrastinate about reflecting on yourself and your drives and like where you want to be and things like that, and it was kind of nice to be scared of something that isn't so futuristic, not futuristic, but like so far in the future. It was like I'm afraid of what's going to happen in the next two minutes, because I don't know what's going to happen and I don't want to go in there (Levinsky 2019c).

This confrontation with the virtual self and the agency of the system acting to bring back the virtual self will be discussed with reference to the 'para-self' that emerges in the digital paradigm of parallel computing (Rotman 2008). Maria describes the 'really disorientating' difference between at times being 'so in-tuned' with *Tools that Propel* 'working with it as one' and at other times working 'with it as completely different individuals' (Levinsky 2019c). I argue that it is the complexity of this engagement with the system – that means Maria perceives the encounters with herself and her movements from the past to be both *part of herself* and also completely *other* – that keeps the important sense of

negotiation alive in the improvisation. Moving beyond the language that emerges between dancer and themselves/others reflected back to them on screen, I also zoom out to explore the way that the particular installational configuration created for *Body of Memory* demanded that the dancers learn *its* language.

The four videos in this chapter comprise edited footage of *Body of Memory*, filmed from four camera angles in the studio; as such they offer a different viewpoint on the improvisational use of *Tools that Propel*. The first two of these videos include the participant dancers' observations on the creation process, and the second two are documents of the piece as it was, complete with Matthew Collington's sound composition. *Body of Memory* was created in an installation comprising two black gauze screens hung perpendicular to each other (see Figure 4, p.109). Neither of the systems (*Tools that Propel*) were connected to each other physically in any way; they operated completely separately, placed at right angles to each other projecting onto the black gauze structure (see Figure 5). There were three stage spaces available for the dancers to occupy, two with active systems (Kinect sensor in front of the screen and projector focussed onto it) and one without. Each space had six theatre lights focussed onto it using top light only, on a rig that allowed different states to be created; the lighting was improvised live by Jess Smith each run of the piece responding to and triggering the dancers.

The effect of the theatrical lighting was to contain the space and ensure that audience who were free to walk around the installation space were not captured on screen; it had been determined that though it was interesting to capture the incidental within the studio, with a larger audience the 'visual noise' of multiple people in overlapping temporal planes would make the images too difficult to watch. Consequently, where I have discussed the importance of the reflection of the exact room that the dancer is in previously (see Figure 1, p.31; also 'Performing Tools that Propel', p.135), in this performance piece in fact the virtual dancers looked more like they were floating on the gauze (depending on the lighting and the level of floor captured by the Kinect camera) – bringing a more transcendental, ethereal quality to the virtual bodies and a greater sense of aesthetics to the images. This in turn stimulated the dancers' imaginations differently, creating more narrative engagement and reducing the overall focus on physical form alone. Maria Evans reported

> I feel like [the lighting] was really enchanting in the sense that it blackened everything else around it so it became this otherworldly experience, but not like, not like so far beyond reality but almost in this reality that kind of exists in like, is a bit up in the air, doesn't really have ground, it's not really rooted, it's almost a mental like, almost like a dream kind of, things connect together that don't necessarily in normal life…like the family portraits we did, the lighting we did, the flashes of off and on, almost like a camera […] it would be like this ever-changing world (Levinsky 2019c).
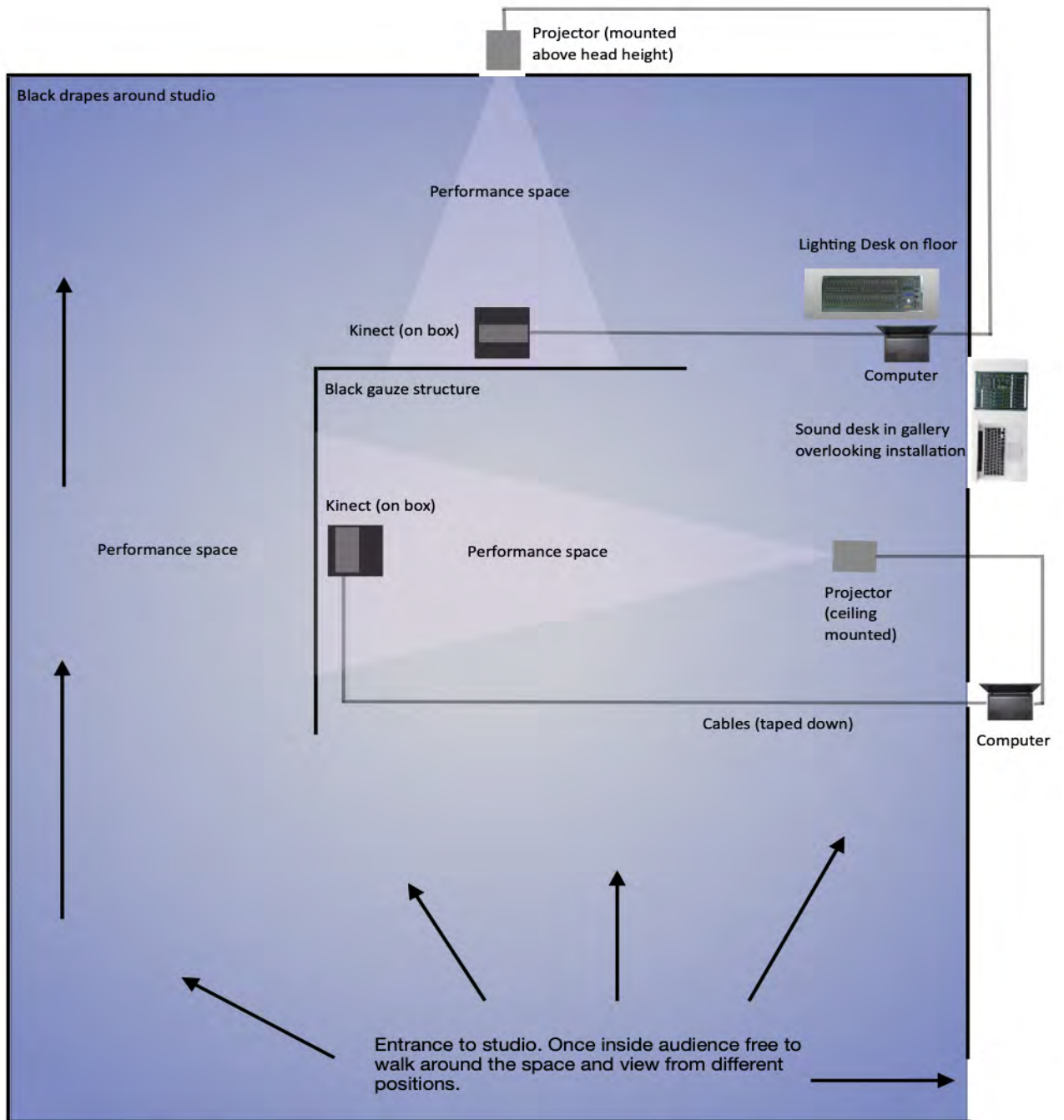
Figure 5: *Body of Memory* set-up

We spent two and a half weeks in the dark studio teasing out the possibilities of the space and the configuration of *Tools that Propel* (times two), gauze, and lighting. As concept and process director I set the dancers tasks (such as creating 'family portraits' with the system, and focussing on the 'incidental in-between' movements captured by the system, for example) and drew their attention to possibilities occurring with the system that I noticed from the outside, working out with them what it meant to 'let the system go' (leave the system to de-activate itself as there was no-one there for it to track). What we discovered was that the piece and the installational structure demanded that the dancers (participant dancers Yi Xuan Kwek, Maria Evans and Zach McCullough) kept both systems in play: their bodily movement, entangled with both systems and the spatial configuration, materiality of the black gauze, improvised lighting, and virtual bodies, meant that the systems were relationally entangled too. The piece emerged through the component parts of the architecture of the piece, with their individual and intersecting properties: two systems of *Tools that Propel*, black gauze and a theatrical lighting design that made it both transparent and opaque, enabling the virtual dancers to *travel through* the spaces and *reflect back* on others.

Each time the dancers entered the installation they met themselves as virtual presences and got to know themselves anew through this encounter. They saw the past and the present concurrently and in embodying their own past movements and animating them again, playing into and out of them, changing their speed and dynamic, they created future manifestations within them too. As in all intra-actions with *Tools that Propel*, in *Body of Memory* the participant dancers encountered 'ghosts' – their own virtual selves and the virtual bodies of their co-dancers brought back by the system according to their similitude (as determined by *Tools that Propel*) to the movements they were doing physically. Yet, the affordances of the architectural and scenographic design of the installation and the use of two systems, meant that they also had a very different experience of these ghosts: entanglement with(in) this different experience brought about deeper learning and understanding about the consciousness that appeared to become across the entanglement of dancer and their virtual manifestations.

[The video 'Body of Memory – 1st Section' can also be found here: https://youtu.be/qfy0SQuFmg4]

DIVERSE POTENTIAL AND MORE-THAN-ONENESS

Massumi writes that '[t]here is no 'one' but always a one *moreness*: a 'more-than-one', everywhere energetically in potential' (Massumi 2012: 33). The way that *Tools that Propel* creates and categorises movement vocabulary in collaboration with the dancer reflects this notion of 'more-than-one' rather than the 'one'. This maintains energetic potential and the always-possibility-of-something-more: through the very process of determining *what a movement is* in the first place, and offering it up for embodied examination, it continually enables 'discover[ies] of structure' and 'provisional resolution of incompatibilities' whilst not destroying the potential itself (Simondon 2011 [1958]: 411). For me, the '*moreness* [...] everywhere energetically in potential' (Massumi 2012: 33) is where Simondon's philosophy links to ecosystems aesthetics which Andrew S. Yang describes in terms that resonate strongly with the fundamental concept of metastability. This thesis is about the diversification of new forms and explores exactly how that happens in the very specific system (*Tools that Propel* in use) within the larger systems (dance, improvisation, choreography, choreographic software, society, nation, world, universe, for example). Furthermore, it explores how this specific system-within-system asks you to look to what Yang terms '*the middle of the thing we are in* - the active and complex middles of creation rather than the subatomic beginnings or the hyperbolic ends dominated by extreme scales and force' (Yang 2015: 176).

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But let us return to Simondon again and consider what happens with the emergence of structure in the human understanding of the world – in the form of subjectivity versus objectivity and the structuring of experience that follows on from such separation. The 'rupture of the unity of the magical mode of being' (of which aesthetic and ethical thinking serve to remind us) is 'the vital relational link between man and the world, defining a universe at once subjective and objective prior to any distinction between object and subject, and consequently also prior to any emergence of the separate object' (Simondon 2011 [1958]: 411). Simondon's concern – and indeed where part of my interest with his philosophy lies – is the process of emergence and individuation from a preformal primitive universe where form and matter are one; as Lapworth writes, 'Simondon forces us to rethink the subject in terms of its transductive emergence from preindividual processes, and its metastable susceptibility to ongoing transformations' (Lapworth 2016: 1). Through these metastable transformations we can gain glimpses at this preformal universe. Massumi writes:

> The only conceptual tools available are prehumanized by virtue of the models they derive from. But becoming-human only makes sense in relation to a non-human phase-shifting into it. And becoming-human only makes sense in terms of the human phase-shifting out of itself, back into a non-human. If the non-human phases in and phases out, it is conceivable that it phases *through* – which raises the issue of the immanence of the non-human to all of the vicissitudes of the human (Massumi 2012: 21).

The system, in many ways, allows movement to be a constantly mutable thing, a mass to be carved, structured, modelled, over and over again, as the intra-acting dancer and the computation form movements and shape their vocabulary out of the metastable mass of possibilities. Nicolas Salazar Sutil writes about the 'creative tension between infinite movement and finite systems of representation' (Sutil 2015: 1) and referring to 'the philosophical literature [dating back to the Ancient Greeks that] enshrines a split between motion and motionless' he argues that the possibility of their reconnection is found in new media technology (Sutil 2015: 7). Sutil states that 'contemporary thinking is informed by an unstable materiality of reflection and representation' and that '[w]e do not know movement through re-moved reflection only, nor through mechanised thinking; we also think and perform movement by shifting from one position to another, or by inserting ourselves in more distributed systems of knowledge production' (Sutil 2015: 7). Through use of *Tools that Propel* in dance improvisation, this research explores how and what knowledge (in/through/of movement) can form with it. Developing a system that is constantly 'asking' what is that movement and have I seen it before, in order to determine what it brings to the improvisation, and in relation to the proprioceptive movement-decisions being made by the dancer intra-acting with it, means that it is literally *playing with*, *manifesting* and *fuelled by* the idea that 'movement is no longer purely abstract or purely concrete [...]

neither metaphysical nor mechanical, neither mind nor body, but always in between' (Sutil 2015: 7). By not fixing the conceptual models through which the segmentation of movement is defined, intra-action with the system involves and activates metastable connections between movement and its purposing in dance; the thinking body explores the potential in the more-than-oneness of the possibilities of what the movement is and can be, of its infinite recurring archivisation, and becomes together with the system, in the movement – formed of and by its 'abstraction and concretion at the same time' (Sutil 2015: 4). The constant fragmentation of movement (as a continuous stream) in order to defragment it, as *Tools that Propel* is essentially doing, is a strange way to reconnect the metaphysical and the mechanical, the motion and the stillness; but the disavowal of the 'conceptual tools' available to us, that are all 'prehumanized by virtue of the models' from which they arise (Massumi 2012: 21), simply because the system has not been programmed to categorise movement as such, enables a possible phase-shift into and out of the human, and a becoming that embodies continual reconsideration of who and what we become. This proposition is, of course, notwithstanding the recognition that the prehumanized models are inevitably conditioning the creation of the hardware and the intersecting software driving them, as well as the gesture following library XMM, even if the programming of *Tools that Propel* is not predicated on predetermined conceptual systems of movement categorisation.
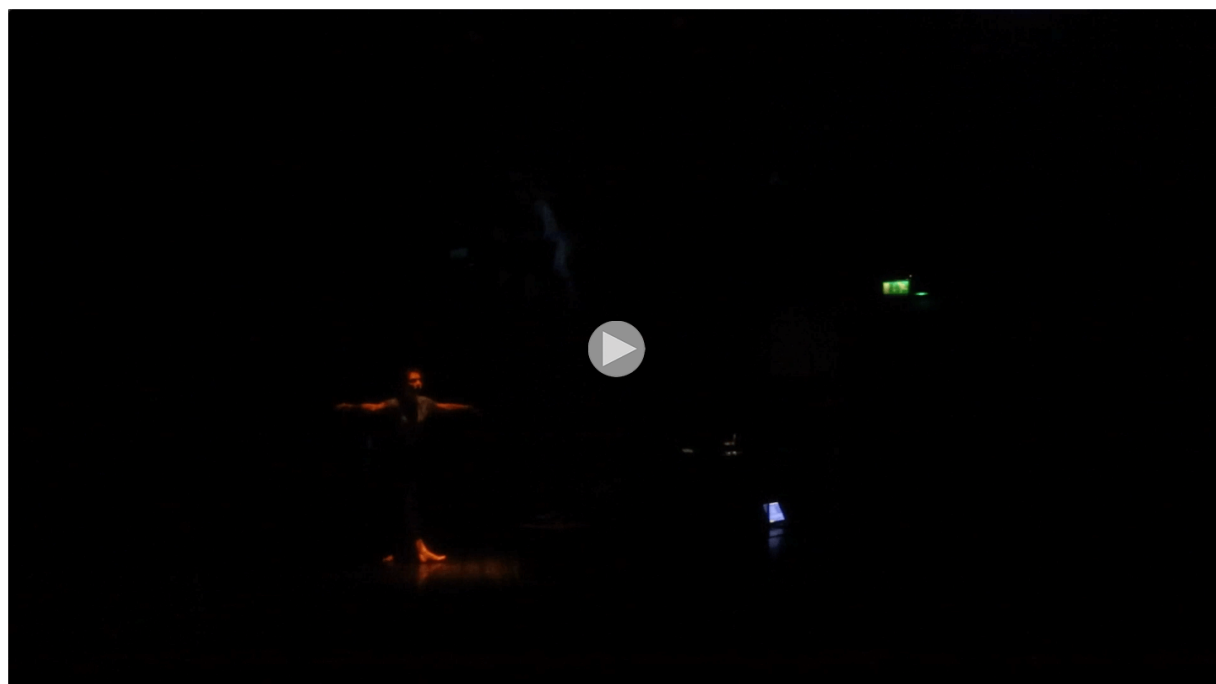
[The video 'Body of Memory – 2nd Section' can also be found here: https://youtu.be/OlxPwuGLsnA]

PERFORMING MOVEMENT TO REALISE POTENTIAL

Tools that Propel overlays two temporal planes (past and present) and can move back and forth in time on the recorded one. For the dancer encountering *Tools that Propel* the simultaneity of the virtual dancers reflected back at them is key to their unfolding improvisational choices. But what does this simultaneity enable in the dancer and what is the implication of their negotiation with this new simultaneous mode of thinking and actualisation of movement ideas? *Tools that Propel* enables the dancer to revisit their past in their present, to rewind it with their present movement, and to move into their future through these past images. The act of embodying the memories on screen, negotiating with them, through one's own body, becomes an exploration of the effects of the movements and a rewinding to the causes; it is a discovery of the centre of the movements, the fulcrum upon which cause and effect sits precariously, the moment of action itself. There can be creative stimulus inherent in the exploration of a movement – performing it to bring about new potential within it – through the entanglement of the physical and virtual bodies, and the movement on screen can also offer divergent and surprising possibilities to the improvising dancer. Equally, the performance of the recorded movement able to move in and out of it, backwards and forwards along the footage directly controlling it through the movements of one's own body tracked by the sensor, can bring about powerful effects for training perhaps: the dancer is gifted the ability to move around within the centre of a movement or sequence of movement to understand and *know* the effect that a cause will produce. There is something about the connection between the felt body – the physical body moving and sensing – and the visual body on screen moving back and forth in time, with all the knowledge that is available in that movement shared between both, that brings this knowledge into being in the real live human body on the floor.

For participant dancer Zach McCullough the system is sometimes disturbing, but through this it seems to open up new creative and choreographic potential. He says that *Tools that Propel* 'almost destabilises [his improvisation and inner rhythm]' but that 'within the destabilisation you find restabilisation' before continuing that 'because you've restabilised in a different place it's going to be different' (Levinsky 2019c). *Tools that Propel* materialises the movement of bodies with relatively little adherence to the physical laws we understand from our experience of causal, linear time. This can be discombobulating for the intra-acting dancer and together, in the material entanglement of the bodies – fleshy and digital – new semantic-ontological possibilities arise. Zach states that working with *Tools that Propel* 'affects [...] the balance [...] when I'd be moving I'd notice that something would catch my eye on the screen that I'd try to replicate and therefore that changes my inner rhythm' (Levinsky 2019c). He suggests that you are 'constantly adapting the physical laws that you are currently working with, so sort of like, if I like to go 90 degrees with my leg, possibly like I see I go 90 degrees and it makes me, it's

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instinct, it makes me want to move my right arm over and the next thing I know I'm flat on my side and it's sort of like that would never have come about if I was just improvising on my own, [...] it's instantly already changing my inside body knowledge of rhythm and it's upsetting that' (Levinsky 2019c). Indeed, despite what he is doing at that moment in time he is stimulated by an external object (a memory of himself or another dancer) to act with a different movement logic. Or put another way he is propelled by different physical laws from those he previously perceived as central to his understanding of himself as a moving body, because of the properties inherent in that objective memory moving on screen which is from a different moment in time; an object that can move back into the past and forward into the future through his (re-)embodiment of it, or that appeared as a memory that started off-balance, rather than in a pathway from stability to instability.

It is a disruption to the energetic flow of a 'tightly imbricate[d] interior space and external space, the inside of the body invested with energy, and the outside where gestures of the dance unfold' that José Gil discusses with regards to the fact that all 'dancing movements are learned' (Gil 2009: 88-89). Gil refers to ballet classes that take place with a mirror in which 'the student learns how a certain position of limbs corresponds to a certain kinaesthetic tension, thus constructing a kind of interior map of those movements that will allow him to move in a precise manner but without having to take recourse to an exterior image of the body' (Gil 2009: 88-89). For Zach, working with *Tools that Propel*, the coextensive space formed of his inner and outer body is disrupted and therefore something new emerges. Gil's discussion of the body-without-organs, whereby energy can flow more easily, unimpeded, and freed from habituation, concerns the possibility that with the reduction of obstacles (of which organs form one) innovation can occur and 'intensities may be taken to their highest degrees' (Gil 2009: 98); whilst at first the encounter with *Tools that Propel* might appear an obstacle to such intensities, in fact, through learning and developing a language with it, new unhabituated movement exploration can occur.

Equally, there might be more obvious symbiosis in the entangled movement taking place between the dancer and their virtual image that Zach describes. Animating the bodily movements appearing on screen, feeling them in his/her own body, a dancer can explore the potentiality within a movement, rewinding it, playing it at different speeds, moving into and out of it, and discovering the fulcrum of action, between cause and effect. The dancer can use the visual and proprioceptive information provided by *Tools that Propel* and explore what effect a cause will produce and vice versa. In Chapter 3, I wrote about how Maria Evans observed the impact that repeated motion with *Tools that Propel* had on her ability to carry out a wave motion in technique class, concluding that 'it's different from a mirror because a mirror would just show you what you are rather than what you could be in some sense' (Levinsky 2019c, emphasis added). This was not just about repeating a memory, nor embodying

another dancer's body which might be more technically correct, but about sharing physical knowledge between the physical body and the virtual one, and about being able to move around that fulcrum – testing out what causality might mean and what other potential and possibilities lay in this moment of action. There is a bridging of the gap between digital agent and human perhaps; where matter meets matter, of another sort, in an entangled agential reality. On one level this could simply be a consequence of repetition: the system can invoke a desire in people to reperform movements over and over because of the intriguing feeling of editing and scrolling footage with one's own physical movements. But it is also about the simultaneous process of an/notation occurring – the dancer an/notating the 'memories' selected by the computer and the computer an/notating the dancer's live movements.

