# Machines in the Creative Process: Limitations Through Choreography

Nigel Guérin-Garnett

Royal College of Art, London, United Kingdom <u>nigel.garnett@network.rca.ac.uk</u>

#### Abstract.

This practice-based project is a critique on our relationship with machines to foreground the necessity of continued human involvement. My approach is from the perspective of a classically trained ex-dancer in an art/design research context. Through the lens of choreography, I propose that affecting elements of the creative process with algorithms may produce unexpected outputs. I am recording my original dance phrases using motion capture technology. The digitised data is altered by an algorithm designed to generate new data sets, which are then manifested physically via vibrating devices embedded in wearable accessories. A dancer's improvised responses to this communication system illustrate choreography processed by an intangible machine. I am interested in the movement languages that may develop and to what extent machine learning can recognise the source.

Keywords: communication system, wearable, dance choreography, algorithm

#### Purpose of the research and its importance to the field

Artificial intelligence and machine learning are used by the public, private and third sectors to harvest substantial amounts of data from their 'users': those of us who interact with the internet in some way. Our employers, service providers, institutions, governments, search engines and social media archive countless factoids on our behaviour as we navigate daily life. What they do with this information depends on their ethics, motivations and structures and is not always transparent, despite complex, small-print online notifications. While there are apparent efforts to regulate the control and flow of the collection and use of our data, I infer that we as individuals do not take the lead in deciding who has access to this information. Current legislation and societal beliefs have not caught up with the rate machines are advancing. This could be traced in part to the notion that machines will gain control of humanity in some or all forms within the foreseeable future. Will art and artists also be automated?

My view is that we need to deepen the interrogation of our relationship with machines (particularly of the intangible kind), in order to foreground the necessity of continued human involvement. And while these questions are being asked by the science and technology sectors, I propose that artistic inquires will equalise and strengthen the struggle to advance our understanding of machine integration. And through these investigations, our ethical definitions and flexibilities may address the increasing value of data.

In an attempt to re-balance the discourse around our potential fear of automation, my investigation looks at this interaction through the lens of contemporary dance choreography, using algorithms to develop new movement languages.

# Brief survey of background and related work

Dr. Thecla Schiphorst was originally a computer programmer who shifted to dance and was part of the team that developed the LifeForms software, arguably changing choreographic methods. Merce Cunningham used this program from 1989 onwards, creating several pieces: *Trackers* (1991), *Ocean* (1994) and *CRWDSPCR* (1993). Regarding LifeForms he is quoted as saying that it, "...is not revolutionizing dance but expanding it, because you see movement in a way that was always there - but wasn't visible to the naked eye."

Schiphorst used algorithms to help Cunningham develop choreographic outputs and, more recently, Wayne McGregor developed a tool to algorithmically affect choreography in collaboration with Google Arts & Culture (Easter 2019). He has stated that his project, entitled "Living Archive: An A.I. Performance Experiment", is exactly that: an experiment. For the world premiere at the Music Center's Dorothy Chandler Pavilion in Los Angeles last July, McGregor used the Living Archive algorithm to choreograph *The Dante Project (Inferno)*. The technology has absorbed his company's 25-year archive of choreography in the style of his ten dancers. It recreates their movements, mimicking the tempo, dynamic and individuality in stick figures on a large screen in Studio Wayne McGregor's space for he and his dancers to engage with directly. Google has developed an algorithm that predicts the next series of movements in each dancer's specific style. "Presented with options for possible sequences of movement, the dancer could then either use the phrase, interpret it in their own way or use it to inspire improvisation. [...] It's a real recursive process between the dancer and the AI system," the choreographer said." McGregor explained the process in a similar way to Cunningham: "It's exploiting opportunities in the data you can never see yourself." (Easter 2019).

Assistant Professor of Dance and Media Technologies at Virginia Commonwealth University Dr. Kate Sicchio has also been exploring the use of algorithms in creating choreography. In a recent teleconference she explained that she fed photographs into a data visualisation algorithm (called *t-sne*, or t-distributed Stochastic Neighbor Embedding), which then re-ordered them based on visual cues and their similarity (K Sicchio 2019, personal communication, 11 June). The movement of the images across the screen were used as choreographic impulse for her dancers in real-time, live on stage.

# Description of the proposed approach

In terms of process I am collaborating with a data scientist to co-create an algorithm as one component of the <sup>F1</sup>communication system I am building. This system is intended as a connection between myself as choreographer with a dancer as performer in a live setting. I have been constructing each component as a link in a chain reaction:

- 1. Through improvisation I compose phrases of movement.
- 2. The capture of these choreographies by <sup>F2</sup>MoCap technology transforms live movement into digital data.
- 3. The VR and data specialists I work with are developing methods for the digitised choreography to manifest into Morse code-like sequences.
- 4. The sequences are realised into electrical pulses fed into a small vibrating device.
- 5. The devices are mounted in accessories built from moulded leather, elastic and knitted panels.
- 6. These accessories are worn by a professionally-trained dance artist.
- 7. They are asked to respond to the vibrating impulses given by the worn accessories on their bodies.
- 8. The dancer's improvised responses are recorded with video for documentation.
- 9. The MoCap technology is also employed to record the new movement phrase.
- 10. The resulting new digital set of data can then be compared with the original from my own phrase.

I am interested in dancers' interpretations to the stimuli and how my choreography would be expressed once processed by the algorithm. What movement languages might be created? What are the variances in response between different performers? What materials are best to build the wearable devices? How does their placement on the body affect the responses?

## **Expected contributions**

This project may contribute new knowledge in the form of my specific interpretation of the research outputs, as positioned at the intersection of fashion (accessory design), technology (machines) and choreography (movement languages). The co-created algorithm itself may be unprecedented and the creative process (system) I am designing to produce dance choreography may be original in its method. Lastly, perhaps this illustration as shown through choreography could be the example that infallibly demonstrates a limitation of anticipated automation.

#### **Progress towards goals**

Over the progress of this project it has become logical to break it down in terms of its system components. However, although the system is intended as a sort of chain reaction, it has not been necessary to build each component in their intended reactionary order.

In light of this approach, I have focussed on material and technique exploration for both functional and aesthetic purposes. Prototyping revealed that moulded <sup>F3</sup>leather mounted on the body with elastic straps and clips is one good option for the wearables. The other is using <sup>F4</sup>knitted panels in synthetic fibres pulled across the body with smaller leather holders for the vibrating devices. I have also <sup>F5</sup>scanned actual bodies in view of subtractive manufacturing my users' actual body forms so that I can mould the leather specifically to their shapes for a good fit. Also, part of this step was narrowing down the form of physical stimuli most appropriate from ethical and technical perspectives. A <sup>F6</sup>trembling structure set in silicone turned out to be the best option for the next stages of research.

In parallel, I have carried out several presentations of my project within my institution and to design industry professionals for feedback via written and verbal methods.

Determining data capture methods (MoCap) and the language (Python) to be used has also been established. I have also created movement phrases that have been digitised so as to produce data samples to be tested.

Current activities include determining the parameters of the algorithm so we may then test the data sample. This is in preparation for the next study where I will involve a dance 'user' to test the wearable devices with*out* the algorithmically affected data. Their design and functionality will be examined using heterophenomenology to record the dancer's responses effectively. A following study (anticipated) will be for the inputs into the vibrating device to be instigated by the algorithm's sequences instead of manual inputs.

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(F2) Figure 2, 2019 MoCap technology used to capture choreography



(F3) Figure 3, 2018 moulded leather accessory with elastic straps



(F4) Figure 4, 2019 synthetic knitted panel with leather holder