Simultaneous an/notation and bodily knowledge

Tools That Propel's segmentation and classification of the movement data stream and its real-time comparison of the dancer's current movement to these classifications leads to a reperformance of the dancer's past movements in the virtual space: the dancer is stimulated to dialogue with these virtual bodies and it is this dialogue which actively creates the emergent, evolving improvisation. This simultaneous an/notation of each other's movement decisions – by dancer and computational system (*Tools That Propel*) – brings about both new choreographic decision-making within the improvisation and (re)shapes bodily knowledge in the dancer. As already discussed, this occurs in several interrelated ways. The system precipitates a relationship with embodied memory that forms part of the dramaturgical thinking within the improvisation, literally prompting re-examination of their own previously actualised ideas within it. It affords the dancer the opportunity to travel within, back and forwards, and explore both the edges and the centre of a movement, understanding more about its potential and its dynamic through the interrelation between her embodied movement and the visual feedback on the screen. It also engages dancers in an exploration of the formal properties of the compositional space, as the relationship between bodies in the past and the present on screen starts to suggest new pathways, shapes, movements and occupations of space.

With *Tools That Propel* the marks denoting movement are *not* permanent, like notation marks, but instead constantly evolve. There is no pre-existing dance work to remake – as there is in the case of Victoria Watts' reinterpretation of the notation marks through her dancing body, discussed in Chapter 4 – but the reoccurrence of the dancer's past movements in the present brings what Vida Midgelow calls 'dramaturgical consciousness' to the improvisation (Midgelow 2015: 106). Midgelow argues that '[d]eveloping this particular consciousness entails a reconfiguration of the dramaturgical and the improvisational, which allows us to understand them both as embodied practices that play with memory' (Midgelow 2015: 106). In this reconfiguration, she argues, 'the body – its corporeality,

knowings, and implicit memories – is recognised as the dramaturgical content that is simultaneously emerging and being performed' (Midgelow 2015: 110). There is a 'conflation of doing and conceiving' and a convergence of the 'act of dancing and the process of choreographing' (Midgelow 2015: 108) in the improvisation that is supported by this dialogue with *Tools That Propel.*

Maria Evans discusses how 'the memory that plays […] initiates sensations from muscle memory because it's a previous movement you've just executed' (Levinsky 2019c). Whilst Jill Bennett's arguments that 'visual media may prompt recognition of one's own or another's past experience not via representational but via affective memory' (Radstone and Hodgkin 2003: 13; Bennett 2003) might be referring more explicitly to memory of traumas, they resonate with this notion that Maria draws on with regards the triggering of both her muscle memory and the feeling within the movement she had enacted before. Maria says, 'it's a lot easier to then follow through the same emotion or feeling of moving because the visual just subconsciously initiates these parts on your skin and emotion as well' (Levinsky 2019c). This is about the activation of an action already known, whereby the effect is intuitively understood in advance and the cause can be initiated. The memories that appear on screen are brought into being through performance, sometimes accidentally, surprising the dancer, and sometimes searched for even whilst the dancer does not know which part of a movement was captured. When they appear suddenly on screen they reactivate moments from the past in the dancers' moving body, stimulating muscle memory and bringing them into being. This language unfolding between dancer and the system is performative: not just used to inform but to actualise, to bring its potential into being. As the system builds up its memory and the dancer circles back inwards on the motifs she or he has already embodied to discover more within them, they are actualising the knowledge inherent in these movements. They are digging within them and mining this knowledge which they make apparent through the conversation that takes place in this shared language that they are also bringing into being through its performance.

This suggests that there is no room for imagination however, if all language is performative, with all that will be actualised inherent within it. Yet, if we remember Barad's discussion of her agential realist, performative approach, we understand not that it is all inherently there to be actualised but that it only becomes actualised – or even ontologically *becomes* at all – in its entangled intra-action. When they appear on screen they reactivate moments from the past in the dancers' moving body, stimulating muscle memory, surprising and challenging the dancer because of the particular start or finish of their interjection, and catalysing the potential of new versions. The virtual bodies on the screen are *explicit* as memories, offering up a dialogue with the physical body's 'implicit memories' (Midgelow 2015: 110); but their fragmentary nature, the beginning and the end of them – as memory, as movement, as an/notation mark – is determined by the system. Unlike notation marks, these

marks/memories are full of body, literally formed of the recorded bodily movements of the dancer, but they are not entirely the dancer's body as she recognises it. In the peculiar way that her movement is parsed and then reflected back to her in response to her current activity and overlapping with its real-time projection, it causes the dancer to look at it again, and to consider this previously familiar body as unfamiliar – to explore its movement, to *think* about it whilst moving. Annotating the movements of this un/familiar body, moving inside it, in and out of its margins, exploring the dynamics, the dancer is composing with her entangled and extended bodymind. As the dancer improvises with and within the motifs she has already embodied and discovers more within them, she is actualising the knowledge inherent in these movements. It is a dialogue in a shared language also brought into being through its performance.

LANGUAGE: SPACE AND TIME

Cognitive linguist Lera Boroditsky relates how Aboriginal people from the Pormpuraaw community in Australia can orient themselves in space – knowing the direction of North, South, East and West – without a compass. It is knowledge, she argues, that they have embodied within them due to the relational viewpoint inherently built into the grammar and structure of their languages (Boroditsky 2011). Boroditsky's empirical studies research how concepts like time and agency are embodied differently in the languages that people speak; indeed her work contributes to a now growing body of empirical evidence that was previously underdeveloped in the field of linguistic relativity despite the plethora of speculative theories proposed since anthropologists Edward Sapir and Benjamin Whorf's respective formulations on the subject, which in subsequent years became collectively and controversially known as the Sapir-Whorf Hypothesis (Pavlenko 2016; Boroditsky 2011).

Whilst there are different levels at which the idea that language influences thought is explored and contested (Lucy 1997), it is with the question of 'whether quite different morphosyntactic configurations of meaning affect thinking about reality', the 'level traditionally concerned with the term linguistic relativity' (Lucy 1997: 292), that I am particularly concerned. I propose that the particular language that emerges between *Tools that Propel* and dancer brings about a new way of thinking about and being within reality. However, due to the *bodily* expression of signs, where body refers to body – both in the flesh as the dancer moves and in the video output of *Tools that Propel*'s movement classifications – the analysis of the system in relation to this could conceivably be problematized by what Lucy describes as the semiotic level. In this, the key question becomes whether it is specifically 'having a code with a symbolic component (versus one confined to iconic-indexical elements) [that] transforms thinking' (Lucy 1997: 292). However, whilst the configuration of movement classifications is not based on a symbolic code, and indeed the use of motion capture technologies enables a direct

mapping of referrer to referent, and an ontological return to the brink of becoming prior to any split between subject and object, it is with the understanding of reality inherent in our prehumanized conceptual model – the languages that we speak and their materialisation of symbolic concepts – that *Tools that Propel* intervenes: bringing the possibility, for example, of a convergence of past, present and future, and planting the suggestion that the agent of human destiny is not just the human.

Yet, what is the relationship between the idea that the languages we speak determine the way that we think (and consequently that our consciousness expands through an accumulation of different languages) and Barad's notion of 'semantic-ontic indeterminacy' (Barad 2007: 120) resolved by a 'choice of apparatus, providing the conditions necessary to give meaning to a particular set of variables' (Ibid. 115)? At first glance, there are correspondences and discrepancies between linguistic relativity – which concerns itself with the *structure* of languages and *semiotics* – and a performative new materialist argument for the coalescent relation between matter and meaning; a relation between language and consciousness where their agential reality comes about only in their entanglement. There are various proposals that have been formulated in the lineage of Sapir and Whorf, and whilst they may differ in how they define the parameters of three key elements – language, thought and reality – they all coalesce around two relations: 'Language embodies *an interpretation* of reality and language can *influence* thought about that reality' (Lucy 1997: 294). Given the human provenance of language, the use of the word 'interpretation' here starts to conjure constructivist ideas about reality, with a shifting human perspective on it according to its construction within a particular language's grammatical structures and the way that culture and geography have influenced its signification. Yet what if words and thoughts cannot be disentangled from their material production? If this is the case then it runs contrary to the arguments made by Sapir, for example, that there is a fundamental difference between the physiological nature of speech and the symbolic referents articulated within it, determining that any localisation of it within the brain in terms of 'the associated auditory, motor, and other cerebral processes that lie immediately back of the act of speaking and the act of hearing speech [are] merely a complicated symbol of or signal' for the 'content or "meaning" of the linguistic unit' that 'consists of a peculiar symbolic relation' (Sapir 2012: 10). Indeed, Sapir determines that 'language is a fully formed functional system within man's psychic or "spiritual" constitution' (Sapir 2012:11) and declares his study of language an abstraction from its physical (guttural) provenance – that which I have declared contains meaning in my inclusion of the non-verbal, pre-formal sounds and elisions the participant dancers make as they try to articulate their experiences with *Tools that Propel*.

However, in turning to the work of Lera Boroditsky whose research within this lineage explores the physical manifestations of thought in embodied speakers of different languages, we can start to reassess this divide between the body and the mechanisms (and articulation) of thought and bring the

body back to mind. The possibility that language and its embodied 'interpretation' of reality can physically manifest in different ways of being within and with that reality – in the matter, the synapses, the thought-processes, however they occur – as affected by the articulation and use of a different language will become more apparent.

Body in the landscape

In a podcast hosted by *Hidden Brain, A Conversation About Life's Unseen Patterns*, Boroditsky discusses spending time in the Pormpuraaw community in Australia to study their languages. The tale that she tells about how she learnt to orient herself in the world without a compass is compelling, even whilst it is not knowledge derived from an empirical study and does not suggest necessarily reproducible results per se:

> One day I was walking along and I was just staring at the ground and all of a sudden I noticed that there was a new window that had popped up in my mind and it was like a little birds-eye view of the landscape that I was walking through and I was a little red dot that was moving across the landscape. And then when I turned, this little window stayed locked on the landscape but it turned in my mind's eye and as soon I saw that happen I thought oh this makes it so much easier, now I can stay oriented […] (Vedantam and Cohen 2018).

Rather than having words for left and right, that is describing the location of objects in relation to themselves as subjects, as do speakers of English and many other languages, the Pormpuraaw Aboriginals use cardinal directions to describe the placement of objects. Boroditsky gives an interesting example of this which shows how such a relational interpretation of the world destabilises the Western subject-oriented one: '"my north-west leg" becomes "my south-east leg" if I turn around, literally that is, becoming another leg' (Vedantam and Cohen 2018). A worldview in which humans are not the centre of the universe, but implicitly part of the landscape which has the agency to affect them, seems inherent in the grammatical construction of many Aboriginal languages.

Cyborg artists Neil Harbisson and Moon Ribas, along with other collaborators who make up Cyborg Nest, have pioneered the North Sense, a commercially-available implant that vibrates when the wearer faces north (Hepworth 2016). But Lera Boroditsky had been in the Pormpuraaw community for one week learning their languages before her struggle to orient herself shifted: her consciousness evolved to accommodate this need and with it emerged a different perception of her place within the world. When she started to see herself within the landscape from a birds-eye view (rather than from her subject position, the all-important 'I' looking out and surveying the world around them) she says:

> I kind of sheepishly confessed this to someone there. I said you know this weird thing happened, I saw this birds-eye view and I was this little red

dot and they said, well of course, how else would you do it? And so what was remarkable for me was that my brain figured out a really good solution to the problem after a week of trying, right. So I think it is something that is quite easy for humans to learn if you just have a reason to want to do it (Vedantam and Cohen 2018).

In dancing with *Tools that Propel* the intra-actor is able to see herself outside of herself, within the landscape of the room she is within. In fact, when a memory of her is brought back by the system it is inseparable from the landscape, the room, the place the body was moving in. This is perhaps unusual given that the affordances of motion capture technologies mean that the movement data is then extractable from its location and transferable to other situations, places, or bodies. As Brian Rotman describes '[t]he kinetic patterns stored by motion capture dis-embed, decontextualize, and de-territorialize the original motion from the place, time, circumstances, physical form, cultural particularity, and presence of its performance' (Rotman 2008: 46). Whilst the magic of this technological innovation means that captured motion can be '[r]eleased from their originating situations and instantiations [and] re-territorialized onto a proliferating range of physical situations and re-embedded within any number of contexts unrelated to the original occurrence' (Rotman 2008: 46), in *Tools that Propel* the movement data is used for computational analysis but remains indexed to moving image files. This means that as discussed in Chapter 3 the system is designed to utilise the camera image wherein the movement is contained, reflecting back the room that the dancer is in but changing it through the perceptual shift that comes through the reorganisation and reconstruction of time in folding the past into the present, thereby giving the intra-actor what becomes a sort of indirect look at reality. This might be compared to the shift from the subject positionality purveying the landscape to the birds-eye view of oneself within the landscape perhaps – at least as an analogy to how such a shift can change an embodied cognitive understanding of oneself within reality, or rather change the construction of one's experience of reality.

It is worth noting here the value that *Tools that Propel* brings the dancer who starts to see themselves within the choreographic and compositional arrangement as they use it. Elsewhere in this thesis, I have proposed that using the system might speed up choreographic understanding and awareness in dancers and dancers in training, as was demonstrated through the remarks of two dancers from the Company Van Huynh and observations of Cardboard Citizens participants who are significantly less experienced in movement improvisation. This can be understood in relation to the proposition that Boroditsky makes, that seeing oneself as a separate entity within the composition, or in her case within the landscape, is 'quite easy for humans to learn if you just have a reason to want to do it' (Vedantam and Cohen 2018). *Tools that Propel* provides the catalyst to the perceptual shift and suddenly the instruction to consider or take care of the composition of the entire space as one improvises, something

I have said to dancers and actors time and time again, takes on a new resonance and is aided by the system. Yet here we are talking about the system developing not just a new skill in intra-actors but a new linguistic capacity and consciousness with it.

Folding (and re-conceptualising) time

Lera Boroditsky's research suggests that 'languages and cultures construct how we use space to organise time, to organise this very abstract thing that's otherwise very hard to get our hands on and think about' (Vedantam and Cohen 2018). She states that 'for English speakers, people who read from left to right time tends to flow from left to right, so earlier things are on the left' and affirms that where English speakers would organise a pile of disorganised pictures that tell a story into a trajectory from left to right, Hebrew or Arabic speakers for example would organise them from right to left (Vedantam and Cohen 2018). But as she says, 'time doesn't have to flow with respect to the body'; speakers of Aboriginal languages who use North, South, East and West instead of left and right, 'organised the cards from East to West' meaning that 'if they were sitting facing South, they would lay out the story from left to right but if they're sitting facing North then they would lay out the story from right to left and if they were facing East they would make the cards come towards the body' (Vedantam and Cohen 2018). She also articulates how we embody our experience of time within our bodies differently according to the languages we speak:

> English speakers consider the future to be "ahead" and the past "behind." In 2010 Lynden Miles of the University of Aberdeen in Scotland and his colleagues discovered that English speakers unconsciously sway their bodies forward when thinking about the future and back when thinking about the past. But in Aymara, a language spoken in the Andes, the past is said to be in front and the future behind. And the Aymara speakers' body language matches their way of talking: in 2006 Raphael Núñez of U.C.S.D. and Eve Sweetser of U.C. Berkeley found that Aymara gesture in front of them when talking about the past and behind them when discussing the future (Boroditsky 2011).

So how do intra-actors learning the language of *Tools that Propel* experience or embody time? The truth is that they do not necessarily carry this language with them in their bodies beyond the time that they are intra-acting with the system, at least not in any objectively evidenced way. So of course, it is not a comparable situation. However, given the arguments for the way that consciousness and perception is constructed by the languages we speak, and the argument here in this thesis that a new language develops between the dancer and the computation, building up from the tabula rasa, we might well argue that the parallelism evoked by *Tools that Propel*, transferring a linear unfolding of time into a layered and simultaneous experience of it (even with the co-existence of only two temporal planes), must have some effect on the dancer's

construction of their experience and themselves within their environment during the time of their improvisation with the system.

For Maria Evans *Tools That Propel* reflects back the infinitesimal moment in which the present turns to past. The fulcrum where past and present meet in the system becomes a point of potential action and discovery. '[T]o me seeing myself on screen is a moment that's already passed. It's like this being that is literally milliseconds after I've moved and it is that tiny tiny difference in time but it does feel like you are very much the next step whereas the digital version of you is kind of the step that your other foot's on. Almost like you're this kind of hovering foot that's kind of undecided on where it's going' (Levinsky 2019c). She describes this 'hovering foot' which for her is about 'not really know[ing] where [she's] going to go' as 'like a support foundation. A constant feedback.' She states that '[i]t's almost as if you are looking at the very last moment of your past, like constantly, like little fragments. So, in that way it's kind of a tool to make you be as present as possible. Because you're feedbacking visually through touch and everything and also seeing the aftereffects and using those aftereffects to push you forward into new territories' (Levinsky 2019c). Maria's hovering foot here could be understood as one self moving into the future, the other stepping into the possibilities held in the past self moving on screen.

As the present (physical) body moves on the same visual plane as the past (virtual) body, it becomes a future; a future that the dancer somehow already perceives because they have seen, and can explore, its possibility in the past images they are encountering. In Chapter 3 I referred to Yi Xuan Kwek's discussion of how 'self-reflective' she had become as a dancer, and how difficult it was to figure out all the 'reflections', specifically drawing attention to her argument that *Tools that Propel* 'in a quite literal but also quite figurative way [makes] you see more clearly what you want to achieve' (Levinsky 2019b). Here she talks about a moment when she 'had this whole image of […a] time stream, like just flowing in like past present future, just streaming around.' She continues, 'from that imagined scene everything else made complete sense for me compositionally. I knew exactly what I was going to do and why I was going to do it because I just saw it' (Appendix B; Levinsky 2019c). She argues that *Tools That Propel* 'triggers things in you that you never really see, like things that just get left behind so you can't really look back on them. It kind of makes sure that you take everything with you so then you're really…I don't want to say confronted by all of this information but you're like presented with that and then you make sense out of that' (Appendix B; Levinsky 2019c). She says that '[y]ou see like the full spread at once. Like going to a buffet rather than like having your food come like…rather than like a three-course meal' (Appendix B; Levinsky 2019c). Yi seems to be moving in and through a meditative state. She feels that she sees more clearly with *Tools That Propel*, understanding the creative implications and possibility of the composition she is both in and part of creating. Yi experienced a realisation that 'how you move

toward your future if you think that every 'now' is like a fresh 'now' to like grab' was 'very different' to 'how you move towards your future with an understanding that you are your past' (Appendix B; Levinsky 2019c). Equally, she compares working with *Tools That Propel* to 'looking at a cross-section of yourself so you're looking in the middle and you see all these layers of sediment like build up so you see all the tree-rings that have emerged' (Appendix B; Levinsky 2019c). Qualifying that she does not actually 'get a glimpse into the future' she suggests that 'having that sediment, that knowledge with you kind of pushes you to do things that would always have been realised anyway but you now realise it because of your knowledge of the past' (Appendix B; Levinsky 2019c). Maria's sense of being 'as present as possible' might well be similar to Yi's meditation on 'past present future, just streaming around'; certainly, they are both open to a new perceptual mode of awareness that is enabling them to discover something new within their choreographic thought-actions and indeed within themselves as sentient beings.

The dancer is learning a new language, as it emerges in its (re)performance by and with the system. *Tools that Propel* highlights the present moment of the 'thought-action'. Starting as a *tabula rasa* it creates new classes of movements as it encounters them. Time does not unfold from past to present to future, with linearity. There is no cause and effect; each movement that the dancer does is digging into the past image presented to her or an escape to something different. Either 'thought-action' carries equal potential. The 'other' that is formed of our own movements, re-performed according to a constantly emerging grammar of the system, opens up an alternate way of perceiving ourselves within the world, contained within a different experience of time and space. The dancers meet themselves as 'other' and get to know themselves anew through this encounter. They see the past and the present concurrently and in embodying their own past movements and animating them again, playing into and out of them, rewinding them, changing their speed and dynamic – as if they are annotating them in real-time – they create future manifestations within them too. Whilst the physical body is propelled through kinetic energy and moves through time, there are less requirements determining movements on screen; the virtual body can travel forwards, backwards and sideways and start and stop half way through its trajectory. If the choreographic composition is often full of simultaneously performed movements clearly a system that is 'writing' the dance with the improvising dancer requires simultaneity too. The computation within *Tools that Propel* has enabled this reality to a certain degree: two temporal planes superimposed and intra-acting with each other in real-time.

PERFORMANCE, DRAMATURGY AND IMPROVISATIONAL ARCHITECTURE

During the creation process for *Body of Memory* various ways of working with the two systems of *Tools that Propel* within the installational set up were explored: whether that was digging into the

compositions and forms emerging on the transforming mirror or responding to the virtual images as a kinaesthetic presence, a feeling, an energy, a body to be sensed. As Maria states, 'you can't physically see the screen all the time so in some sense you're kind of listening to…even just the light of the projection and how close you are and how the space and you can kind of see a flicker and you know something's happening and that initiates movement' (Levinsky 2019c). Sometimes it was observed that the dancer seemed to do more of the work and sometimes the bodies on the gauze. This led to exploration of focus, and tasks that shifted levels of focus on the virtual dancers emanating from *Tools that Propel* from 1 to 5: 1 being very intently focussed on the images and 5 not at all focussed on them. Sometimes Zach would move a lot in the space, and the images would be blurred, and sometimes Maria, for example, felt like a puppet master with the emphasis and our focus as witnesses tending towards the images she was playing with which were doing the majority of the movement. One of the aims of this performance installation was to ensure that the physical body gained as much prominence in the audience's gaze as the images on the screen, which tend to draw attention. The use of theatrical lighting helped this, and Jess was able to play with the level of focus she gave to dancers on the floor and on the screen as part of the unfolding dramaturgy of the piece.

Whilst I started the performance-making process with a series of questions[39] that had emerged out of working with *Tools that Propel* over the 1.5 years prior to it, overall the idea was to allow the piece

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[39] Who am/are I/we?

Who am/are I/we when I/we encounter *Tools that Propel*?

What is my relationship with this technology?

What is the relationship between us humans and all of the other technologies in this constellation?

Is my body a technology?

Where does my body begin and end?

How do I/we appear to non-human objects/things in the world?

How does *Tools that Propel* see me? How do the others see me?

What is happening when *Tools that Propel* cannot see me?

Where does a gesture begin and end?

Who or what is dancing when I dance with *Tools that Propel*?

to emerge from the affordances of the performative configuration of the installation – seeing it as a dramaturgical structure or an improvisation architecture. I have thought of the process like sculpting: imagining it like a lump of clay, with perhaps the odd groove or dent, the light caught in those spaces, shadowed under ridges, indicating potential form that might emerge with sensitive manipulation. One might compare the creation process of *Body of Memory* to that of carving and moulding a sculpture from this block of clay; we needed to keep working with the substance – the material – to allow what was potentially there within it to emerge and take ontological form. Of course, involving time, as well as volume and space, it was more complex (whilst not necessarily more skilful) than moulding clay perhaps. Indeed, it involved the embodied history and memory of each dancer too; all that they brought to the engagement. Furthermore, as has become clear, it did not just involve an experience of time as we conceptually understand it – linear, unfolding from past to present to future – but time that folds in on itself, multiplies, exists in parallel overlapping temporal planes. The language that unfolded in this piece – in this particular emergent form – travelled forwards with dramaturgical flow, within the 45-minute container of the piece, but also in parallel to this it rewound in moments, brought the past into the present, and shifted backwards. The co-existence of different conceptions of time is a vital part of how this piece operates and a key to audience reception of it, giving them an experience which ricochets between narrative and poetry (complete with the instinctive, random, and abstract). The audience and the dancers see the visual images and experience the dancers' relationship to them. These images are full of people, so they are rooted in our real-world frame of reference, the memories

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Where does my dancing body come from?

What is the history that determines its present and future?

Does history determine its present and future?

What is making me move?

What is my relationship to all the dance that has come before me?

Am I the same person in the past as the present and the future?

What do I discover in reperforming myself and others?

What happens to time and space in this dance with *Tools that Propel*? Does it matter to me/us? What does it do to our bodies and their movement?

What is memory, whose memory, our memory, its memory, the memory of/in this architectural, technological, computational, fleshy, moving, embodied, material, immaterial, choreographic meeting?

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we carry, the places we occupy. Yet they offer potential readings which hover between the literal and the metaphorical – there are two dancers entangled on the floor and on the screen, then one of them is gone from the floor and the other searches for the memories of them on the screen, failing to find them sometimes; there are gaps in their memories.

Just as we have explored the language that the dancers are learning as they encounter their virtual selves on the gauze, and the defamiliarized other within the computational manipulation of their movements in terms of trajectories and temporality, so too there is a language to learn within this spatial set-up. It is the job of the dancers not just to discover this language but also to embody its consciousness and to act as guides opening up understanding and the possibility of perceptual shifts for the audience. The dancers listened to the affordances of the installation to inscribe (or compose) the piece in the moment of its emergence, allowing it to unfold with its own agency.

It is important to remember the idea expounded above that the language that emerges between the dancer and *Tools that Propel* is performative; it emerges out of the entanglement of all the involved phenomena, and it is only through its performance that it becomes a reality. Whilst I have argued that the dancers are discovering language as it emerges, the tabula rasa of the system's memory filling up in accordance with its capture and comparison of their movements, in reality of course, after 1.5 years of working with *Tools that Propel* they have learnt that the system seems to prefer some types of movements over others – as often or not this is to do with technological limitations (frame rate, for example) or affordances built into the originating purpose of the Kinect as a motion-capture camera for a games console. We might see a dialogue here between the vocabulary that the dancers brought to the exchange with their technological interlocutor and the new language and consciousness that emerged within the encounter. Zach, for example, refers to the challenge presented to him by the fact that the system struggles to keep up with the fast momentum that his particular movement style involves. (Prior to his contemporary dance training at Falmouth University Zach's training was predominantly in hip hop and bboy.) He states 'I had to almost adapt myself and my movement. I had to create borders and barriers within my own movement and my own knowledge of being, of what I could do and what I can't do' (Levinsky 2019c). But importantly, he acknowledges that 'overall I think that's made me a bit more intelligent with my movement because now I have to decipher what's more important and what's needed at the time' (Levinsky 2019c).

Maria talks about exploring the 'accumulation of everything' they had created. She calls the movement language they've developed 'complex', but also states that 'it's become so subtle and delicate' (Levinsky 2019c). Asking Maria to list some of the specific ways of using *Tools that Propel* that she felt she had discovered during the creation period, her responses range from the concrete – 'repetitions', 'durational movement', 'breathing [...] and trying to make her move in the same quality

and emotion that you're moving' and 'extensions through arms and legs' – to the geometric – 'negative space between the memory and the live image and metaphysical' – to the abstract and metaphysical – 'there's never really a barrier between anything because even digital, the digital space, like the pixels it's not really a barrier as such, just a different shade' (Levinsky 2019c).

Yi too refers to the knowledge of the system's particular way of sensing and categorizing movement that she brings to the improvisation. Talking about how her relationship with *Tools that Propel* has 'deepened', she says 'I feel like I've gotten to know it a lot better, in a way, like in the sense that I know what are the tools that I have to like trigger it or like work with it and like things like that. […] I mean obviously there's like types of movements like gestures that work really well and then it's just about placement until you like can trigger a, what's that, composite image that you want to have' (Appendix B; Levinsky 2019c). We might think from this that the dancers are bringing a substantial amount of prior knowledge to the negotiation, but it is important to remember the relational agency of the system. As such Yi talks about how 'system failure happens and like there's memory loss and things like that so like you won't be able to fully access the past, it's not a fully well-preserved record of it and so you only get like traces of it, and something what you want to say or you want to trigger you won't be able to, and that is quite sad, but it does like give room for new things to emerge' (Appendix B; Levinsky 2019c). For her, and for audience witnessing[40], the loss can be haunting and melancholic, but also a source for new narrative and creative impulses to emerge and transport them alike:

> So I just…the trace, whatever trace emerges on the screen will be whatever I work with and like I don't in that like quite harrowing sadness of not being able to find what I want to find, like the moments where I wanted to retrigger Zach and I couldn't find him anymore or I wanted to find something that was like there and I couldn't find it like I think in that gulf you find something else instead. But then through that discovering of the loss you've created something else in the effort of remembering, or you rediscover another memory and you now work with that. I think somehow the effect of the loss resonates a bit in the system and in the space, like physical space, and you just take things with it (Appendix B; Levinsky 2019c).

Of course, throughout this thesis I have discussed the co-evolution of the human and the technological. As Brian Rotman states, '[t]echnology's mode of operation at "the heart" of the subject

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[40] It is worth noting that I only have anecdotal evidence of audience experiencing the piece as haunting. In this research process the audience experience of *Tools that Propel* fell outside the scope of my enquiry, but I am interested in investigating the role the system can play in performance and how to engage audiences with the affect of its affordances more deeply in the future.

is not simply the action of something external introduced into a 'natural' psyche, one that was inner, private and secluded from technological influence. The operation of machines both augments already existing sites of technological mediation of the self and is transformative and works to constitute the very subject engaging with them' (Rotman 2008: 5). It seems that Yi's relationship with the loss of memories – and corresponding virtual people, mediating her experience of them and mediated by her search for them – encompasses both looking within herself, a 'harrowing sadness' experienced physically, as well as beyond herself, in the absence of images in the coupled environment.

[The video 'Body of Memory – 3rd Section' can also be found here: https://youtu.be/OizVHHS8xQw]

Parallelism and the digital self

Despite the fact that the three participant dancers who worked on *Body of Memory* were thoroughly used to working with *Tools that Propel*, that they embody significant knowledge regarding it through their practice with it over 1.5 years prior to the performance-creation, the new configuration in which we worked with the system provoked a new encounter with it, new lines of enquiry, and new emergent consciousness over the course of the creation and performance weeks. A question emerges with regards the idea of inscribing a dance as it occurs in collaboration with the system: what is the 'self' that the dancers encountered on the gauze in the dark everyday across three weeks and in front of witnesses (audience) in the two public performances and was it theirs? We have discussed the idea that this self itself might be considered 'other' to them. Brian Rotman might indeed choose the term

ghost, which I have used throughout this thesis too. Indeed, he argues that digital, virtual and networked technologies have created a paradigm in which the *third self* exists.

Rotman argues that writing as a technology is what brought about the singular, disembodied 'I', configured within the linear and serial form of the Western written text. He argues that this self was split off from the body and the gestural utterances, sounds, elisions and breath – those bodily extrusions not contained within singular words with their specific known signification (Rotman 2008). He writes that '[f]or Western culture the writing of speech […] has served as the West's dominant cognitive technology (along with mathematics)' and states that '[t]he result has been an alphabetic discourse, a shaping and textualization of thought and affect, a bringing forth of a system of metaphysics and religious belief, so pervasive and total as to be – from within that very discourse – almost invisible' (Rotman 2008: 2). Where the construction of selfhood was aligned with the written self for 'at least the last half millennium', absolutely intrinsically tied to 'the apparatus of alphabetic writing describing, articulating, communicating, presenting, and framing it' (Rotman 2008: 2), photography broke this. The concept of the singular 'lettered self' and its construction of subjectivity has been yet further disturbed by virtual and new media technologies. These technologies, he argues, are returning parallelism and simultaneity to human construction of experience and they can bring the pre-speech and pre-written embodiment of human thought into the communication and mediation of this experience: he sees these technologies as creating the conditions of possibility for new gesture-haptic (non-representational) languages.

If the first self is intrinsically linked to the body of the speaker, the 'I' of speech, and the second self is separated from the writer by its release as a disembodied 'I' into text, given over to the reader's interpretation, he states that it is the relations 'between internal self and external other that parallel computing puts into flux, since it is a machinic implementation, not of individual linear thinking but of distributed bio-social phenomena, of collective thought processes and enunciations that cannot be articulated on the level of an isolated, individual self.' He goes on '[i]ts effects are to introduce into thought, into the self, into the 'I' that it facilitates, parallelist behaviour, knowledge, and agency that complicate and ultimately dissolve the idea of a monoidal self' (Rotman 2008: 92). I want here to explore the embodied (non-articulated) thought with which the dancers encountered these parallel ghosts, and the notion that an evolution, or becoming takes place in the negotiation between them and their virtual interlocutors, a negotiation that is specific to dancing with *Tools that Propel*, in a (gesture-haptic, relationally entangled) language which develops between them in the moment of its utterance.

Rotman draws on the work of Ricardo Nemirovsky and Francesca Ferrara to discuss not only the embodied nature of thinking but the 'embrace of an ecologically understood thinking body' in which human thinking occurs through interconnections, co-existence and even competition between ideas

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(Rotman 2008: 34). He argues that the effect of this is 'to establish that the deep links gesture has to speech and thought are not confined to verbally expressed narration but appear to be significantly linked to the nonverbal ideograms and diagrams that comprise mathematical languages' (Rotman 2008: 34). It may seem strange to be discussing the embodied awareness of mathematical languages and geometrical shapes, but of course dance itself – and particularly its formalisation in choreography – is profoundly connected to such structural and patterned organisation of space and time.

As discussed in Chapter 3, as dancers create and explore choreography they travel through shapes and along pathways, explore points of interconnection, and manipulate the forms they play within, holding the geometry in their heads as mental imagery. This is intuitive sense-making, a skill that it turns out we are all capable of, but to which we have perhaps lost immediate access. Or perhaps, without diffractive apparatuses that return us to the preformal brink, we have lost the knowledge that we have the skill: for we see everything through a historical veil of representation. As Rotman argues, 'the creative force, their ability to mediate new meanings, of mathematical entities such as triangles is pre-formal, inseparable from our lived, embodied, and dynamic interaction with them. Before all else triangles are 'thought' through the active body' (Rotman 2008: 34). Dancers become skilled at tapping into this intuitive sense and mentally mapping space, time and geometry. Arguably, *Tools that Propel* can help train this faculty. The dancers encounter virtual human bodies on screen, but what they are noticing and engaging with are the shapes, pathways, and occupation of space, and the relationship of these bodies to their own bodies in terms of ratio, direction, and configuration. The dancers are thinking collectively with these virtual bodies, engaging with, occupying, and carving up space. *Tools That Propel* introduces into the dancer's self 'into the 'I' that [dancing with it] facilitates, parallelist behaviour, knowledge, and agency...' (Rotman 2008: 92). It enables the dancer to encounter and improvise with their own 'para-self' (Rotman 2008) – multiple versions of themselves from the past and present that they encounter and negotiate, sometimes moving inside other people's virtual bodies, acting according to the computational rules determining when a movement begins and ends and when these para-selves (ghosts) will appear and dialogue with them. Interestingly, the effect of their entwinement and negotiation of these bodies and the geometric traces of their movements in the virtual realm, is something that draws out narrative – a kind of storied thinking – despite the system's complete lack of regard for any meaning associated with a movement in its perception of it. Yi stated that 'I've started to allow myself to like weave stories with it. So, whether that's just like something […] that I recognise in my head, as something from my own history or whatever, or something that in the moment I see it generating between the three of us or like it's the story line that I choose to go with and that is how I am responding and the other two just somehow get affected by that' (Levinsky 2019b).

Improvising with *Tools That Propel*, dancers are, as Rotman would put it, 'becoming beside themselves' and they are doing so through the collaborative materialisation of their dance in an entangled relationality, or, if we believe that the various components within the phenomena of dancing with the system have preexisting ontological being, an assemblage of distributive agencies. As Rotman explores, the 'I' of the digital paradigm 'is *plural* and *distributed*, as against the contained, centralized singularity of its lettered predecessor' (Rotman 2008: 8). It is, he argues

> internally heterogeneous and multiple, and, like the computational and imaging technologies mediating it, its behaviour is governed by parallel protocols and rhythms – performing and forming itself through many actions and perceptions at once – as against doing or being one thing at a time on a sequential, predominantly endogenous, itinerary. In short, a self becoming beside itself, plural, trans-alphabetic, derived from and spread over multiple sites of agency, a self going parallel: a para-self (Rotman 2008: 8-9).

There is potential stored in each of the selves the dancers meet on screen – potential to support, to disrupt, to flow, to break, and so on. Yi Xuan Kwek articulates how she is 'offering up [her] memories for or [her] bodied, [her] embodied history' (Appendix B; Levinsky 2019c). She says, 'if I'm interacting with other people, something, someone's going to come in and interrupt it or break it or change it up and it will feel like something precious has been like ripped' (Appendix B; Levinsky 2019c). But multiplicity brings with it multiple possibilities. As the trajectory of that 'self' is 'ripped', she states 'then like something else emerges' (Appendix B; Levinsky 2019c). In learning this language of simultaneity, she is indeed suddenly experiencing, embodying and in dialogue with multiple selves becoming beside themselves. 'It's kind of like we've set a landscape that you build and take away and you never see it as that, you never see it as your past forming like around you as you travel forward. Like I've never seen my memories as my landscape, but now I get to see it that way and work with it and play with it in a way that pushes me toward a different future' (Appendix B; Levinsky 2019c). We might here refer back to Maria's hovering foot; one self moving on one foot into the future, the other stepping into the possibilities held in the past self moving on screen.

The multiple selves encountered on screen can be both comforting for the dancers and very exposing. As noted nearer the start of this chapter, it was quite confronting for Maria to encounter herself on screen every day in the dark, but the encounter of multiple selves on screen can also be very exposing. Yi states that:

> I keep getting this weird sense of just like offering it up to the system and when you asked me about whether the system has any agency, because like in a way everything we've done was to serve the system almost, kind of like you're doing what you know it will respond well to and letting it really decide for you. And so, yeah, in that way, you're kind of like lying on

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an operating table which is like presenting yourself but I think...so there's something very precious and vulnerable about that, but I think also in the sense that as it evolves you take it back for yourself and you make all the decisions and choices too to discontinue or change something or just stop something and then something else emerges through that, that is not fully human but not also not fully system. It's just something in the middle. Yeah, like symphony (Appendix B; Levinsky 2019c).

Yi talks about the vulnerability of offering herself up but the comfort in finding versions of herself and her collaborators all around her in their virtual forms. She states, 'it forces you to bare a lot, in a way that you don't expect yourself to be vulnerable in that because it's kind of like you're armoured by all these memories of the movements that you've chosen to make' (Appendix B; Levinsky 2019c). But she says that 'this system in a way kind of like...is like a safety net, like you know [...] at the very least it's going to look interesting even it wasn't the best thing that you've ever done right, but like, something about how technology, how when technology's present for me anyway like always, I don't expect it to be a vulnerable thing' (Appendix B; Levinsky 2019c).

Yet, the vulnerability within the becoming that is the splitting of the self into parallel selves within the darkness of this techno-ecology is not just about a reflection back on oneself of everything that one is. It is also a vulnerability that comes from a loss of control over one's 'self' through the technological mediation of it. If it appears with Yi that the selves are splitting off from her, offering new emergent possibilities of futurity, Maria's articulation of the selves she encounters seem to suggest she sees them within her interiority. Talking about how she feels about how she works with *Tools that Propel* and the avatars on screen she states that 'a relationship kind of signifies another thing and I know it is separate but I feel like it became [...] almost like a relationship with myself responding, because it was obvious what I was feeling and if it's a good day or a bad day it was being fed back. It's almost like someone who constantly tells you you're having a bad day so it's like oh ok what am I going to do about it and then it initiates even more opportunities in you so [...] I think it's very much fluctuating but in the best possible way. It's like a long friend, a long-term friend...' (Levinsky 2019c). Just as Rotman says, the parallelism evoked by parallel computing processes, and here *Tools that Propel*, is not emerging into a self that knows nothing of parallelism, given that the many processes in the body are going on in parallel: 'many layers of simultaneous activity of the body from the cellular level to the organization of the central nervous system' (Rotman 2008: 92). An encounter with parallelism in technology, with the digital mode of thinking affords an intensification of the parallel self. 'A parallelist psyche, then, will be as much an intensification of these existing parallelisms as it is a computational planting into a self that knows nothing of such things' (Rotman 2008: 92).

[The video 'Body of Memory – 4th Section' can also be found here: https://youtu.be/l4mnPK9kqCo]

'IMPOSSIBLE DIALOGUE': FINAL QUESTIONS OF AGENCY

What happens when the parallelism leads to a feeling of saturation? With the multiplicity, the 'one *moreness*: a 'more-than-one', everywhere energetically in potential' (Massumi 2012: 33), the memory of the system might start to feel impenetrable, provoking a sense of loss of self on behalf of the physical human moving on stage, trying to find themselves. We began the piece *Body of Memory* with individual portraits, a dance of becoming with the system (and its peculiar language) for each dancer in turn; a learning of the language as if from new, so that the audience could build emergent understanding of it too. Yi states that once when '[she] went into [her] portrait, it was just so filled with Zach and Maria that [she] just could not find space to make [her] space available' (Appendix B; Levinsky 2019c). She continues, 'And then like I was just like actually I don't want to be seen, what if I am not seen for this whole thing, like what if I don't emerge?' (Appendix B; Levinsky 2019c). This raises interesting questions about presence, absence and identity in a digital age. Of course, the audience could see her on the stage space, but she had no parallel self floating on and through the gauze, no digital footprint, none of her own ghosts beside herself. She asked herself 'what if I'm not captured by the screen' and continued by doing things that were triggered by the virtual images of Zach, which meant that she 'left virtually no memories'. She confesses that the 'feeling of invisibility…I thought it would make me really

like powerful but actually it made me feel really small' and in the end, she asked herself 'why choose to be in the space if you want to be invisible?' (Appendix B; Levinsky 2019c).

This seems to evoke questions of agency in a developing world we don't entirely understand. Yi has discussed feeling both supported by the simultaneity of the virtual dancers (memories, ghosts, para-selves) in the space with her, and personally distressed when the pathways and movements of her virtual selves were broken or disrupted by her fellow dancers. But she has also seen creative potential and emergent futures within those ruptures. This spoke of an embrace of the hybrid space, the techno-ecology she found herself within for three weeks over the creation and performances of *Body of Memory*; a discovery of the choreographic agency within this dramaturgical conflict. Yet, in refusing to dialogue with them, to subsume her own self to their presence and try to stay invisible, uncaptured, to hide within their safety-net and the boundaries of movement they offered up for re-embodiment, she ended up feeling 'small' – lacking in agency because she was refusing the entanglement perhaps. Indeed, this attempt at invisibility is like a refusal of dialogue; a kind of refusal to engage with the presence of her interlocutor and a refusal to be in a metastable equilibrium – in which there would be discoveries, 'provisional resolution of incompatibilities', and continual transformations (Simondon 2011 [1958]: 411). For indeed, at other times she celebrates what she calls the 'impossible dialogue' she has with it: 'you ask a question about A and then you expect the answer to be B, and you go to C instead…and you kind of just take it on and like it's a weird kind of dialogue but it works and like things emerge…not in the way you expect them to but they do' (Appendix B; Levinsky 2019c).

As we continue to discover new consciousness within our experience and expression of this parallelist techno-ecology we are fast creating around us and becoming within, there are continuously surprising and unpredictable things to encompass. Referring to various affordances of different hardware and computational processes – mobile phones 'interchanging private and public spaces' and the 'manipulation of external avatars of the self in communally played computer games' for example – Rotman states that 'these computational affordances make the who, the what, and the how of the parallelist self radically different from its alphabetic predecessor' (Rotman 2008: 92). He goes on to state that 'they do so in surprising ways, since the effects and disruptions inherent in parallel and distributed thinking are not easily predictable. This is because collective cognition and collaborative thought is open-ended, heterogeneous, un-schematized, and emergently surprising compared to the more transparent and predictable cause and effect logic of linear thought' (Rotman 2008: 92).

Responding to a question regarding the level of agency he perceives in *Tools that Propel*, Zach McCullough states that '[y]ou can't pinpoint the agency I don't think because as I said you can come in and give it your all and it doesn't work for you but then you can come in and be walking across the space and, or just be doing some very simple movement and something beautiful can arise and that's

the total agency of the unpredictableness of the machine then' (Levinsky 2019c). Maria's response takes us back to the original premise of this research, which sought to use digital technologies to enable play which was expansive and involved discovery through 'not knowing': '[i]n some way it's made me trust more that even though I don't know what I'm going to do something will come out of it, if you're aware of the screens and your surrounding and your context something will always come out of it' (Levinsky 2019c). It is indeed a self in flux, a self in the process of becoming, all the time whilst it improvises with the system, learning the language and the possibilities of consciousness embodied within it.

CONCLUSIONS:

DISCOVERING POTENTIAL IN THE QUESTION OF MOVEMENT

What is a movement? Where does one movement begin and another end? How do we distinguish one movement from another? As promised, I have not answered these questions in this thesis and instead sought to problematize them. This research project and the articulation of its findings in this thesis – the textual, oral, visual, temporal *record of*, and *practice of*, a research process with and through *Tools that Propel* – has prised open spaces where we can begin to see the rich potential of *not knowing* the answers per se. By not knowing, the boundaries of our conceptual and categorical knowledge – or being – can shift, evolve, change, and maintain metastable equilibrium.

Consider the broad research question in response to which *Tools that Propel* was (partly) developed: *how might we create real-time interaction between technology and dancers that catalyses growth of embodied knowledge?* One answer can be found in this problematization of what I have called 'the question of movement', which pertains not to the *nature* of movement, nor *how* it is perceived, but how it can (or whether it should) be understood as a semantically universal and recognisable language. Improvising with *Tools that Propel* real-time intra-action both occurs and seemingly catalyses growth of embodied knowledge in its intra-actors (that is, greater compositional awareness, intention, attention, movement articulacy, kinaesthetic energy, and empathy, for example): through the push and pull between dancer and technological system as they actualise movements, bring them into being, evolve them and define them (against what they are not).

Just as the system asks *what is a movement? what is this movement?* so too does the dancer. She asks similar questions as the one the algorithm is programmed to do, and also *what does this mean to move thus?* She just does it in different terms and with her bodymind. Here is a movement she performs (articulates), answered by her parallel reflection on screen projected by her technological interlocutor (staying silent), or by an offering: yes, like this one (proposes the system), playing back a memory. The

dancer moves into the recorded movement, plays at its edges, moves into and away from it: I am doing that too, together we are re-forming it, reperforming it, rewinding it, changing its journey in time, forwards, backwards, slower, faster, in and out; and now I move outside of its limits, I am no longer within this movement, whatever it is. And so, it goes on.

This is the feedback loop that causes a real-time intra-action between dancer and *Tools that Propel* that catalyses growth of embodied knowledge. I have discussed it in terms of Mark Coniglio's notion of digital intervention and the creation of a dramaturgical conversation (Coniglio 2015), and as a dialogue between the dancer and *Tools that Propel*. Yet, I suggest that whilst a dialogue presents us with a recognisable metaphor for the improvisational exchange between dancer and technological system, it is overly associated with the idea of *back and forth*, an action and reaction circuit which seems limiting in a creative context of generating performance material. 'Dialogue' is also predominantly associated with the notion of reaching a conclusion between two interlocutors and the intra-action with *Tools that Propel* has been shown to send the dancer in to the middle of the subject matter ('*the middle of the thing we are in*' [Yang 2015: 176]) and to find more potential within this, rather than to come to a resolution (or as Gilbert Simondon states, 'the death of any further transformations' [Simondon 2011 [1958]: 411]). The problem of what a movement is, one that opens up objective and subjective possibilities for interpretation and potential answers in the nexus between them, lies at the heart of *Tools that Propel* and its functionality, as well as within the experience of dancing with it. It is a richly productive and affective problem that in Brian Massumi's words 'twists itself around its own loose ends to tie itself into an alluring knot' (Massumi 2015: 204); it is the inability to answer it, and the acceptance of the differential possibilities thrown up by computation and dancer in their entangled intra-actions, that keeps the conversations going.

I have also proposed that *Tools that Propel* is a type of diffractive apparatus that enables a consciousness of entangled relational becoming in its intra-actors; leading to discursive enquiries about how and why it does this, and how such an apparatus can reconfigure or disrupt our relationships with the physical world and our perceptual understanding of it within culturally constructed concepts like time. The key problem of '*what is a movement?*' enabling its emergent, relational and continuous functionality – the problem that can only be interrogated, examined, and temporarily solved over and over again by intra-action of a person with the system – allows this to happen (indeed ensures this happens, self-sustaining as this relational becoming of human and technological affordances is), yet it was stumbled upon accidentally: as we erred, lost our way, were led astray in the dramaturgical journey of our research and development process. Adam and I did not know the answer to the question of (what is a) movement and did not want to spend our research time defining and delimiting gestures, so in conversation with Anton Koch at the Choreographic Coding Lab in Amsterdam in 2017 we

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determined that we would arbitrarily determine the ending of a movement by the machine's decision that what was being performed live was sufficiently similar to one of the previously recorded memories, and determine its beginning by the fact that it was now sufficiently unlike one of them to mean that the recording would no longer be played. Alternatively, it would just be termed by the factor of time – a parameter that can be changed in the system but largely determines that a movement phrase is never longer than 5 – 8 seconds in length. So much has happened, so much has opened up since then. But I contend that that (accidental) discovery – or arbitrary delimitation of movement determined in the café at De Brakke Grond in Amsterdam in May 2017 – has made *Tools that Propel* intra-act with dancers in the way that it does and open up the enquiries that it has.

I would also here point to the parallels between the way the system diffracts (movement) knowledge and the role of the dramaturg in process-oriented dramaturgy. The shift to the centre of a process as propounded by André Lepecki and Marion Van Kerkhoven (and discussed by Bojana Bauer) is about a shift to the dramaturg (or dramaturgy) not as the subject of knowledge but the subject of aesthetic experience and intuition. The dramaturg (or the act of doing dramaturgy) is also taking the process to the brink, before the separation of subject and object, observer and observed, to find the sense again within it as the piece emerges in its own embodied language. As Bojana Bauer states:

> When the merging of aesthetic experience and critical discourse is practiced, the dramaturg becomes creatively productive *subject* of knowledge – knowledge which is both mediated and unmediated, conceptual and aesthetic, and which is deployed in terms of plasticity and rhythm (Bauer 2015: 38).

That too is what *Tools that Propel* does and is: it is why I have suggested that it might be considered as a digital dramaturg and why one of my concluding propositions is that conceiving of digital systems that collaborate in performance and creation processes through enacting the role of dramaturg(y) might provide a rich array of discoveries going forwards. Fundamentally, I also advocate through this thesis the design of systems and tools that do not necessarily augment already-known human capacities but allow the co-evolution of human and machines to bring about new and surprising possibilities for learning, being (becoming), and making art/performance.

FURTHER RESEARCH: LIMITATIONS, QUESTIONS AND ENTANGLED PERSPECTIVES

What *Tools that Propel* is and how it works has been visited and revisited throughout this thesis. Through practical investigation using *Tools that Propel* I have discovered different ways of working with it, different potential applications, and different relationships with its inherent knowledge. I have returned to these over and over again, prompted by the system itself:

like the memories of our movements it brings back, I revisited, tried-on again, and re-performed our relationship with the thinking it evokes in us. What I am clear about is that it is unique as an interactive system within dance practice in the way that it evolves with and responds to the dancer in real-time, and in the way that it is full of body – with presence, kinaesthetic empathy, and the ability to elicit, negotiate with and facilitate the movement of the physical dancer.

Indeed, *Tools That Propel* brings the experience of imperceptible elements of improvisation (the memories, past motifs, repetitions, decisions, accidental discoveries, pathways, the past that can be picked amongst archeologically, the potential transformations etc.) *back to the body* and perhaps more importantly, *the body as part of an ecosystem*. The experience of improvising with *Tools That Propel* challenges the dancer's understanding of themselves embodied within and commanding over the landscape from the viewpoint of the singular subjective 'I'; it makes them constantly connected to the landscape, part of an ecology on which they depend, seeing themselves from the outside as a body within it. It is a challenge to the causal unfolding of time, looking towards the future, through the creation of a perceptible experience of time that is full of co-incidences of past and present, which encourages the embrace of an 'ecosystems aesthetics [which] remains most present *in the middle of the thing we are in* - the active and complex middles of creation rather than the subatomic beginnings or the hyperbolic ends dominated by extreme scales and force' (Yang 2015: 176). It is the fleshy body in the studio which experiments with and within these new constructions of reality, embodying its para-selves to rewind them, speed them up, play in and out of their edges, and reaching out and across the gap between them; but in the annotative dialogue 'the experience of the dancer' and the 'intensities occurring between their bodies and space' (Blades 2015: 32) is made more perceptible too.

Hetty Blades has suggested that digital annotation can make the imperceptible perceptible in choreographic works; that is the 'imagined line' (Blades 2015: 31) that the dancer holds in their mental imagery as they move through space in relation to it. In Chapter 4 I suggested that there might be a dual annotation – from very different perspectives, dancer on movement as data, computation on bodily movement – going on when a dancer improvises with *Tools That Propel.* But it is also worth pointing out that this dialogue between digital and human agents, this tool that 'reshapes [the dancer's] perception, altering how they see and act' (Kirsh 2013: 1) facilitates an externalisation of thought of sorts – not just for the participating dancer but perhaps to some degree for the viewer (when the system is used in performance). Whilst annotation in the form that Blades discusses – lines of energy, imagination and spatial connection – overlaying the video, is not perceptible, arguably the experience of watching the extended bodymind that is the dancer with *Tools That Propel* 'allows the viewer to share in the concepts, expanding as opposed to reducing the vision of the movement' (Blades 2015: 31).

Yet, whilst Chapter 5 has partly concerned itself with how *Body of Memory*, an improvisational performance unfolding in dialogue with two systems of *Tools that Propel*, was created and our intentions with regards how the performance might open up the experience within the installation for the audience are discussed within the videos therein, this thesis and the research it expounds is not primarily concerned with the experience of the affordances of *Tools that Propel* for a passive audience – that is, for people who are not themselves intra-acting with them. I did not choose in this instance to embark on audience feedback surveys, for example, as my primary interest was in the experience of using the system. In the research as it stands, there are hints that the dual annotation – the system's parsing of movement and the dancer's 'inscription in space' (Watts 2010: 8) as she improvises with the memories – can also make the knowledge inherent in the thought-actions more apparent so that decision-making becomes a layer the spectator is watching, but I am aware that to observe this one might need substantial prior knowledge about how the system works and what the dancer is doing when they intra-act with it. Possibly, access to the embodied thinking process *with Tools that Propel* is not sufficiently available for spectators; how to enable them to engage with this better could offer rich potential for future postdoctoral research.

Throughout this thesis, I have explored how dancers have become curious about their movement – and the environment in which it is enacted – through using *Tools that Propel*, and I have also examined how the technological failures, errors and limitations are part of what brings about affect, as dancers search for what was there, what does not appear, what they yearn to be, and as they are surprised, provoked and jolted into new movement possibilities through the strangely reconfigured (re)performances of their movement in the memories (and phrase-determinations) of the machine – through the otherness of the movement coming back to them and its familiar yet unfamiliar thought-actions. Yet, there is no doubt that there are limitations to the system, and I have referred to these in earlier chapters. Indeed, the dancers who worked with the system over the course of two and a half years, whose voices and bodies are featured most heavily within the videos, have learnt to *play* the system to some degree – learnt to accommodate its inconsistencies, its failures, and its limitations and use them as affordances. As Zach McCullough discusses in various videos, but in 'Working it Out (Brick Walls)' on p.183 in particular, the system struggles to keep up with faster movement, for example. Equally, for the virtuosic, highly-trained dancers of Company Wayne McGregor, it is perhaps neither complex enough in its gesture recognition (or gesture following, to be precise), nor fast enough to process the speed of their movements and changes of dynamics and directions. This is partly because of the use of commodity hardware, and also because of the requirement to track only 6 joint positions in order to sustain interactive frame-rates, which suggests that further development as technology advances, as well as financial investment into the hardware used in professional performance settings could go some way to rectifying some of these problems if required.

Another limitation has been discussed with regards the reaction to it from the dancers of Studio Wayne McGregor, however: this concerns the use of screen-space as the primary index of gesture recognition, meaning that a movement performed down stage right does not appear to the system as being similar to the same movement performed up stage left, for example. Ways of recognising movement within the system could be explored further – for example, through acceleration, relative angle of joints to each other etc. – but it is also worth considering that much of what is affective about *Tools that Propel* now (or so I have argued) is tied to this very problem of screen space, when seen as an affordance instead. By this I refer to the fact that the uncanny effect of not knowing whether you are looking at yourself in the past or present, for example, and the supportive sensation of seeing yourself in the room you are in (a transforming mirror), are both brought about by the use of screen-space positions to determine (partly) the similarity of movements performed.

A key question emerges here with regards any future technological development: how might the rich unknowable and unpredictable affects of dancing with *Tools that Propel* (the way that its affordances open up other ways of perceiving and being in the world) be balanced with dancers' requirements for it to keep up with and reflect the complexity and dexterity of their movement? Indeed, whilst it could be developed further with regards its potential role as a choreographic development system in professional processes of dance creation (building on learning from the limitations identified by Company Wayne McGregor dancers, some of those working with Dam Van Huynh, and at times the participant dancers), this research work could be taken in a different direction by investigating the potential impact of the *current* affordances of *Tools that Propel* (born of its emphasis on screen space positions) within digital applications that could be developed for particular communities of interest. When I embarked on this research, I did not know the system I co-developed with Adam Russell would become the catalyst for my theoretical investigations, let alone that it would enact them in an embodied form or, perhaps more accurately, enable our ability to encounter them in a *sort* of embodied form. It has, however, prompted a lot of conversations, not only with dancers and choreographers, but many other people from different disciplines and walks of life that have not been discussed within this thesis. These include, for example, a neuroscientist interested in the system in relation to how people with mental health problems would perceive it; a theatre-maker who suggested that the young people with autism she works with would respond well to it; and an archival researcher whose first encounter with *Tools that Propel* led to new understanding of her mother's Alzheimer's:

> I watched as other people's movements and memories were traced, retraced, and overlapped in space and time. I couldn't help but reflect on how I now have conversations with my mum. She talks about who she is with, who is missing, who she can't find, how she doesn't recognise where she is but knows she wants to go somewhere – back in time or in the present (Bossom 2018).

This thesis is full of conversation, for that is what *Tools that Propel* provokes, but also because the research has been about the relational understanding and agency that unfolds with *Tools that Propel*, as it shifts our perceptual framework, and we begin to see it and its potential through different prisms. Pursuing conversations with practitioners and researchers working in the fields mentioned here – mental health, autism and dementia, for example – may well also provide rich possibilities for postdoctoral research with the system. I have argued that an artistic-research approach was vital to the discoveries that this thesis has explored; that is, an approach that did not attempt to develop *Tools that Propel* according to aggregate findings within empirical studies or user design processes but rather prioritised a longer entangled exploration and creation process (a dramaturgical process, where Adam and I, working with a small collective of committed dancers, lost our way in order to find something new). However, it would now be interesting to embark on further investigations as to how those affordances that have been discovered through such an artistic-research approach can be applied and developed in entangled relation to different fields of practice.

Back in the field of dance and choreography, there are other technical developments that could be carried out to expand, improve or change *Tools that Propel*'s functionality. Developing the system to record and select from clusters of similar movement classes would make the recognition more accurate and less crude, providing potentially more nuanced and developmental reperformances of recorded movements in relation to the live improvisation. Through the memories recorded, categorised and replayed, I would like to be able to see the evolution of movement occurring as a dancer intra-acts with *Tools that Propel*. As such, in tandem with creating clusters of movement classes, it would also be good if the system could create memories whilst in playback mode. In this way, it would be recording movements that were created in relation to the played-back memories and thus in all likelihood it would record potentially more unusual movements as they evolved through intra-action with the 'original' version.

Yet again, though, an interesting research question arises regarding how the problematization of the question of movement (as I have defined it in this thesis) can be maintained whilst also changing the system to create new movement classes during playback mode? For this particular technological development would necessarily provoke a return to the question of how to define what a movement is in the computation, given that the end of the live movement recording is currently determined by going into playback mode. Whilst the precise affordances that were brought about through this problem – *what is a movement?* – were not preconceived, and indeed were discovered through the dramaturgically-entangled practice-research process, I would now seek to apply to future technological developments the subsequent learning about metastable equilibrium that came about through the

machine knowing and defining something differently – but not too differently – to the human intra-actor.

OPEN ENCOUNTERS WITH TECHNOLOGY

The development of new technologies is often perceived as a threat to what is essentially 'human'. But what is essentially human? And can humanity be constituted as a singularity that is separated from the objects that mediate experience of the world any more than anything else? It is indeed the word *intra-action* that best describes the relational exchange that takes place within the dance with *Tools that Propel.* In keeping with Karen Barad's theoretical framework underpinning this neologism, the thesis has demonstrated, through the *Tools that Propel* research process, that 'objects are not already there; they emerge through specific practices' to use Barad's own phrase (Barad 2007: 157), and also that our own ontogenetic becoming is entangled with the world's. The real-time intra-action that occurs within the use of *Tools that Propel* brings the improvisation into being, the dancer (with all her selves) and her movement into being, and the system itself into being. As this 'being' is relational it keeps shifting; it is an entangled becoming. So, this thesis, and the explication of both the development and use of *Tools that Propel* within it, has not offered any guiding framework for the future development of digital performance systems: a framework that presupposes knowledge about where we want to go and what we want to achieve. Instead, it has advocated for an open encounter with technology where we do not know where we will go, what we will achieve and what we will become.

Indeed, whilst development and planning are confined to the possible – imagination limited by and defined by what we already know – we might heed Derrida's words: 'to go [*se rendre*] there where it is possible is not to surrender [*se rendre*], rather, it is to be already there and to paralyze oneself in the in-decision of the non-event [*anévénement*]' (Derrida 1995: 75). I embarked on this research project as an exploration into, indeed a surrender to, the unknown; dancers and dance-makers collaborating equally with technologists, programmers and coding artists, navigating through and across disciplinary boundaries 'without a compass […] so that together we [could] build that which we [did] not know what might be' (Lepecki 2015: 54). In doing so I hoped to discover something unexpected regarding the potential impact ubiquitous technologies, interaction design and computational creativity could have on performing arts' development and teaching (and vice versa).

When I began this research project in 2016, it started out as a reaction to what I perceived as rather limited digital thinking within mainstream arts organisations, whose digital strategies largely consisted of live streaming performance works to reach larger and more distributed audiences, websites (albeit

sometimes quite innovative ones), and uploading production recordings and videos outlining creative techniques for use in classrooms.[41] There has been a growth in interest in digital work since then – or an interest in how digital technologies can engage audiences differently and engage different audiences. But an underlying resistance remains and arguably, the recent attraction to the digital during the Covid-19 pandemic – born out of necessity in the face of social isolation and the closure of theatres and arts organisations for much of 2020 and half of 2021 – might well serve only to heighten the divide. This is because the digital move that has been prompted by worldwide lockdowns has increased the correlation of new technologies with the screen, and the computer screen in particular, and worked to remove them categorically from their integration into the living world we inhabit. We have reduced them temporarily to the communication devices they were perhaps designed for, seeing them as interfaces *to reality* rather than as *part of that reality*, affecting and affected by that reality.

Admittedly, I end this phase of my research no more able to develop the software myself than I began it. That is not to say that my understanding of the implications, affordances and limitations of artificial intelligence and a range of hardware has not substantially grown. I have developed significant knowhow in relation to the process of creating new dance tech works and projects and as argued within this thesis, the power of relational entanglement within this. Understanding entanglement as productive of agency is not just about understanding how new choreographic thought-action comes about within the encounter (and elements within that) between dance and digital meaning. Long entangled relationships with the technological system (*Tools that Propel*) enable people to shift, open up, or turn upside down their perceptual and relational awareness of themselves within the world. So too, long entangled relationships can lead to substantial shifts and new ideas opening up in collaborating sectors, whether dance, theatre, technology, design, manufacturing, education or others.

New ways of seeing and perceiving our relationship with the world and our place within an ecosystem that includes not just the natural world but also the materials, objects, tools, and systems we invent, can enable the emergence of new ways of thinking. Moreover, the performance of that

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[41] There are of course notable exceptions of course, including for example choreographers such as William Forsythe and Wayne McGregor whose long-time explorations of technology in their dance works are well known. Equally, there are now a range of UK-based artists emergent in this field, many of whom have been supported by Studio Wayne McGregor as well. The work of Eric Minh Cuong Castaing in France is also of particular interest to me and there has been more widespread support and emphasis on the dance/tech field from theatres, institutions and funders recently, as evidenced by the Dansathon initiative co-produced by Sadler's Wells, Téâtre de Liges and Téâtre de Lyon in 2018.

thinking enables it to become part of how we operate within that ecosystem. We have been learning a language, all of us who have been involved with this project and with *Tools that Propel*. It began with me and a sensation that technology felt impenetrable, a tangled mass of cables, connections, inputs and outputs, coupled with a deep certainty that I should not just shut myself off from this thing that I did not understand but try to engage with it and find a way of expressing myself with and through it. I would like to think that I have simply tried to immerse myself in it and indeed that I learnt to listen to it. Perhaps one might say that my vocabulary is largely passive, but I don't think that describes my ability to work with it entirely either. I am thinking differently as a result of this encounter. So too, I believe, are the participant dancers who have engaged in a long relationship with *Tools that Propel*. They too have been learning a new language.

For me, the learning of my new language has given me access to and a certain degree of agency to tinker with the insides of the system as it has evolved and grown, but fundamentally, like them, my language has been learned through an encounter with its front-end. That is where this research has situated itself; in what we can learn from dancing *with* technology. In dance, of course, there are sometimes leaders and followers, but I chose for this metaphorical embodiment of the dance/tech encounter the horizontal relationship, with its potential to *affect each other*. Appropriately, *Tools that Propel* has predominantly been used by dancers working within contemporary dance practice, in which leading and following are often continually shifting states. But this is not always the case where the human interacts with the technological. In a *dance with technology*, the 'with' is the fulcrum balancing between dance and technology. Suddenly this little preposition becomes full of energy, resource, and potential.

It is the unforeseen affordances within *Tools that Propel*, brought about by the pitching of human and machinic perceptions of movement and its meaning against each other (or in dialogue *with* each other), that have led to the system becoming self-sustaining, reaching concretisation in the evolution of technical being (Simondon 2012). It is partly through the positive utilisation of the different perceptions of movement – that of the human intra-actor and that of the intra-active system, *Tools that Propel* – to feed sustained and evolving real-time intra-action that this research brings something new to the field of computationally-enhanced choreography and digital dance; equally it is also through this that the thesis contributes to discourse concerning the digital transmission of embodied knowledge more widely.

Tools that Propel has been both object and agent of this research project. It has been shown to be a diffractive apparatus, and a language machine that in retrospect does indeed fulfil Nicholas Salazar Sutil's call that such inventions 'generate new possibilities of movement representation that no longer carve up thought and body into separate domains' (Sutil 2015: 4). Its agency comes from its

functionality which only comes into being in the relational entanglement of the phenomena involved intra-actively, including the dancer and his/her movement decisions. Yet his/her movement decisions are also brought about through this relational entanglement too. The embodied knowledge that grows in the dancer is dependent on the real-time intra-action which is dependent on the embodied knowledge which is shifting and evolving: there are in this entanglement perpetual 'discover[ies] of structure' and 'provisional resolution of incompatibilities' (Simondon 2011 [1958]: 411), perpetual returns to the middle of the thing we are in (Yang 2015), where new potential proliferates, and *this is self-sustaining* – as system, as bodymind, as matter and meaning, and as ongoing techno-ontogenetic emergence in which we continually become.

This thesis is a record of a process, and the enactment of just such techno-ontogenetic emergence itself; if indeed we agree with Brian Rotman that language, in written, spoken, and indeed gesture-haptic forms, is a technology (Rotman 2008). The thesis is not the finished, written-up articulation of completed findings. Its matter is entangled and co-existent not just with the meanings it discusses, but it is also part of the creative practice output and part of the production of those meanings; it is not discontinuous with the choreographic improvisation and discursive-material practices that are actualised through intra-action with the system but unfolding because of and entwined with them and enacting a way of thinking too. The system as object and agent of enquiry has brought about a new pedagogical practice – intra-action with the system enabled me and my collaborators (many of whom were undergraduate dance students) to learn in an embodied discursive way, to discover new knowledge that we did not know we were looking for, and to experience new ways of understanding and conceiving of the human self in relation to the non-human world. *Tools that Propel*'s intra-actors became the experts through its facilitation: its functionality, of which they are part and in which they are entangled, enabled them to learn from it and analyse the experience of becoming with(in) it simultaneously. We all developed semantically, ontologically, as part of this co-created, entangled pedagogy that involved *not knowing*, *process*, and *becoming*. This entangled pedagogy is a contribution to knowledge that emerged from within the thesis, the system, and its/our entanglement with each other.

This entangled pedagogy encourages the human in us to develop. It is relationally entangled with the fact of our 'subjectivities, affects, agency, and forms of consciousness [being] put into form by a succession of physical and cognitive technologies at [our] disposal' (Rotman 2008: 1) and it is born of curiosity and acquiescence towards this. For our relationship with new technologies is complicated. Speaking of Covid-19 and the impact that it had on turning the arts (and everything/one else) towards the digital, it is the rush to the future which has surely been part of what has brought us this pandemic. The 'critters' have been enabled to spread so virulently from body to body, host to host, because of

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globalisation and the ability of humans to travel constantly from country to country at a speed and ability that perhaps quite ludicrously (in hindsight) outstrips the rate of our natural beating hearts. People's bodies are mutating under the impact of the critters and as hosts to the virus, facilitating its mutation. Whatever the case, it made our bodies alien to us. Familiar, yet deeply and disturbingly unfamiliar at times; uncontrollable even. *Tools that Propel* provokes mutation and a *gentle* disfiguration; it splits us into multiples, it enables us to climb (virtually) inside the other's skin; to move as them. It has been enabled by the extraordinary inventiveness and capacities of modern technologies to remediate our experience and multiply it, reflect us, refract us, rewind us, separate us out in a parallel film-reel; but ironically, what such mutation or provocation strangely reveals is the essential human in us all. Yet this is *no irony* at all in fact, for this thesis concludes that if we embrace our entanglement – and consequent entangled agential capacity – with the universe in all its performative, vital, withheld, and extended materiality – technological, ecological, biological, or otherwise – it is what *makes us human*.

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APPENDICES

APPENDIX A:

SEMI-STRUCTURED INTERVIEWS WITH PARTICIPANT DANCERS AFTER THE DIGITAL ARTIST RESIDENCY, NOVEMBER 2017

Sample Interview with Maria Evans, 6th December 2017

Sarah: So Maria, if you could just begin by talking about your first encounter with Tatiana or Tools that Propel, how you felt and what was happening for you?

Maria: I think it was quite distant at first, I felt it was quite daunting, especially on a massive screen, walking into it and being like 'Oh I don't really know what this is'. But it was quite intriguing to find out how to manipulate it to some sorts, not really manipulate, I didn't really find I could manipulate it at that first point. But kind of seeing how it was working, figuring out, and seeing other people encounter it in different ways as well, like some people would go straight in there and just dance and others would do just slow movements to see what was going on. I don't really remember what I did. But I remember being quite confused at first I think. And then I slowly warmed up to her a bit more. I say her! I think the first encounter was probably...I think Yi went before me, so I had her memories. No I didn't, I can't remember, sorry. But it was quite nice to just dance. I think mainly the initial part was this idea of challenging your movement and then I think it wasn't until the next time that I felt more of this maze. Because I started to understand it a bit more and how it worked so my brain was like oh ok, I'm just going to go with it and use it as a stimulus and to play with it a bit more.

Sarah: Great. Thank you. So did your relationship to Tatiana change during the period of time, so the seven days that we were working with her.

Maria: Yes, definitely. I would say there were like three stages. The initial stage was that kind of what is this, is this a tool, am I taking stimulus from it? And then the next stage was this maze of data stage, where I just imagined all my little memories in this system and I was just trying to figure out how to get to them specifically. And it was quite random I thought, I didn't feel I could pick one out at me, I felt like one just happened to come out at me and I'd be like Ok, what can I do with this. Try and find another one, in a different space or a different movement. And then the second, the third stage even, was me picking out individually instead of choosing one and like continuing movement and just playing within that memory, I kind of controlled it and took numerous memories and was making memories in the moment but also dancing on. So they would be left behind but also be a part of what I was doing because I was…it sounds strange but it felt like I was connecting it, somehow without being in…without living in that memory I was connected to that memory because I was controlling…I don't…it's hard to explain but I did feel I wasn't…I was taking notice but I wasn't living in the past memory, I was living in the next memory if that makes sense, and making another memory, with that one echoing me almost. It's quite strange but that's how I felt.

Sarah: Great. And what do you think Tatiana does?

Maria: Challenges. Maybe manipulates people in their movement to try and live in the memory. She's quite visual as well. Like one of those dynamic abstract paintings where you don't really know what's going on but you have to stand there for a long time and figure it out, then all these shapes appear. I would say she's a tool I guess, but not a tool, not the same tool for everyone, so everyone has different tools and takes different parts of her, like some people might want to just challenge it and others might want to kind of like use it, and live in it almost, rather than try and create something from it. [6.04 mins] Either back track and find something…it sounds really strange but…

Sarah: No, it's interesting.

Maria: And others maybe look at it without being in it, rather use as a tool to look at how people take to new things, especially confronting yourself visually, how different people do that, if they have the same traits.

Sarah: What do you see as the main challenges of working with Tatiana?

Maria: I think, initially, like initially meaning daily like the start of every day, I just felt quite disconnected, I don't know, it was a like it was a different thing every single day. It was strange. I felt I had to build up a relationship every single day. But then I don't think, if I didn't have that initial disconnection I wouldn't have had the three stages, because I was approaching it a different way depending on how I was feeling that day. Like I remember one day I just felt completely disconnected so I felt like I should just go to the other side of the room so that found something else just by being completely away from it. I don't know, it was nice to explore how I was feeling towards the thing while it was going. So yeah, I'd say that disconnection at the start was challenging, but also a good challenge. But also figuring out who it was following, like initially that was a big part for me, but then towards the end I just didn't really care or I didn't really...I felt like what Keir was saying I was more of a passive dancer so I didn't really mind if it was following me. To be honest I didn't rewally want the responsibility because I wanted to see it how it would go just by not knowing.

Sarah: Great. And what do you like about working with Tatiana?

Maria: I quite like how it's almost like a relationship, a conversation, communicating with each other, especially when I did a solo, I think it was like mid-week...the solo with the words. Because I felt that was literally a conversation and I got so involved with that. It was almost like I'd do something, she'd repeat it, I'd do another thing, kind of just bouncing off each other I guess.

Sarah: Cool. And what is different about improvising with Tatiana to improvising with another human dancer?

Maria: I think it's more aware, like conscious, rather than improvisation...which is quite, when you are involved with another person you're very much aware of them as a human and looking after them, but with Tatiana it's not really looking after her as such, so that enables you to think about you and how...I felt quite dominant, whereas in a human interaction improv piece I'd always feel quite passive and quite...even though I was a passive dancer in Tatiana in the group work on my own I felt like dominant over Tatiana, I feel like I could manipulate her and control her rather than letting her control me and being the passive dancer that I usually am in these...when I'm working with other people...it's strange that, kind of like human's dominance over technology...but not over people! Erm, it's also you don't really have that sense of touch as well so it's less natural in a strange way, like less warmth to it,

more kind of you're on your own so what you going to do, are you going to back down a bit or are you going to actually control this thing. Yeah.

Sarah: Actually, just following on from that, is the lack of touch a big problem?

Maria: Erm, for me not really. I think it depends what you're trying to find. What kind of relationship you're trying to find. Like, if you want a sensitive one that's quite fragile I would think touch would be very important. But if you want one that like expresses more meaning in more…I don't want to say more powerful because I don't think…touch can be powerful as well…but less…I feel touch, humans can respond more, so I think this whole idea of responding without touch is more intriguing, as soon as we've not experienced it as much and people kind of know what to expect with touch, there's a lot of predictions, whereas I couldn't predict what would happen next with Tatiana, I can't, I don't know what would happen, I really just have to, you just have to do it.

Sarah: Ok, what impact does working with Tatiana have on you beyond the time you are working with her, or what impact has she had on you?

Maria: I'm more aware of myself and how I dance and what kind of movements and dynamics I usually do. And also I think she's made me realise that, to trust how I respond to things, even though it might not be what some other people are responding to, because I usually always think I'm wrong as such, but now I think it's kind of like, ok, it's ok to feel different, or react differently to something because sometimes you can find something more interesting out of it.

Sarah: Ok great. And do you think Tatiana can help you develop as a dancer or as a choreographer?

Maria: Definitely. I think, it's just opened this whole world of like technology and just all these new ideas and this idea of memories as well. I think it was Yi that said about living in other people's memories, just exploring all these kind of new elements that people haven't heard of or people have and they've explored it a different way and connecting the two, I think it would be quite interesting. And with movement as well, to see what unique movement that comes out of it. And also the same movement that comes out of it.

Sarah: And if you could make changes or develop any new or existing features in Tatiana what would they be?

Maria: Oh, I don't know, that's a hard one.

Sarah: It's only if you can or want to.

Maria: I don't think I'd really change any of it. Because I felt like the raw material was…I know we added some things on at the end which was intriguing. But I quite liked working with just the raw basis foundation of it. Just so then it was kind of like a journey like together so in that way it I guess it felt like a relationship we were moving on together. Like I think if I was, if you were to put me in a room with the white one with the, when you appeared in, I'd be like this is too much.

Sarah: So there's something in the sort of reflection feeling of the room [think it says that, can't hear well] that feels more supportive or more enables you to be in the same space together.

Maria: Definitely.

Sarah: That's really interesting.

Maria: I think it's because you're not really really used to seeing yourself on screen so it's nice to see the first reality of it, rather than this void of something.

Sarah: Cool. And finally just if there's anything we haven't covered, if there's anything you want to say.

Maria: I think it helped me accept myself more as weird as that sounds. I went from just being at the back to being able to just go right up to the camera and just kind of accept the way I move in a strange sort of way. Erm, yeah.

Sarah: That's pretty cool. That's a nice outcome. Well thank you. Brilliant. That is really great.

SEMI-STRUCTURED INTERVIEWS WITH PARTICIPANT DANCERS AFTER THE CREATION PROCESS FOR BODY OF MEMORY, SEPTEMBER 2019

Sample Interview with Yi Xuan Kwek, 25th September 2019

Sarah: Can you tell me what it feels like to dance with Tools that Propel in performance and if there is anything particular you can share about that experience?

Yi: I was not expecting such a huge question right off the bat!

Sarah: Don't worry about it! They're just triggers…

Yi: What it feels like to dance with it as like…

Sarah: Well, performatively, maybe not necessarily in performance as in erm…

Yi: What's your definition of performance?

Sarah: Well, I don't necessarily mean when there's an audience there. I mean that it was in a configuration that worked performatively.

Yi: Like composition, like towards a product, was that…?

Sarah: Answer in any way that…

Yi: I think it's strange, like slightly because it's kind of something that I've always seen as [can't hear] the moment. But then like obviously in how we were working towards having a creative product at the end of it then there was like needing to pace yourself and like hold, not hold back, but just be aware of how you're building the thing as a group. But it was great, it was really fun and like I really enjoyed it. I miss it, I'm having withdrawals now!

Sarah: Are you?!

Yi: I am! It's really sad.

Sarah: How has your relationship with Tools that Propel changed over this creation process? I mean, do you think it has?

Yi: I think it's not like changed, but like deepened. I feel like I've gotten to know it a lot better, in a way, like in the sense that I know what are the tools that I have to like trigger it or like work with it and like things like that.

Sarah: What are some of those tools? Can you tell me? Because I felt like you were all discovering quite a lot of new different ways of working with it so I was just wondering whether you could identify them at all?

Yi: I mean obviously there's like types of movements like gestures that work really well and then it's just about placement until you like can trigger a, what's that, composite image that you want to have. But I think also, I found myself thinking a lot about how, like what it meant timewise, like, for me, obviously influenced by all the readings that I had. But also just like if you like things about like being in the present but having your past flash at you and then using that to so called construct the future or the next moment, or the next moment becomes this because of what you've seen. Things like that so like I was thinking a lot about that and about how like, how am I then relating to my memories, other people's memories, a landscape of memories in the present. So like the idea of trace and things like that, I was thinking a lot about that. So yeah. I don't know if that really answers your question.

Sarah: No, that's, yeah, it all answers the question, don't worry about that. I'm curious about, so therefore do you think it affects your imagination?

Yi: Yeah, 100%. Yeah, like, I think that for me imagination is like a huge, like I've started to allow myself to like weave stories with it. So, whether that's just like something, being a ref…, being that I recognise in my head, as something from my own history or whatever, or something that in the moment I see it generating between the three of us or like it's the story line that I choose to go with and that is how I am responding and the other two just somehow get affected by that. Yeah, like it does affect…for example, this one time when I think Zach was on the other side, or was it Maria? Zach was on the other side, we were on the side of the screen where there was no Kinect there, so it was just…you're just doing but you're not being recorded because the Kinect wasn't there and like just in that moment as I was thinking, cos I think when I work with it then I'm starting to find the significance of what I'm choosing to do so…but for that particular time, like Maria was on the other side of the screen and I was just thinking about how rather than making her pass like really fleeting I wanted to make the consequences of whatever she chose to do really present and really permanent so like I went beyond how long the machine, I mean how long the system was

holding the memories for so then that was me actively thinking about making sure she sees the effects of her movement not just in the screen but in the scene. But then, also then in my head like as that compositionally that then built because I was still there and I think Zach was like moving around me or like kind of following me but not really it was just, I just had this whole image of like a time, like time stream, like just flowing in like past present future, just streaming around. Then like from that imagined scene everything else made complete sense for me compositionally. I knew exactly what I was going to do and why I was going to do it because I just saw it, so like I think it triggers things in you that you never really see, like things that just get left behind so you can't really look back on them. It kind of makes sure that you take everything with you so then you're really…I don't want to say confronted all of this information but you're like presented with that and then you make sense out of that. You see like the full spread at once. Like going to a buffet rather than like having your food come like…rather than like a three-course meal. Can you tell I haven't had lunch?

Sarah: I love that though! I love it, the idea of your whole lunch coming all at once.

Yi: Yeah, like it's just all there. You know what I mean right, yeah?

Sarah: So in many ways there are lots of different elements or components effecting the unfolding performance and I wondered if you there were some elements or components that were more important than others in how that performance grew each time?

Yi: By components do you mean like the parts of the performance or like?

Sarah: It's sort of whatever you read that as. I was maybe thinking about the system, gauze, lighting, dancer, embodied memory, I don't know…

Yi: Everything…! Oh my gosh! Lighting definitely helped, but I would say it kind of like…it feeds the imagination because it sets the scene so well, it signals that like this is not your attention, like whatever. It just constructs the space very nicely. It's such a, it makes it very rich. Then obviously with the gauze rather than like a wall…I don't know the see-throughness, something about choosing whether or not you want to see through it is quite interesting because obviously at the start in the portraits like we don't see through it, like you do but you don't acknowledge it, but then after that allowing it to emerge. Almost like, I don't know, I always see that portrait part as something quite inner, so kind of like that inward gaze in you…you can see everything else going on but you choose to ignore it. You're choosing to just focus on yourself and establish yourself…but then once you allow

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that to open, like, the self doesn't really get lost but you learn that you are there with everything else and you can just all be together.

Sarah: You mean you're sort of opening your awareness bit by bit to all the other different components in the space that are affecting you…

Yi: Yeah, kind of like when you are ready you open it up and you see through it and you just…I don't know, I think it's the gauze plus how the mind chooses to work like how the eye chooses to…like you look at one point and then you like ignore everything else around it right or you just look and see everything like yeah that … I think that, something about that was really strange…not strange but interesting.

Sarah: So I was going to ask you how the particular configuration in terms of the gauze structure and having two systems of Tools that Propel, what you think it offered you or us choreographically?

Yi: Ooooh, windows. [laughs]. Erm, I don't know. What do you mean? OK, I mean, I kind of like took the space as it is, so I was like OK, this is the space I'm going to be working in so I'll just work with it. But I think maybe in the sense that like the scenes become very porous and like multiple things can happen at once. Rather than like we do this scene and then move onto scene 2 and then scene 3, it's like it happens, it can happen concurrently, and then it all merges and becomes like a new thing that you didn't expect it to be. Yeah, maybe it's like that porousness of it and the exposure, not exposure but how you will be captured, yeah. I think. I don't know. And like and then obviously with the part when you are not captured the whole question of like visibility and invisibility and like do you want to be seen or not because there was, I did start one improvisation, like one of the runs, deciding that I wanted to be invisible in this whole run which obviously didn't happen.

Sarah: But that's interesting. So that was your intention? That was what you wanted?

Yi: Yeah, so when I went in with my portrait, it was just so filled with Zach and Maria that I just could not find space to make my space available. And then like I was just like actually I don't want to be seen, what if I am not seen for this whole thing, like what if I don't emerge? Yeah, but then like, what if I'm not captured by the screen, and then, so then, obviously I did was triggered by Zach, so I think I left virtually no memories on that and then I went to like the back of it because there I could do anything without actually being captured by that. But then I was also struggling like but if I'm not being captured but I'm being seen by like the other guys and they're copying me and what they're copying is being fed back on

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the screen what then happens? And obviously that like that feeling of invisibility I thought it would make me really like powerful but actually it made me feel really small. And then after while I was like oh no I think I like need to go in at some point so I like went in like to the screen and I was with Maria so I was like ok, it was still tracking her for a bit so I was like ok, this can still work, I can still be kind of like invisible and then I just kind of gave up! Because it just got a bit like difficult to like control it but also like why choose to be in the space if you want to be invisible? I think, but yeah, it was one of the runs I just went in like thinking about that and I was like ok I have to let that go now because it's not very productive. Because yeah…

Sarah: It's really interesting to know though that that's what you were thinking.

Yi: Secret thoughts!

Sarah: It's fascinating. Erm, how much agency do you think Tools that Propel has and how much do you think the work grew out of the particular way that Tools that Propel works?

Yi: Actually, quite a lot I would say because it really affects how you choose to move and how you choose to respond to what you can see. I mean obviously you can choose not to but engaging in that way for a sustained amount of time wouldn't be really productive for the particular set up. Yeah, and obviously there's certain types of movement that work better for this system, and then, so we all just start doing that. Yeah. But I think also like it affects how you compose the space, like, just like whether you choose to be captured and how you want to be captured and stuff like that, like when we were playing with all the big and small stuff. Just compositionally it raises a lot of interesting things to take note of. Rather than just like, you know generally when you go in like an improv circle and you do like those composition games things, it's always by feeling, you kind of watch and then you're like ok, it feels right and you go. But now it kind of, it may feel right but it may be right to also hold back a bit and wait and then like go in at something else that's less expected but something more will emerge from that because you can see what's going on and you know that what you do will be captured and or will be captured through someone else and then like, I don't know…does that make sense?

Sarah: Yeah, yeah, totally.

Yi: I don't know, I'm sorry!

Sarah: No, please stop saying sorry, it's all really interesting! Erm, did you find this process challenging?

Yi: Yeah!

Sarah: In what ways?

Yi: It was so hard! I actually like some nights I went, this one night I went home and I was on Amazon Prime shortlisting all the videos on Chinese dance that I could find to watch because I was like who am I? I don't know who I am anymore! So actually I did homework ok for rehearsals! Yeah, so I did that! Erm, I think it's difficult because it's something, like it forces you to bare a lot, in a way that you don't expect yourself to be vulnerable in that because it's kind of like you're armoured by all these memories of the movements that you've chosen to make and this system in a way kind of like…is like a safety net, like you know anything that, at the very least it's going to look interesting even it wasn't the best thing that you've ever done right, but like, something about how technology, how when technology's present for me anyway like always, I don't expect it to be a vulnerable thing. But then like obviously this process has been quite interesting because obviously improv you're taking in all the human emotions in with you and everyone says you leave that at the studio door but in my essay as I've concluded it's impossible. So you can't, you basically can't, so you take everything in with you and it's all these like memories that are, somehow they become quite precious. Yeah, no, I think the day that I got pushed by Zach and there was just like that whole oooh moment for me I was thinking about why that was so painful, and I obviously like I knew in that moment and all I was thinking about because I had my back to the screen and all I was thinking about was how to construct this in a way that will open this up to him and bring him in again and I was not expecting him to push me out, right! It was just like oh, ouch. But I was also thinking that like actually maybe that's fine, like it is, I should like expect that in a way because I am offering up my memories for or my bodied, my embodied history for that for like, it's put in the space and some, like if I'm interacting with other people, something, someone's going to come in and interrupt it or break it or change it up and it will feel like something precious has been like ripped but then like something else emerges. So yeah, I don't know. Excavating memories, not for preciousness but for digging in, that's what's here. Yeah, so, yeah, I suppose in a way you just, I don't know, I keep getting this weird sense of just like offering it up to the system and when you asked me about whether the system has any agency, because like in a way everything we've done was to serve the system almost, kind of like you're doing what you know it will respond well to and letting it really decide for you. And so, yeah, in that way, you're kind of like lying on an operating table which is like presenting yourself but I think…so there's something very precious and vulnerable about that, but I think also in the

sense that as it evolves you take it back for yourself and you make all the decisions and choices too to discontinue or change something or just stop something and then something else emerges through that, that is not fully human but not also not fully system. It's just something in the middle. Yeah, like symphony.

Sarah: Erm, you've talked a little bit about the role of lighting in the performance…have you talked about that? What do you think the role of lighting is in this performance?

Yi: I don't know. Other than like setting the space and like, I think there are really useful moments where you could like turn it off but it was still triggering stuff on the screen…I like to call them like the ghosts, yeah, I just really liked those because it was quite trippy…

Sarah: So I suppose it unlocked other ways of …

Yi: Yeah, but also, I suppose if you look at it, like when you're watching it, it is quite like you don't see the present but you only see the past which I think is quite interesting because performatively we're always about what's in the now, oh it's present, you have to be in the now, but then like the now is made up of the past so it's only right that we can, we are able to bring it up and flash it up in this way. Yeah.

Sarah: And what about music? How much did the music dictate your decisions and how does that balance with what the decision-making with Tools that Propel is?

Yi: I think at the start when it was really fresh like you can't help follow it like with the beat and everything, but then like I think, for me, I've like just seen it as, I see how it affects me, how it affects the scene or like the qualities that I take in or like whether I go with or oppose it. And so like that part kind of like it works together with the system for that story to emerge so like if Maria was being a bird, but then like the music was really strong and heavy I wouldn't be thinking of like birds flitting in the garden together, it would be something else, maybe like an eagle unfolding or something. So then I like I would have a different mental image and then I would do something different with it. But then, erm, yeah so, I think it goes together, I can't really pinpoint which one has a…I suppose I should say the system has a stronger one because we are able to function without the music but I do think, I do think that the music helps a lot, especially for a 45-minute improv where you need to keep drawing things out.

Sarah: So are you essentially suggesting that the music is part of this imaginative space but of course the system needs you to input things in order to then, to feedback and that is then [feedback loop that is] evolving? [bit unclear at the end from first 'feedback']

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Yi: I think that the music and lights set a very nice and rich space for you to feed stuff off of. Rather than doing like meaningless improv it kind of like helps create context and things and [can't hear]. Especially because music it was like improvised as well, I mean like Matthew did it with us as well, rather than just playing a track and [can't hear].

Sarah: Cool. So I feel like you were all discovering a lot of new ways of engaging creatively with Tools that Propel right up until the end, and I wondered if you were able to list any of them?

Yi: Oh…I don't know! Erm [laughs]. I think, I think for me it's like, it's honestly like the first time I did something practical where everything I read in theory applied or like I could use. It was just very strange but very very addictive, and very like amazing. Like, I just felt so smart! No, but it just felt great that I could see exactly what was happening, I felt like I got spiritual awakening or something. Yeah, just to be so clear on the idea of memories and things, and like… but yeah, anyways…I wrote down stuff here, I think I wrote down here 'an impossible dialogue'.

Sarah: Hmm, can you tell me a bit about that?

Yi: I don't know! And then below it is says intervention and interruption. But I think also like in the sense that system failure happens and like there's memory loss and things like that so like you won't be able to fully access the past, it's not a fully well preserved record of it and you so only get like traces of it, and something what you want to say or you want to trigger you won't be able to, and that is quite sad, but it does like give room for new things to emerge I think…and I don't know, like, if you think of the idea of trace, like, and for me this has been my whole season in life just right trusting that the things I need to take with me are with me and I don't have to desperately like hold on to everything I can just let it go and that idea that like erm, what needs to be there is there. So I just…the trace, whatever trace emerges on the screen will be whatever I work with and like I don't in that like quite harrowing sadness of not being able to find what I want to find, like the moments where I wanted to retrigger Zach and I couldn't' find him anymore or I wanted to find something that was like there and I couldn't find it like I think in that gulf you find something else instead. But then that through that discovering of the loss you've created something else in the effort of remembering, or that you rediscover another memory and you now work with that. I think somehow the effect of the loss resonates a bit in the system and in the space, like physical space, and you just take things with it. Yeah, kind of like, you ask a question about A and then you expect the answer to be B, and you go to C instead…and you kind of

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just take it on and like it's a weird kind of dialogue but it works and like things emerge…not in the way you expect them to but they do and yeah, also like for me I like really struggled with the idea of portrait because I, not because I didn't know what to do, I knew I could just go up and do anything and it would be ok but I wanted it to mean something for me, so I kept thinking about how we were painting our portraits with memories and it was just such an amazing collision of past, present, future. Because you are making your past now but you are working towards something in the future, but you can't actually move towards it, it comes at you instead, and like, it's so strange. But yeah, that was like this very poetic, there was something very poetic about this idea in my head I think and like, it really influenced like the later runs of my portraits as I was thinking about how do I paint myself in the now with my past. Yeah, there's something about that, it was just very crazy for me, it was very strange.

Sarah: Can you define your relationship or your relationships with Tools that Propel?

Yi: I don't know [can't hear]. It's like all the philosophers that I've read about, just staring at me on the screen. No… erm…It is not a mirror but it is also like kind of like if you are looking at a cross-section of yourself so you're looking in the middle and you see all these layers of sediment like build up so you see all the tree-rings that have emerged. It's kind of like that. But then you also kind of…not that you get a glimpse into the future, but having that sediment, that knowledge with you kind of pushes you to do things that would always have been realised anyway but you now realise it because of your knowledge of the past. A cross-section of yourself, there you go!

Sarah: What role has this technology played in your growing choreographic voice? Do you think that it's had an effect on you outside of the process?

Yi: Yeah! Everyone that I've spoken to about my dissertation, they're like is it is any way related to the work you did with Sarah? And I was like…yes! I was like everyone has said that [can't hear]. It is. I think obviously when I first started with it in my first year it was just about movement and creating interesting things, and like, so choreographically it was just creating interesting movement right, it was my favourite duet partner but only because we were so on board and we were making these cool amazing duets together and it was still very cathartic in a way but I think now obviously in the past three weeks I've also like seen so many new things in new ways from like compositionally deciding what to do and what not to do…I don't know how to articulate it now until I tried something else and realised that's what it has done for me, but I think…and it's also made me very aware of like time. I

never used to be the sort of person to think about things like time and space and be like…because Zach and Maria would always be on about it and I'd be like ok, it's interesting but it was never something I was like particularly interested in but now I'm just like it's crazy, and I think the idea of like time it is so vast but it is so personal. And obviously it relates to like where I am in life and everything, and everything just feeds together, like, feeds each other. I'm sorry if it becomes weird. I don't know, I think like with Tatiana, seeing your past kind of like look at you, like stand in front of you, something very strange and reassuring and frustrating all at the same time, because then like you in a way you kind of, you can't fully control it, even if you do get it to do what you wanted it to do it's always like one count, two counts later and you're like oh, come on… it's lagging, it's the system… But just in that sense of like, I don't know, just in the past three weeks I've been made so aware of like how everything's just colliding in this current space, and it's almost like we're pulling up virtual walls because of the system in place and you just get to see everything that's going on, that's happening, that has happened, and then you make what will happen. I just, yeah, like that whole collision is just very amazing for me, as someone who has always been like very forward looking in the sense that I want to be that person, I want to dance like that, I want to be that, so what can I do now to be like that. It's a very desperate sense of trying to hold on which gets very stressful and very unhealthy…Kuldip says I can't use the word stressful anymore by the way! Sorry, but, yeah, like it can get quite stressful and frustrating because it's impossible to hold on everything and it's just stupid and it's just such a stupid way of thinking but now I'm like everything that needs to be there is there, everything that you will be is there, it's just where you are now, and you will just move along it and you will see it. I don't know, it's just this strange awareness of time, yeah. And like memories, things like that. Because I've always talked about time, like even, over the summer as I was reading for my essay and whatever, but I never really thought about memories, like that word, it never really came to me even though it should have… It's kind of like we've set a landscape that you build and take away and you never see it as that, you never see it as your past forming like around you as you travel forward. Like I've never seen my memories as my landscape, but now I get to see it that way and work with it and play with it in a way that pushes me toward a different future.

Sarah: Are they in your body?

Yi: I think so, I definitely think so, yeah. Yeah. Because like how you move toward your future if you think that every 'now' is like a fresh 'now' to like grab it, versus how you move towards your future with an understanding that you are your past. It's very different. You see like

my Instagram story the day after, I posted 'what is now but a then-shaped whole?' and it just made so much sense for me in that moment. Yeah.

Sarah: I want to carry on this conversation but I have to go and pick up Caspar. But it's amazing to hear about all of this.

Yi: Agggh, I just want to do it again!

DISCUSSION AFTER WORKSHOP WITH COMPANY VAN HUYNH

4th December 2018

Sarah: Ok, thank you so much guys.

Dancers: Thank you.

Sarah: I hope it's been an enjoyable day. It's been really great to, and scary to encounter you all in this space with it. But it would be really useful if we could just have a conversation about the experience, about what it made you think, what the potentials were for you, what you discovered about working with it, in quite a loose way, what it felt like and what you think it's doing. GO! Talk, anybody.

Dancer 1: Erm, I'm just going to start. One thing that came up really early on, before I knew anything about it, it felt more erm, like I was focussed on the product rather than the process when I was improvising, which I think we touched on is different to what I'm used to having as a thought process. So…I guess whenever we'd improvise in a studio we'd always cover the mirrors so that was almost like having a mirror but then it wasn't as clear and then it was like things coming back, so my focus was slightly different to a normal improvisation for me.

Sarah: Did that evolve at all or did that shift in any way your process over the course of the day? Or not? I mean it's fine if not…

Dancer 1: Erm I think it, like I'm not saying that was a major thing, I kind of, it was nice to feel like you were dancing with someone, even if I was on my own. Because I could see it I felt like I was dancing with someone. So that gave me a bit more to work with. That was like working with external factors rather than my internal choices. Does that make sense?

Sarah: Yep.

Dancer 1: Ok. So, once I got over…Oh actually at the beginning, sorry, er, I think at the beginning because I could see it so much I felt like way more self-conscious. Because I could see what I was doing. But then maybe I got over that and felt like I was dancing with someone or with my old self repeating stuff so it gave me more inspiration….to move.

Sarah: Ok.

Dancer 1: Does that make sense?

Sarah: Yeah, totally. Great.

Dancer 2: I found it quite challenging. Same as Xanthe when I improvise I don't, I'm not facing a mirror because I don't want to be influenced in, by what I'm seeing, so it's going back to, yeah it felt really unnatural for me to move like that erm, and yeah the first time that I went I was completely drawn into what I was doing. I felt...But erm, because it kind of reprojects things that you've done it's different to seeing .... And it's also a bit, slightly slower so it's not like working in the mirror it's a different feeling so eventually you kind of get past that and yeah you kind of see reprojections and then you kind of work off what you're seeing and then maybe continue it in a different way and seeing resemblances with Tomaso, Xanthe, dunno it makes you, it gives you more opportunities as well. And yeah. Really very different because I almost always close my eyes when I'm improvising so it's very internal and today we did completely the opposite so it was challenging but it was good.

Dancer 3: I feel like it was very interesting that naturally it makes more people in the space than what is actually there. And as we were talking about earlier I feel like I started out having choreographers say like 'dance, make something fabulous' [laughs]

Dam Van Huynh: [laughs] I say it all the time!

Dancer 3: And then I kind of went over to a more choreographic way of looking at it and looking at patterns instead of necessarily a phrase as such. Yeah.

Dancer 4 (or 1?): I think it was the repetition. Because you do, well when improvising you do a lot of random stuff, but actually you kind of hold onto one movement and repeat it, hoping maybe that it will come up again when you get into that same position so you kind of get attached to some of the stuff you come up with. Erm, and it really, and yeah seeing, because you're kind of opening your eyes more, you're more aware of people around you and what they're doing as well and it's kind of nice because most of the time when we're all improvising in one space we're all together but actually we're all improvising as individuals so...yeah...

Dancer 5: I thought that erm, I understood that one of the ways you use this programme it was to try to get away from your habits in order to rediscover a different way of movement, of moving...or...

Sarah: Possibly. Possibly it doesn't do that at all…

Dancer 6 (Tomaso): Finding…not to go back to your comfort zone in terms of movement…but what I found most interesting actually, it was to go back to my comfort zone because I was trying to trick myself or like to trick the machine which was to find a way to make it collaborate with me without it knowing it so I wanted it to do what I wanted it to do so that I could create what my mind wanted to see or what I was thinking of as like image, or feeling or sensation or like aesthetic. That was the most interesting thing for me and also what I found a bit erm, it was that it's so unpredictable….you would expect it to be predictable so that you can play with it but then in the end it's not that…sometimes it does what you think it's going to do, sometimes it doesn't. And so I found that a bit challenging to work with it because I wanted to do something and then it wasn't working because I needed it to repeat my image at a certain point because I was going back to it and was expecting it to repeat my movement because it was the same. Maybe you know 60 times out of 70 it would do it. And…but that was just I don't know…I guess it's a margin of error, I don't know. Or, yeah. But that was the most interesting thing; I was trying to collaborate or like to create a feeling or like…I was trying to repeat a movement like over and over and over and over so that it would keep doing it and I would give the machine the illusion that I would do the same thing but I would snap out of it to create another path so that I would get a clash between my image that I gave to the machine and the image that I wanted to clash with it. And that was a very interesting way or like…you know we were playing with sense of surrendering so I would surrender into the floor and then look at myself and surrender again and so I would look at myself surrendering. To me those were the most interesting things. Rather than trying to understand what the machine does just go with it and develop creativity into the screen. I think that was yeah…

Dancer 6 (Vivien): I would enjoy watching much more because of it delaying the people dancing and then making shadow. So for the very first time because I wanted to avoid looking at myself that's why I just create a picture in my mind that someone is following me so how can I fill up the space like creating the more me in the space and with different quality and after that realised that it doesn't really recognise your quality but it is more like alignment, shape, posture and location. Then with that in mind the intention is I want to create picture now then I need to look at the screen, I need to look at different people, what they are creating and what will be interesting to put into the picture. So for another time then I will, I would need to create looking at it and then see what elements, like vertical or another position, or around, or someone standing then, the level differences, so it's to create

different things to put into the picture to make it interesting. And then, and I love watching it because it kind of give me a feeling of life, or something called déjà vu is it? Something you thought is happened before and then you [re]visit it. And most of the time like looking at the picture, like a drama, or like a live picture happened. You forget kind of forgetting it. But life is sometimes a circle, you're making the same mistake or sometimes you encounter the same person or you did the same thing, and then eventually it comes up for just one second and then you move on so it's rich in picture…I think it's co- [or called?] echoing with my mind with what happened in my life, so as an audience I really want to just sit there and look what happen. And as a dancer, it capture[s] your movement so to …I can see like what I do most, or when I look at different people moving I will see 'oh, they move similar' and then how do that similarity inspire something new because you can look at that, you've done it before. How to against it, how to make it a different way, to use the thing that already have, to put in some new element to make it interesting.

Dancer 5 (Tomaso?): Yeah, I think that was very interesting, like the fact that you could go back to certain habits, but I found that also quite challenging because I had to force myself sometimes to get a habit. Because you don't necessarily always have habits when you improvise. So to make the machine, I always say this, to make it do, I would have to repeat things whilst maybe naturally I wouldn't repeat it because I would go with my own flow and my flow in my head would just bring me in other places and that would make the machine struggle…if I want to collaborate with it…

Dam Van Huynh: …what's the long-term implication of this? I mean the long term implication of working in this fashion where you are continuously building a relationship and

Dancer ?: Thank you so much, thank you. Bye.

Sarah: Have you signed this?

Dancer ?: Yes, I have.

Sarah: Thank you. You star. It was great to meet you.

Dam: Yeah, the implication of either working with the machine and the programme or continuously fighting it would actually yield something else that we are not used to. I think that's also quite an interesting perspective.

Sarah: Well that…

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Dam: I think that's what…I mean there's so much application for it, I think it's about perspective, like when you come in it forces you [points at dancers] to look at a creative aspect into the frame itself whereas you [points at dancers] are trying to trick it. I think all these things are valid approaches that already spins us into another realm that we're not used to. We wouldn't approach development in this manner and I think it could force, or forge something different, whether it's interesting or not that's a question mark. But the fact that you're fighting with this thing, trying to find harmony, trying to trick it could yield something else. You know. That is also interesting.

Dancer 5 (Tomaso): What would happen I noticed is that if you would variate the movement and you make it different and different and you change shapes and levels and speed it doesn't repeat movement any more but starts repeating flashes, so basically it would flash images of you moving but it wouldn't actually repeat sequences as in when you were trying to get back to your habits. And that at least to me personally was making it less interesting as I wouldn't feel stimulated from that. I would actually feel disturbed by it, by these flashes.

Dam: But were you more interested with more people in the space? What I felt was interesting when Vivien was saying that she was actually able to look at other people's repetition or patterns and then make a choice to either go with it because she found it interesting or go against it because she found it too repetitious. That in itself is another tool that we could use to gain new information.

Dancer 5 (Tomaso): Yeah, what's challenging to me was the shifting of the machine's attention as well. Because like, maybe in the group I was looking at the big picture and I was trying to create a sort of, an effect myself to put into the picture which I thought would have been interesting but then at a some point the machine wouldn't follow me anymore and would follow someone else so I would just be left by myself doing that repetition and the machine wouldn't repeat it and that it would have been probably helpful if the machine would have been able to catch 3 people at a time or…like…or…yeah

Dam: But I think that goes back to my original point in terms of perspective on improvisation. Like I said initially when the first three artists came into the space you were doing essentially what you would be doing if you were working with me as the choreographer because you were essentially choreographing with the notion of solving the choreography in the space and kind of allowing things to emerge out of your body organically and letting me do what this programme is trying to do which is capture images in my head of aspects which are different or new out of our bodies that we hadn't discovered before. Hence you weren't

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interacting at all. Whereas if I were to engage with the programme I am on the search for something. Whereas you were on the...your objective is to open and my objective is to discover and grab, so then we are trying to solve the body as a team, you inside the space and me outside the space.

Sarah: But I found it curious that, in relation to that, that a couple of people have talked about starting to thinking about, I think you mentioned thinking, I don't know if you said thinking choreographically...and then again, with you saying I'm starting to think about the shapes and patterns in other people and this external eye of composition from the inside of the space and I just found that quite interesting as a shift...

Dam: Yes, of course.

Sarah: Because as a maker myself coming into this space, now I come from theatre originally and then started to make movement work and things but I am not a trained dancer and I therefore come with a slightly different approach, and I've always been very interested in things being infectious in terms of across people and other information in the space and things and it always interests me that that's not necessarily an approach. So as I said when I came into the space I was like 'oh they're talking to each other and working to this I suppose very somatic impulse from the body within and how is that going to work in relation to this?'

Dam: Yeah, sure.

Sarah: So it's an interesting question that you ask as to... So I wrote down the word 'surrender' because there's always this thing that comes up I think about how much one tries to control it or let it disrupt or impact. You were very disturbed by it...what happens if you allow the disturbance to...and I'm not, this isn't me in any way criticising, I'm absolutely fascinated by all these responses, it's just, oh it's interesting, where is that space that... where something new might emerge...and as you say it might emerge and not be very interesting.

Dam: That's another conversation...!

Sarah: There's a question over that.

Dam: Yeah, ok.

Sarah: But it's good, it's interesting that you ask that question.

Dam: I mean also I think that this could be a different conversation on potential different outcomes if you build a relationship with the programme over duration, as a tool, no different from me building a relation with you as an artist over a long duration, things emerge. Especially because I understand you, I understand where your dynamics are and where I can push and press, where I need to ride the rhythm with you before and then press again. Do you know what I mean? So it could be that the programme is challenging now but I might know in the future how first to…like I said, towards the end, we need to establish the memory first and then press it. No different than when I approach you. I know when I need to give you a moment, ride your rhythm and then a bit trick you and to press into you another sense of direction. I think maybe the rapport is also another aspect of the research that might need to be questioned. How long will I need to understand this programme as I would any other artist? And then press on their…

Dancer 5 (Tomaso): I found that also quite…like the amount of time that it took me to understand the programme, I mean not understand but…

Dam: Just become sensitive to it…

Dancer 5 (Tomaso): Just get along with it. That was a durable amount of time, like a consistent amount of time…

Dam: That becomes another question for the 21st century. How do I build a relationship and to what capacity with technology? And how do we…

Dancer 5 (Tomaso): I mean because nowadays everything is so responsive. Like our ipads, our iphones, are so easy to understand. So my brain is so easy to interact with technology that is very sensitive and very interactive. That this one was a bit disorienting, because I was like woah, it's not exactly going with my…

Dam: I don't know because it's a bit different, because the ones, the technology that we are working with, we're interacting with already has a preset interface, that's set for A B C, like it's quite…you know…

Dancer 5 (Tomaso): swipe right, swipe left…

Dam: … super user friendly, the idea is not to disorient you, not to disrupt you, it's just to flow, whereas this one is designed to ask you questions. I think it's just different perspective. I would be curious to see the application for it. As a performance I think it's also interesting.

In terms of an application. I think you're already beginning to explore installational aspects of this?

Sarah: I'm beginning to explore installation but also as a performance. As a sort of 'performer' in the space as well.

Dancer 5 (Tomaso): It was very curious the fact that it's not able to recognise people.

Dam: Yes

Dancer 5 (Tomaso): So my first position can be your first position. So if I was in a position that Vivien took before me he would think that I was Vivien and he would show me Vivien. And I thought that was… I was like [blows raspberry] 'oh you don't get it that it's Vivien that it's not me' you know what I mean?! [laughter] I was like '[?] machine!' you know what I mean?

Dam: Yes.

Dancer 5 (Tomaso): But then also it's interesting because Vivien did other things and sometimes the machine would think that I was going there so it would show me Vivien's evolution of the movement or then it would go somewhere else, as in like I would lift my arms and Vivien maybe did a jump with her arms up but I wouldn't jump and it would be like Vivien in the air and me not in the air and that was very like, that was very interesting. That I thought that it doesn't recognise people, so like anyone is anyone. It's just movement.

Dam: But in terms of perspective of your personal development, I know that it's only been a brief period, but I'd just be curious about how it has pushed you, so for instance Vivien I got the sense that it made your brain fire up the creative aspect of your brain to want to create in the space whereas maybe in fact you wouldn't have approached the space like that before. So from this perspective it's quite interesting for me as an observer and also as an artist always looking for information, I wonder how this has pressed you in any other direction…?

Dancer 3: I think I do agree a bit with what you were saying that it took a while to get into what it was and what we were doing because when I initially came here I was expecting you know, someone or something to tell me my habits in terms of improvising, like you do this a lot or you have this quality a lot and then I realised that it's more about finding the shapes rather than the quality or the habits that you are doing. Which is what I found hard initially but also when I got past that it's also what gives you the new tool to actually use it as something choreographic rather than something that is viewing you as the artist and the person, if that makes any sense.

Dancer 5 (Tomaso): And I think that that includes the fact that as a dancer or performer or whatever you put in front of the camera I think it asks you to have a very strong awareness of time and space and direction and erm, climax, or a very good awareness because otherwise it becomes harder to interact with the machine. So I think that in order to use the machine as its best potential you have to be very aware of space and texture and how to create whilst sometimes as dancers we're just, we just dance.

Dam: [laughs]

Dancer 5 (Tomaso): But you know what I mean?

Dam: I understand.

Dancer 5 (Tomaso): Sometimes we just dance so we're not, we're not that aware, we don't have that ability of knowing, what's, which is being asked of us more and more now, because we do a lot of improvisation, guided improvisation, so we're asked to look at our fellow dancers, to look at the empty space, to fill out the …whatever… but most of the time we're not used to that. So this requires you to know where you are in the space, and when you are in the space and when you are there what did you do there before and how do you interact with it…what is the illusion that…what is the image that you give if you repeat your movement and then get out of it…that is a very three-dimensional and 3D sensitive…I just made that up!

Dam: You did! But I would be curious the application across different expression forms of movement, how they could apply it. So, I'm aware that this is one aspect of dance, of contemporary dance, and of particularly looking at movement in this manner is our curiosity now, in these hours, but I would be curious how other movement or artforms that use movement as expression would utilise this. That would be interesting. I don't know what your research is and how many types of groups you've used…

Sarah: I've only worked with erm, with people who are contemporary dance trained or training and then in an installation setting people who approach it with no, with much less embodied knowledge, and you know, sort of…and you know, sort of…and then I am going to workshop setting…

Dam: That will be interesting…

Sarah: With homeless people.

Dancer 5 (Tomaso): With what?

Sarah: With homeless people and ex-homeless people. I've done a lot of work with a company called Cardboard Citizens over the years, which are a homeless people's theatre company but I did a lot of dance and choreographic work with them. So I'm doing a workshop with them, to see really, whether it opens up things for them as well, or…

Dancer 5 (Tomaso): I think it would be super interesting to see how do you use this in a context of like martial art or fighting…for instance the closest thing that I can think of to dance now is capoeira, so to use that to see how predictable you are in your choices when you interact with the person that you have to dance slash fight with, because they have this, you know capoeira is like this you know this interaction of they hide the fight behind the dance but it used to be a fight so you need to be able to defend and fight back so how much of your movement is predictable because they play on that, they play on being predictable so you can make it look like you are dancing…it's very interesting… I think it would be super interesting to see where do they go with that.

Sarah: Yeah, there are lots of really interesting stuff. It's interesting this word habit keeps coming up and I keep thinking 'ooh, that's sort of like, I think habit is a really loaded word in dance as well…'

Various: [acknowledgement] yes.

Dancer 5 (Tomaso): I think habit is beautiful as well.

Sarah: And probably we shouldn't use it. Sorry?

Dancer 5 (Tomaso): It's also beautiful.

Sarah: No absolutely. And I don't see this as…and sometimes I think I'm using old text…you know, research is a really nuanced thing, it evolves and develops and evolves through the thing, and I don't see this as a habit breaker, as a default breaker anymore and it's not really what I totally…because I'm interested in that… I think you only break defaults or habits by digging into them, not by clearing them away…

Dam: No, of course.

Sarah: And actually that's some of the interest I think in it, is that I think it operates as something that you can, I think, but, you know, that you can dig into those, that stuff that comes back, the movements that come back, whether they're yours or somebody elses, there's nuance or variation in that or not. Or you can escape it. Some people are trying to escape it constantly and some people are playing into it. But there's something in that space

between that intrigues me. But… I can't remember what…oh because you said something… it is quite psychopathic as well, it sort of just [raspberry sound and gesture of wiping something away?]…it has no sense of quality and it has no…you know, there's something problematic with that as well and also something

Dam: Stimulating…

Sarah: … in that problematizing of the body I think that there is potential for something new within that and erm…

Dancer 5 (Tomaso): Especially when you're alone, when you're by yourself in front of the camera. When you're in a group it's different. But when you're by yourself the programme doesn't have the sensitivity to keep the experience alive.

Sarah: Ah, that's interesting, because that is a question that I've come across, that I've asked a lot and I've had alternative answers to that actually. I've had people who've had very very sustained engagement and built up over many many months a relationship with it, but I was curious because I thought, does it sustain your engagement? Can it? And for some people it really does and for some people it doesn't. So it's interesting to…

Dancer 5 (Tomaso): I had to follow it. I had to change my decisions to make it sustain it, as for my, for my sensitivity of the piece, of the experience, I had to do things in order to keep it going, because if I wouldn't do something the machine wouldn't respond, if I would just go for whatever I thought and would just expect the machine to follow me and expect it to do something with me…it wouldn't happen, I would have to check on it and see…

Sarah: But that's what I'm curious about, because you talk about it constantly, as the expectation that it *will* follow you…I'm really curious about that, because, I'm not challenging you…

Dancer 5 (Tomaso): If I do my thing….

Sarah: But, but, it's not designed so you just do your thing. And that's what's interesting is that it's never been designed so you just do your thing and it follows and it tells you something. It is an intervention. It's designed to potentially change….

Dancer 5 (Tomaso): But that breaks my flow.

Sarah: Yeah, I get that.

Dancer 5 (Tomaso): As a creator.

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Sarah: Ah, I get that and…

Dancer 5 (Tomaso): I can't go all the way there because I have to look back.

Sarah: Yeah, and that's the interesting thing is for people that have had a sustained engagement
           and have evolved that they've taken on a new a language with it and they're not necessarily
           dancing in the same way that they would if they weren't working with it.

Dam: Yeah, sure, course.

Sarah: But there is a dialogue and an evolution of that dialogue. Erm…

Dancer 5 (Tomaso): But that assumes

Sarah: Because it does disrupt your flow. There's no, you know, I'm kind of, I'm quite interested in
           disjuncture as a creative impulse. But erm… But I…

Dancer 5 (Tomaso): Destruction.

Sarah: Disjuncture.

Dancer 5 (Tomaso): Disjunction, ok.

Sarah: And as the idea that something intervenes and opens up a potential new space to move
           into that you wouldn't necessarily go. But these are all my words and I'm just putting them
           on and your experience is just as valid you know, and useful for me to know…

Dancer 5 (Tomaso): Yeah, it might be that someone has a different process as in I don't enjoy looking
           at my process to move forward into another direction. I like to take from the outside. I like
           to take from all the sources, rather than taking from what I see there. So my process is in
           here, and it's almost never looking at myself.

Dam: But this is where the question of perspectives on the task, where the improv task itself
           comes in. Whereas you, inside the space, are trying to do something to open to another
           space, but it could be that choreographically I would like to continuously dissect into you at
           every point in order to not let you go to some places because we all tend to go to a place;
           first you go to a familiar place then you go to other territories but this is where I think you
           should be clear on what you wish to do in order to make maximum use of the programme.
           From my perspective because if I do need a session where I continuously have to disrupt
           you this could be of interest for me. But then there will be times, this is why with most
           tools, they are tools, no different than using other tactics like playing a sad song when I

need movements that are slower. Do you know what I mean? So, they have to be tools to utilise when as and when so I think it's, it could be a way to redefine what you believe in terms of development: is limitation interesting? Is it a moment to reclaim the interests of limitation? Because I think that's quite interesting for me in terms of dances, there are limitations. There's only so much jump one can do, there's only so much floor one can fall into. And you know, these parameters create lots of obstacles which we have to creatively get around.

Dancer 5 (Tomaso): So that's the objective. Is it the objective to give the programme or the machine a function? Is it to identify what the machine does? Or is it just to play randomly with it? And if we want to identify what the machine or the programme does, what is it that it does specifically and what's the use of it? As in like I know that a pen it's to write with. So I know how to use it. It's very clear for me…to take the pen and use it. But I take the programme and I'm like…how do I use it, what can I do with it, how does it work, what does it make me do and how to define that? And do we have to define it, is that the question?

Sarah: No…No, that's not what…

Dancer 5 (Tomaso): The research, the research that your PhD…?

Dam: I think this is where she is…

Sarah: No, the research for me is about, is come about to do with there is this space to do with tech and dance and it's happening and it's evolving and I'm interested in…when I first started the process it was more about how you use technology to facilitate more embodied processes in sort of, at that point thinking more about education, learning and community sort of things because a lot of digital processes were very, just disseminating, just putting out performance recordings and things…but it's shifted a long way from there, it's not specifically remotely to do with, you know it's shifted to this you know and then this was built out of a collaboration and a lot of shared thinking and philosophy, discussions around theory and philosophy and my practice and Adam's practice and we started to build this thing and then the questions emerge out of that. And I became very interested in this notion of sort of a digital dramaturgy that sort of disrupts your flow actually so that you don't predetermine your movements all the time, or you don't, you're letting the work evolve from the centre of the work….

Dancer 5 (Tomaso): Yup, yup.

Sarah: What I'm actually personally interested in is this sort of distributed, but this is quite theoretical yeah, but a distributed agency, a distributed choreographic agency across the body, the person and the various components of the system. And so, it is going to do something different for you choreographically; potentially it's going to produce a different type of material but whether you want to surrender to that or not or whether that is interesting is different for different people but ultimately I think there is only any interest really in using technology and dance together if it is producing something new, it's not some kind of deficit model, it's not less than we can do live, you know it's something different.

Dancer 5 (Tomaso): Have you ever tried to show the camera video?

Sarah: No because it wouldn't be able to, it wouldn't be able to track into…it has to have live data to measure it against.

Dancer 5 (Tomaso): If you put a screen perfectly in front of it and he sees a movement, he sees a person moving like a dancer…

Sarah: Oh I see, show the camera the thing.

Dancer 5 (Tomaso): Show the camera a dancer.

Sarah: So not the system, the camera. No I haven't.

Dancer 5 (Tomaso): I say that because it would be very interesting to see if does the same thing when I show them, when I show it the same video. So if I have a five minutes long video and I put it in front of the camera like 50 times I would like to see if it, and precisely in front of it so that doesn't have any difference, or maybe I just go and play and begin again, so I keep it there and I record the whole process and I would be very interested to see the variable – is that in English a word?

Sarah: Yes, it is. I mean there's a lot of unpredictability about it…

Dancer 5 (Tomaso): Because you know that the person and the camera and the video is going to do exactly the same thing every time…

Sarah: Exactly the same thing. No, I haven't.

Dancer 5 (Tomaso): That would make me understand the thing even more and then I would have access to different notions.

Dam: Obsession much with these…?

Dancer 5 (Tomaso): Yeah, I know, it's because, I don't know, it's very interesting. I want to understand.

Dam: It could be interesting to couple the tool with what we are already using which is basic camera recording itself. So we use the camera to capture a movement that we are playing with. I don't know, it might be an interesting process to have another wall that gives us just the raw data of the live recording so you're seeing yourself go there at the same time as being affected by this information. Does that make sense? So you are going trying to get to the space you try to get to and this on the other side so that between what you are playing with, so that's two sources of disruption, well one an aspiration to a space and a disruption of that space. That would be interesting.

Dancer 5 (Tomaso): So do you use this also, do you research about this from a performative point of view?

Sarah: I'm going to be creating a performance with it.

Dancer 5 (Tomaso): Yeah, because what is also, what I'm curious about, it would be…I forgot, sorry!

Sarah: Well I think there were some curious things about it, from a performance point of view, to do with how you create equalise, equalise is a funny word, but the eye, the audience eye to the material physical body and the bodies on the screen. I think there is a materiality to technology but there is also a draw to a screen and I've been thinking a lot about that in the process of working with people and on Sunday we worked with, in a really large studio, with a very very large projection on one wall and a similarly large one on another. So we had two systems running.

Voice: Wow!

Sarah: And it was quite extraordinary and it was incredibly intimidating at first.

Dancer 5 (Tomaso): Can we do that?

Sarah: B ut you started to get…erm, that was when we also started to explore the infinite regress thing, putting the Kinect here, partly because…which came about as accident actually because we didn't have long enough cables…we suddenly had a problem because there was a problem with an adaptor and we couldn't get it to work and we suddenly had…underneath one screen was one Kinect that actually referred to that screen, the

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Kinect over there, if you imagine there's a screen there and there's a screen there, and that Kinect referred to that…and that blew our minds…

Dancer 5 (Tomaso): That's super cool.

Sarah: Because there was a sort of perceptual thing in your body and I'm interested in that, I'm very interested in work like by I don't know if you know Shonen dance, there's a French company with Eric Minh Cuong Castaing, and he does a lot of work with technology that somehow destabilises the dancer and produces new languages in very interesting ways. That was kind of weird because you didn't know where the image was being produced…and then we flipped it…at the moment it's in mirror mode so obviously my right arm here is the left arm there, you know and we can deal with that…but we can flip it yeah, and when we switched it, we could have switched it in the system so although the Kinect was here you were moving in the same direction. So we had to because perceptually we couldn't deal with, there was something, but the amount it took for us to work our heads round there's something we need to do here, what do we need to do…And so it was capturing a bit of the screen on the image but we put the bit on the wall close to each other…anyway…and that started a process of, starting to think well if you move it what does it do, and if we move it here, well we had about four or five, it was such a good clear image on this huge projection, it was visibly, aesthetically very interesting in a very different way. This is really kind of just like a reflection of the room, which most people who've worked with it have been, have liked the reflection of the room, like we've done it with filters where you for example just have the dancers and you don't have any background, we can do all that, but you have a very different relationship. And most people feel there is something about that familiar/unfamiliar relationship. And once you had an infinite regress you had a different aesthetic quality because there were things to do with exposure that kept happening and, it was really interesting. But anyway, the key thing was that in the bigger space, weirdly there was more of a relationship with the body and you could take in the body and the screen and somehow in that there was, so there are all sorts of questions about what that means performatively. You know because of our eyes going to the screen…

Dam: Do you think it's the life size interaction versus…

Sarah: I don't know. Possibly. I don't know. It is something that I need to dig into a lot because there is not much point if you lose the body.

Dancer 5 (Tomaso): And also as a director or choreographer I wonder how much one would be willing to deal with the unpredictability of the programme.

Dam: Well, that's a question.

Dancer 5 (Tomaso): As in me, what I want to say or what I want to communicate, how much do I want that to mess with my message. This is from a performative point of view.

Sarah: Well I think so, I think like any performance it's intention. You know if I was to create performance with this it would be semi-structured improvisation because I'm interested in what the intervention of that system is doing in the performative space for an audience and for a performer but it's…and that's I think how it functions…I don't think it functions currently and doesn't have an intention to function as something you can control completely.

Dancer 5 (Tomaso): Which is still beautiful. Because if you have to tour a work you can be sure it's never going to be the same in every venue.

Sarah: It's never going to be the same.

Dancer 5 (Tomaso): and that's still great.

Sarah: And you build that into the piece, no? Or you don't, you go actually I am a choreographer who needs to know exactly what's going to happen…

Dancer 5 (Tomaso): And there was another thing but I keep forgetting…there's so much…

Sarah: You can email them to me. Yeah really useful, I mean you know I get into a slightly strange situation, I don't want to be defending anything because I'm not, I'm opening up, I hope that in responding to things I'm opening up rather than telling you how it's supposed to work…

Dancer 5 (Tomaso): I mean if it hasn't got any definition or hasn't got any function, it's perfect just the way it is…

Sarah: Yeah, ok.

Dam: Well thank you everyone. Thank you for coming and playing. Thank you Sarah for letting us have a go with your technology and programme. I definitely think there's application for it. We just need more time to work with it and question mark how many different ways we can play with it. I think. I enjoyed the performative aspect as well. I would be keen…I've never done an improv only performance but I would be keen to see what that does…every time…

Sarah: Cool. Thank you.

Voices: Thank you.

DISCUSSION DURING WORKSHOP WITH CARDBOARD CITIZENS

25th & 26th January 2019

Sarah: Ok, we're going to do lots of work with this but I think it would be really interesting and useful to get people's initial observations. What it was that you personally were doing or that you noticed in somebody else. It might be that you noticed something and you thought next time I want to try this or I want to do this. It might be that, what is it that you, your relationship with it or the space with it, what were the decisions…if you can think back to what it was that was driving your decisions, what you were trying to do…just a little bit of response to that, because we'll also be…I think I find that if you talk about it then you build up a way of working with it as well.

Participant 1: I think that my drive was total lack of ambition so I was just really going with the flow and really trusting my body, where my body will take me, so maybe not having inhibitions at all and just opening to the flow and to the energy and also working with people as well. So it frees me up.

Sarah: OK, so that's great. That's really interesting to know from the point of view of today but let's just think very specifically about this first encounter with the technology, with Tools that Propel. So all the work we did prior to that, yes of course, it's opening you up and thinking about all these things but…

Participant 2 (Sasha): I really, I liked the idea of me interacting with the person who was there who was not me, whoever that happened to me, sometimes Paul and sometimes Udemi and I can't remember who else, mostly Paul I think and Udemi. And trying to shadow that image, or mirror it, or interact with it, pat it on the head, or … That was really interesting.

Sarah: So there were a range of things you just said which was really interesting. That you were interacting with it as an image, or that you were shadowing it.

Participant 2 (Sasha): Because it was just moving randomly, or maybe not randomly, and that's really hard cos we don't know how it works so it's unpredictable, at this point it's unpredictable, so it was random and very improvisational. Yeah. It was great.

Sarah: So you felt that it was stimulating you in the improvisation. Great.

Participant 3 (Udemi): My little movements were inspired by some of the music videos that I've seen on the telly, you know to do with certain bands that are making videos and some of the things I've seen on films like El Sid or Ben Hur or Jason and the Argonauts. You know. The way they have their little voyages, like Sinbad the Sailor or something like that. That's what…I thought I might do a few of each, and then a few of the music band video movements that I've seen and then do a few of the other things that I've done in some of the other workshops basically.

Sarah: So was it the fact that there was a screen there that triggered that thought or music videos.

Participant 3 (Udemi): Yeah.

Sarah: Something about the materiality, we'd say, of the digital, of the technology that makes you move in a particular way for you.

Participant 1 (Elisa): Like Big Brother, always watching you, always spying on you.

Sarah: Ok.

Participant 1 (Adele): Although I'm saying you're free but you're never free to do what you want, you know everything's being recorded.

Participant 3 (Udemi): Yeah.

Workshop assistant (Paul): I think that like Sasha, after watching everyone, I still couldn't figure out if there was a pattern or anything. So I was like, ok, I was trying to see if I could appear in like different corners. So like when I'm physically moving, maybe on the opposite side you can see me doing something similar, but I couldn't get it to do it.

Sarah: OK, so you were trying to see if you could move to a different corner if you could appear in the opposite corner? No, it won't.

[laughter]

Sarah: But what is interesting about that is that it gave you a rule to improvise with.

Workshop assistant (Paul): Yeah, certain things started making sense to me when Patrick went up and did it. I was like, ah, ok, I can start to see things here because there were pauses in what Patrick was doing and it was making it do something else that I hadn't seen so far, which I found very interesting.

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Participant 4 (Patrick): What I was doing was doing Bruce Lee. I've seen all his films, Bruce Lee's films, that's what I was doing, and getting legs exercise on the legs, that's what I was doing.

Sarah: So again, for there's something about, I'm really intrigued, I'm interested that by having a screen, the technology, there's a mental imagery, there's a sort of imagination for some of you of going ok, I'm on screen, I want to do something that is filmic, which is very, I'd never thought of before that that might happen.

Participant 5: I was wondering how this work. And I think when I move this if previously somebody did in here which this record when this attach connected [Kinect?] then this would appear, no?

Sarah: Yes, I'm going to explain in a minute. But I'm really intrigued, there's always people that really want to work it out, it's really interesting.

[laughter]

Participant 5: Yeah, yes, for me, how this work, working out.

Sarah: So it's a mental thing of what is actually happening, what is the relationship happening…

Participant 2 (Sasha): Because sometimes there were no other people, was it you, Udemi, I think when Udemi was dancing there were no other people. Somebody, somebody, there were no other people.

Sarah: Well when Ada started there would be no other people.

Participant 2 (Sasha): No, it was somebody else. The third or fourth one. It wasn't Ada, it was much later on and I thought why are there no people and I couldn't work out the pattern.

Sarah: Any other thoughts?

Participant 6: Yeah, I'm completely the opposite to Elisa. I was so busy trying to second myself, I was like trying to work out what's going on that I was doing too much thinking, not only about what I was responding to, but what am I going to do, to respond to. In other words I wasn't just letting it go. And it's only when I sort of, basically I thought I'm not going to be able to do that that I started to enjoy myself so I started running about a bit more.

Sarah: With this?

Participant 6: And not looking at it even. I deliberately turned my back on it so that I wasn't so busy trying to do, and just go with the flow with it, and then see what I'd done, you know what I

mean. Then. So continue…if that makes sense. Second guess myself, that's the phrase I was looking for.

Sarah: There is no right or wrong. So if you just share. Any other thoughts?

Participant 7 (Ada): For me it was immediately you said the words interact, you said, because screen, filming, and all that stuff, I'm alright around it, it's sort of media, that outside of performing is my thing as well, so naturally the space thing with, you know, once you said interact I was absolutely mentally aware of the space, so even when I couldn't' see my image, I lifted my head and seen the little space and worked it out a bit. So when I was going probably out of shot and stuff, if I felt I was doing that I was quite aware of the space I had to do stuff in or improvise in, but the key word to me was when you said interact with it. Because obviously I was the first person so I didn't have any awareness of what it was going to do, and then seeing what it started to do on a smart level obviously with technology I know about these things, and motion capture, I was saying to you I know Andy Circus has got a whole motion capture thing and also the version of motion, the model of motion capture that you're doing, because usually what my idea of it is exactly what you said, the points and then taking it off and editing and stuff. And so it's really interesting to have that opportunity to interact with that on the first, on a sort of first level or first experience thing.

DISCUSSIONS DURING WORKSHOP WITH COMPANY WAYNE MCGREGOR

27th November 2019

Discussion with two dancers after working in pairs on self-designed tasks

Sarah: Ok, so if you want to tell me what you were doing just then? What you became interested in with it?

Dancer 1:   We started with an idea of if we were both one person, because obviously the dots only track one person, so if we both moved an arm and a leg each, what would it capture?

Sarah: Yep.

Dancer 1:   From there it would capture movement but to also trigger the memory changing its space would end up being more useful. And then you had an idea of…

Dancer 2:   So, I then came up with a grid system like walking around each other in a square kind of switching, erm what's the thing the the…

Sarah: The tracking?

Dancer 2:   The tracking so that like er, stealing the tracker from each other basically. So, as we'd walk in front of one another the tracker switched to the person who was in front and then the memories were triggered in different spaces in time and space.

Dancer 1:   And the trigger would, that memory would be of both bodies still…

Dancer 2:   Hmmm, because we saved…

Dancer 1:   And like an arm and a leg…

Sarah: Yeah, and I, watching you and, were you starting to [can't hear – lots of background studio noise]

Dancer 2:   Yeah… so we had like…standing behind one another in different points that we used the grid for, so as we kind of rotated between the points of the square each point kind of showed a different kind of memory of what we were playing with at that point, so that's a pretty cool task. It seemed like quite like a machine, kind of the way it was working…

Sarah: That's really interesting. So you took the kind of machine, what it was offering in machinic terms and allowed that to dictate some of the choreographic decisions you were making.

Dancer 2:   Yeah, yeah.

Dancer 1:   And in terms of like the layering of what it was tracking and what memories it was capturing, the different points in, spatially as well, as it remembers the space as well as the movement, as like a film-effect, it had like a lot more layering of where people were in the room, not just a movement on the spot or you can trigger a lot more by moving systematically through the grid you knew where the triggers of the memories were.

Dancer 2:   For like, it could work very well in like a larger scale, having like a group of ten dancers all in a grid kind of system rotating, doing one movement and then going to the next grid and doing another bit and then going to the next grid and then having this kind of memory of everyone in this thing…

Sarah: So you would…

Dancer 2:   [can't hear well] as each person moves…

Sarah: So you became kind of interested in it as a compositional tool that you were composing what was happening on the screen?

Dancer 2:   Well, just now as I'm explaining it, I was starting to become more interested in doing that idea. [Laughs]

Sarah: Yeah, that's ok! Erm…

Dancer 1:   Especially in what it produced on the screen in terms of like…you develop a whole lot of memories, it's the same as if you had like a time-lapse of a person just moving, it's that same effect, you get like a little ripple effect of what they've been doing.

Sarah: And if you were to carry on working with this task do you think it would produce…what kind of movement or duet or would it produce? Would it surprise you?

Dancer 2:   I think this would be a lot more affective as a film kind of perspective.

Dancer 1:   Also like compositionally like floor patterns of then how you, how do you reproduce that so literally just with two people, what if you got like ten more people so there was twelve to recreate that in real life having all of those memories happen and triggered as one person moves through the grid maybe.

Dancer 2:   Like each memory is being moved at the, where the dancer moves, each person is in a position that we previously learned so then the new memories that are being created are of the older memories that have previously…

Sarah: Kind of replacing into each other's memories…

Dancer 2:   Yeah and having like a larger group of people actually filling in those kind of…

Dancer 1:   How do you…

Dancer 2:   translating bodies…

Dancer 1:   create that timing of when your memories are triggered…

Sarah: Yep.

Dancer 1:   Because in terms of that when we were just playing it was sporadic until we understood the grid system works so that you can make it have that timing of reappearing but again, like you were saying, film-wise because of what you see on the screen it's very interesting having that ripple effect of different memories, same person different time.

Sarah: Ok, cool. Thank you.

Dancer 1 & 2:   Awesome.

Discussion with whole Company at the end of the three-hour workshop

Dancer 3:   Erm, I don't see the screen helping me, it's more like the people. In terms of with people it's more I'm taking it from them, not necessarily…

Sarah: So essentially what you're saying is it wouldn't make any difference whether the screen was there or not?

Dancer 3:   When you're with people. I found it easier when I was on my own to feed off my own movement. But in terms of… Or maybe it was just because I was concentrating on the space?

Sarah: Yeah, I know it's interesting…

Dancer 3:   Or where we were in space… then… because also I questioned why I was trying to go back to that space and find the position that Kyle made and what that's gonna do for me?

Sarah: Yep.

Dancer 3:   For my movement.

Sarah: Yep.

Dancer 3:   But just questioned that, just…

Sarah: Yeah.

Dancer 4:   Something we did talk about was the composition of like a group, even making something by yourself in a group. So you could have an archive of lots of group stuff but then if one person was like oh I want to make a group piece but I don't have dancers… to go in with this… Like if I was to go in by myself, would it pick up all the other dancers as well? So there's three of us and I can imagine dancing with them. That makes you feel you're not dancing alone.

[Laughter]

Dancer 4:   It's something we just also discussed, but briefly, we didn't make that into a task.

Dancer 5:   In terms of like just generating material, it's a quick tool for that. Like if now Kyle went into the space and just improvised and we then recorded it and then you guys learn what that is in playback then that's generated material in set form.

Dancer 2:   There's also some really like some tasks you can do from like creating images from like, creating movement from seeing everyone's movement in one thing, and you can see how that passes onto your body.

Dancer 5:   Exactly.

Dancer 2:   Like there's so many things you can use to like quickly generate material within this, using like multiple people.

Dancer 6:   And you could generate like a group section because it kinda felt so, it just multiplied you each time.

Dancer 2:   Hmmm.

Dancer 1:   Yeah. That's what we sort of discovered just with two people you could have very quickly generated like a movement pathway, a group section, or even a film straight away. We could have produced that, edited it slightly, put a set to it and you've got a film that has like this resonating rippling effect of memory or I would say time-lapse of someone's journey or two people's journey.

Sarah: So can you just tell us what, actually can you just very briefly repeat what you were doing, what your task was that you set yourselves on that? Just so that I've got what…

Dancer 4:   Oh god, so the original task task was the idea of er, the space of where is it in space is more important for producing what we wanted.

Dancer 3:   So we made a three by three grid, erm and then chose where we wanted to be in the grid and then chose kind of where we wanted to be in the grid and improvised trying to I guess overlap the images on the screen so when we went back to spot one on the grid or coordinates 1.1, whatever, erm we would find the same position and then see what would come from that and then overlapping other people's positions as well.

Sarah: Ok, thank you. And what were you guys…what was your task …

Dancer 5:   We just basically went like with generating quick material from it and so it began with like one of us would improvise in the space with it and when it recalled a memory of a different dancer the other dancer would go in and find that shape or movement and

then we registered that as 1. We did 5 of them and then came away from the screen and put them into an order of 5 and then created a duet from that.

Sarah: So in terms of capturing each other's movement, like taking from each other's movement as a choreography, generator, choreographic generation, is there anything about that though that is any different from just doing it from each other?

Dancer 5: Erm, I think just in terms of, if it's a tool, if there's like an eight-hour creation day that's really helpful for mind and energy levels, like it does, it just, it feeds you, you don't have to think or you don't have to you know, like, try to create something interesting for them, it's just giving it to you. So in that sense it's...

Sarah: So when it's giving it to you is that shifting what you might have done in that moment because it comes in as a stimulus or ...

Dancer 5: I, I literally didn't think, I just saw and copied. So like I saw Bex do this with her hands and so I did that with my hands and that was, it was that simple really ...

Dancer 7: And because it was from the memory of the whole, like before...

Dancer 5: Yes.

Dancer 7: This part of the day it had everybody involved so it wasn't necessarily our movements which might be quite nice if you don't want to just do your own stuff all the time.

Dancer 5: Yeah.

Dancer 7: And then we reversed, we retrograded it to see if we could go forward and then do it backwards and see if it had...going back to what you said it kind of picked up more spatial stuff didn't it, on the...

Dancer 5: When we put it back into the screen...

Dancer 7: On the reversal...

Sarah: So I was interested to know like if you put it back into the screen whether you can, like you've obviously taken, you've created, you've reversed it, you put it back in, yeah...and then what happens if you put it back in and you let thinks break your, the phrase that you've done but it gets broken by the stimulus that comes in so it keeps, so it's keeping...

Dancer 5: Its evolving.

Sarah: Yeah, it keeps evolving.

Dancer 5:   I think that would work with a long phrase because I saw like, because we had limited it to 5, it was very like, you know there was kind of 5 snapshots whereas if that was a much longer phrase you'd get the in-between moments, that then you could make movement from the in-between moments whereas with this it was, what I saw on the screen was what I was doing but I think with a longer phrase perhaps that would work.

Sarah: OK, thank you. And you guys were watching your stuff that you'd created… did you, because we talked a little bit earlier about what you were doing, but did it generate anything else that you wanted to do with it or…

Dancer 2:   Well we were just talking before about how, our ideas was on a grid system as well but we used kind of a square facing the tv, so like we started like kind of, I stood behind Bex and we started playing with the idea of erm the tracker going over two bodies and then move that up to the first, second point of the square, third point, fourth point. And then we kind of split up and started playing around with erm where we are in the space…

Dancer 1:   Trying to hijack the tracker from one another because it would only capture one person at a time.

Dancer 2:   And we came up with some really interesting kind of images in a film perspective, moving between the points of the square and finding the memories of each point and in between, the transitions. Erm, we were also just talking about how we could work this as a, like co-generating material, we could use it accumulatively so if like say Bex started at one point of the square so like the first outline of the square and then I joined in using, creating material from the memory of her and then kind of rotating round the square adding one person each time, generating movement off the dancer previously, that's previously gone around, and kind of seeing how that would work as an accumulation. And then Iike finish in like four duets in each point.

Dancer 1:   And also like with our original structure, because we were hijacking being captured each time plus there was also a memory of two bodies in one place, because it would either be your arm and my leg, or, so you could… in the grid it would trigger those memories to appear so that as like a film, once you watch it back, how could you recreate that with that many real bodies in the space? And get that timing of the

impetus to go, the reaction time to go, but as we real people not just the images of the two of us moving… You could add for every person and every position in space that's a real dancer.

Dancer 2:   And have triggers for each memory.

Dancer 1:   And have a group section.

Dancer 2:   [can't hear]

Dancer 1:   Having a bit of a conversation in that.

Sarah: OK, great. Thanks. It would be really great just to hear a few general observations about what you've done over the whole…you obviously started encountering it one on one, and started to build that up, so some of that's sort of come out, sort of, perhaps the, I'm kind of curious about what you're curious about, what you're interested in, what you think are total limitations of it and the challenges and also if you have things that you would really want it to be able to do…? Or that you think it might, as you as a dancer in relation to it, what it might, how you would imagine developing it?

Dancer 2:   I think what would be really cool was if you could have a memory of another dancer that stayed in the screen without kind of flashing in and out based on where you are and what position you're in, so when you went in you could have a continuous kind of partner in the space, so you could have something you'd constantly be working of instead of trying to focus on where you are and what position you need to hit to get to trigger a memory. So, if it was just like a ghost recalling of somebody that's just previously went, and then you went in that and you'd actually have stimulus to continually be dancing and generating new movement.

Sarah: So, to sort of take a step back is what you're identifying is there's a, that the disruption of the changing of memories… you find problematic, that you want, that you can't, that it's stopping you develop with that avatar…

Dancer 2:   Yeah, in order to get like a nice flow like choreographically erm it would be very helpful to have like just a continuous kind of…

Dancer 1:   I think also with that I would agree but in a sense I don't mind it coming in and out but a lot of the memories tended to be more sort of static rather than moving

memories. They wouldn't be so much the knowledge of what we know as a movement is a pathway.

Sarah:	Yeah, I think that's an interesting thing…

Dancer 1:	It's quite static…so to trigger it you just get an image of a person rather than a complete and utter reaction where you could move alongside them in a relationship.

Dancer 4:	Even if it is …

Dancer 1:	It's very like what you said, you had positions to capture, it wasn't a phrase or

Dancer 5:	pathways

Dancer 1:	a pathway or a …

Dancer 3:	I quite like the flickering in and out.

Sarah:	No, that's great. So you like the flickering in and out. That's interesting, I'm picking up on this but I'm also wanting to respond because I don't, I'm not, not defensively at all because I think it is hitting a lot of poses at the moment and I think that is, it can be very problematic but I was curious to know, picking on that, so when you have your, you capture that, whether instead of, whether you started to move with that and discover what, because I wonder whether if you move with it whether you can find some of that pathway because

Dancer 5:	Definitely.

Sarah:	Because my knowledge, my experience of it is that you can…

Dancer 5:	But that just wasn't the task we chose to do.

Sarah:	OK. Right. So that's why I was interested in… do you know what I mean? But I think you're right. I think sometimes it gets into a lot of, particularly with fast movement it starts to…

Dancer 1:	But in terms of like the interaction with it and developing it when you're in there, yes you can, it shows you the memory, it comes up on the screen, you can take that and reproduce a new memory but I think what we're saying is how can you make that memory and you actually interact?

Dancer 2:	Yeah, have a relationship between the two of you.

Dancer 1:	So his memory could be moving but me as a real life person could be moving with it.

Dancer 2:	Yeah, have a duet being created.

Dancer 1:	And then from there that becomes a whole new memory as well.

Dancer 2:	What would be cool is if you could change the amount of time that the memory is kind of showing for, so you could have like an image or then have like a three second image of the dancer going like this and then disappearing again. And then having that in space that could be a cool thing to put into a little upgrade.

[Laughter]

Sarah:	I think it's quite interesting in terms of what you're identifying in terms of a desire for some of those memories to stay for longer, to be able to control how they, rather than it be, the control mechanism at the moment is always on whether it recognises it or not, that's what's determining it and there's something interesting in how that might disrupt your pathway or your flow and that that's part of what its built on but I can see that what you're saying is that if there was a different way, a different thing determining where the, how long the memory stayed, you'd be able to play with it in a different way.

Dancer 2:	Even if it was just like a setting that you could put on.

Sarah:	Yeah, that's what I mean. It would be really interesting. Cool. But you were saying you liked the flickering?

Dancer 3:	Sorry, they kind of, they won me over now.

[Laughter]

	[not totally clear – something like…] I realise that it would be really nice if we could interact with…

Sarah:	But we've got a world where we can create multiple…

Dancer 3:	Yeah, yeah, yeah.

Sarah:	Multiple choices.

Dancer 3:	I agree with Bex because the flickering is nice but also it would be nice to have something longer to… but I don't necessarily want it to be there all the time because

it's also nice then…just to give you little like 'oop try this', try it and then it can switch onto something else.

Sarah: Right, so you like the sort of intervention of something new.

Dancer 3:   Aha.

Sarah: But perhaps the length of …

Dancer 3:   [can't hear] the position or like the movement

Dancer 5:   It would also like, on that thing, when we were doing it before it kept getting trapped on the same like three or four images or we kept making it think of the same three or four it would be nice to be able to cancel those out

Dancers: Yeah, yeah [lots of noise]

Dancer 5:   can we just forget that, let's see what else there is.

Sarah: Actually we probably can do that, just by changing a setting. I suddenly thought, it's very interesting that, but we tend to use it on forgetting the oldest memory but from what you're saying…there is a setting, there are two settings on there, you can forget the memory that it's been in the most, so it's been used for the longest amount of time, or the one that's been repeated the most.

Dancer 5:   Yeah.

Sarah: So yeah, it could absolutely forget on those bases. And you know, you could tail it down to, you can change the threshold at which it decides what the memory is, or …

Dancer 1:   Can you, without having a person in front of the screen, can you go back and see what the memory bank is? Without triggering it with the person? Can you visually just see like that was memory 1, 2, 3, 4…

Sarah: That's an interesting…

Dancer 1:   I just thought it.

Sarah: I can…it…yes, it captures all the individual memories so there's a whole bank of those as well as the session recordings. But I don't know if it determines what memory 1, 2, 3 it is… you know, I don't think they're recorded as…

Dancer 2:   That would be a good choreographic tool, if you were to pick and choose what memories looked good and then create…

Dancer 1:   Because you could then go in…

Sarah: Yeah, I agree with that and that's something I wanted to do, because I wanted to look at like creating like portraits with people as well, like over a week or something so that, and for that to apply, for it to be able to, at the moment it can't pick up on memories, it can't, so after we close this down if we were to come in tomorrow it wouldn't have any of your old memories, right? It will only keep the memories of that session. And so ideally it would be able to draw on, you'd be able to set a parameter, set it so you could determine what types of memory you wanted.

Dancer 1:   At least like save them…for later. To put them back into the system. To be able to come back to it.

Dancer 2:   That would be cool. You could have like a different bank for each type of memories. Like one lot of memories could be quite sharp movements, one could be quite slow and then if you could pick and choose what kind of memories you wanted to put into the system like to show what kind of choreography you wanted to generate.

Dancer 3:   I feel like this tool's niche is that its live, because you know with cameras and stuff we're so up to date now we can do this on the iphone what you guys are kind of saying, erm, so for me, if I was going to use this tool it has to be in the moment. How is that going to benefit me in this moment with this machine in front of me? Not to save or look back because you could get that from…

Sarah: I think you've cottoned on completely to what I'm interested in, the live interaction with it, and how it changes your, or can or not change your thinking, decision-making in the moment but I think it is possible for both to happen in that you could … what they're, I think what [Dancer 2] is getting is that you would draw on a particular bank of memories and you could still improvise with it. So I could put in, I'm coming to it, or I'm working with it and I put in Company Wayne McGregor and it brings up all the memories from you guys that people can then improvise with and that would stimulate… or you put in a different filter which is as you say a particular dynamic of movement or a particular … and then you improvise but then I think you're right because how do you then, is it new movements… what would be nice if it was then creating new movements off your, off my movements in relation to your movements,

you know, my movements as somebody who doesn't have the kind of you know…choreographic knowledge that you do.

Dancer 1:   It would just be interesting if from every bank of memory what is left for it to remember that it doesn't think it knows already… So if you were able to save it and continuously come back and have all of the saved ones in its memory bank, can you then come in and still find movement that you haven't done before, does it look similar or it doesn't recognise… how much new is there?

Sarah: Good question… I think… personally I think there might not be new but there might be movements that start half way through …

Dancer 1:   But could those snippets be … if you were developing something could that be what you choose to be more interesting rather than the things that are generating a trigger…. that's what I mean by using the saved, not to continuously come back to it, but to have, to continuously push new movement.

Sarah: Yes. Yeah yeah yeah.

Dancer 1:   Rather than things that we know or are comfortable doing or is our bias or we've seen someone do or anything like that … if we had a bank of every single one of these people here doing it, could I still produce something new?

Dancer 3:   The thing I really enjoyed that ties into that is someone going in and solo improvising so when Bex did and then I went in and saw some of her movements that I could then, you know I don't generically move like Bex so I could take something from that. So that's like a nice idea, you could have two people trying to make one phrase if we combine their movement styles. Which is, I enjoyed using it like that.

Sarah: So you liked it when you were working one on one after each other.

Dancer 3:   Yeah, maybe you can both be learning something at the same time or improvising at… no you can't improvise at the same time. But just taking something from…

Sarah: Well you can improvise at the same time …

Dancer 3:   someone else's memory I guess. It's nice.

[Can't hear]

Dancer 3:   Yes, like a longer memory. Yeah. Would be, yeah you're right, even better. It's only because I know how Bex moves I could like pretend, like try but erm…

Sarah: The memories are 5 – 8 seconds long… It can't create a memory that's any shorter than that.

[Can't hear]

Sarah: I think it's getting…I think part of the images is partly because it's slowed down because we put up the number of memories that we're keeping. I don't think you had as many of the images when you were working one on one when we had less, I think. Erm, I think it's also because it's only staying in a memory for as long as it thinks you're in that memory …

Dancer 1:   So once you move out of…

Sarah: So once it moves out you've gone down the threshold, it no longer thinks it's likely that it's that movement so it might only come in for a moment so the threshold could be different, do you know what I mean? And erm, but at the same time, that's what I'm saying, what happens if you find a memory and then you start to play with that and see where that takes you even though you were on a trajectory that was going somewhere completely different… it disrupts your flow. And what new thinking comes out of the disruption of that flow? Or not, I mean you know …

                Any other thoughts or interests?

Dancer 6:   Is there room for it to capture more than one person?

Sarah: Yes, I think there is. Kinects can capture more, it's just that, it's to do with, at the moment it's set up just to capture one because the data stream is very expensive in, even in capturing six joint parts and then constantly determining that against the progression, where it is against all these different memories and then every time, so what it is that it's doing, and then every time that it creates a new memory it has to train itself again on the whole set of memories so its continuously training the model all the time, it's just doing a lot of work all the time so you could potentially but… we did some experiments where we split the dots across two different people so it was tracking three bones on one and three on another but actually we found that it was much harder to…you just didn't capture enough but I think that was a pathway we

could have gone down a lot more actually and I certainly think you know it could be developed a long way I think…

Dancer 3: That doesn't feel like such a big deal actually that it only connects to, only dots one person, because the other person is still on the screen when the memory comes back.

Sarah: Yeah.

Dancer 6: Yeah, I erm…

Dancer 3: So it didn't feel like that much. For me.

Dancer 7: I think it could be cool if it was like… you disconnected it between two people, like torso and legs… so what if it was to film, record someone's legs for a period of time and then someone's torso for a period of time, it would be cool if it like I don't know, you were doing something and it came up with a memory of this person's legs and this person's arms, both on the screen at the same time… because you're doing something that it makes them remember it. You know what I mean?

Sarah: Makes a composite.

Dancer 7: Like it figures out like oh, that looks like this legs, so we're going to put that on screen and you're doing something that looks like this person's torso so we're going to put that on screen as well.

Sarah: Interestingly though, I don't think it would be, I was about to say that's a huge amount of development but actually you'd have to get rid of the… you'd have to do background removal and just have… because at the moment it's obviously filming, it films the whole room… and you can do a filter where it, a filter where you just got rid of background and you just had the figures and then it could blank out, you could probably easily cut out just the…

Dancer 7: Yeah it was just an idea.

Erm, yeah. [Laughter.] I don't know.

Guys, just before we finish, can I just ask you about your interest in the liveness. Because you said you were interested in it because it was a live tool.

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Dancer 3:   Yeah, I like improvising. So this, I think plays a good part… rather than constructing movement, for me, it's like a game. Like I would rather play with it. And I'm not sure how you develop, like I haven't thought about how you would develop… For me it's something more to play with and see what I create on the screen… and…

Sarah: For me that's what it is as well, but I'm just interested in…

Dancer 3:   I don't know if you were a, if a choreographer was maybe creating a piece and they got to like a standstill it's something to just play with and try to, and find new, I don't know…

Sarah: So in terms of your improvisation, your interest in improvisation, does it feed you with new, I mean does it do something for you particularly in the…

Dancer 3:   Well not with me, that's why I said I enjoy someone else.

Sarah: Right!

Dancer 3:   You know, so [Dancer 2] has a really particular way of moving, and if he went on, like if I went straight after him and like tried to do what he was doing it would make me like move out of my comfort zone which is exciting for me.

Sarah: Yep. Cool. Thank you.

Dancers: Thank you very much.

Sarah: Yeah, really thank you for a really lovely afternoon. For your generosity and playing and thinking.