'Conversations With My Data'

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ABSTRACT

We present an on-going autoethnographic case study grounded in data-driven design. Through physicalising the traces of the first-author's dance learning progression, we engage in a reflexive conversation with her data. The first author's movement data, and her subjective experience of getting to know the dance repertoire of modern dance pioneer Isadora Duncan, are together encoded into the design of physical artefacts. The physicalisation of this data serve as tools for introspection and communication and trace the narrative of the first author's learning progression.

Authors Keywords

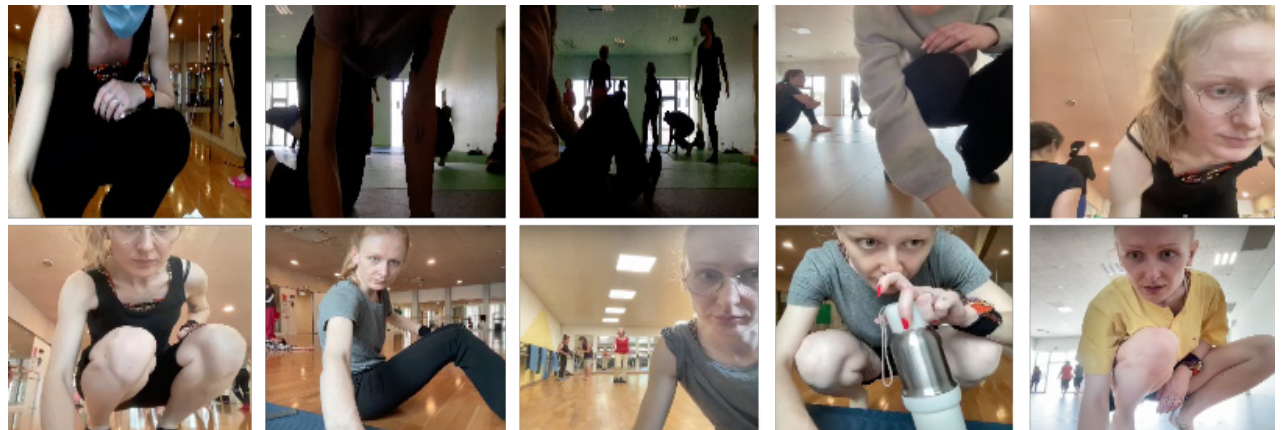Data physicalisation; dance; movement analysis; inertial measurement unit (IMU);

CSS Concepts

• Human-centered computing~Interaction design process and methods

INTRODUCTION & BACKGROUND

During an eight month period of attending dance classes learning the repertoire of modern dance pioneer Isadora Duncan, the first author, recorded her movements using temporal sensors. One sensor attached to the wrist, and another to the chest, the *solar plexus*. Along the first author recording her movements with these sensors, we engaged in a co-design process and a tight collaboration with the dance teacher and Duncan dance expert, Elisabeth Schwartz, that in addition to collective dance practice, also consisted of conversations around the dance repertoire and the first author's learning experience [1]. In the classes with Elisabeth, the students were taught the foundations of Duncan movement qualities and her idea of 'natural movement', consisting of continuous movement, fluidity, perpetual transformations and the *solar plexus* as the origin of movement. Elisabeth taught the class three of Isadora Duncan's heroic dances from her soviet period from the early nineteen-hundreds, Dubinushka, Varshavianka and Polonaise.

The first author, Tove, journaled her reflections following each dance rehearsal and the conversations between Elisabeth and herself, where they together unraveled some of the reflections that Tove brought from the dance practice.

After eight months of recording movement data, we now hold a large set of quantitative movement data accompanied by qualitative data, the journal of Tove's subjective experience of learning the three Duncan choreographies.

Now does the felt experience of Tove's dance learning experience show up in the quantitative movement data? Or how can the qualitative date support or enrich a movement analysis? With these questions, we moved on to physicalise this data with the goal of creating an object, and follow a design process that values and centers introspection, and serves as a means to communicate and share the trace of this learning experience.

DATA COLLECTION
Tove recorded her movements using wireless inertial measurement units (IMUs). We decided together with Elisabeth to place the IMUs at the wrist and the chest in an attempt to capture the ever-expanding and -retracting movement of the *solar plexus*, the continuous movement and perpetual transformations of movement present in the extremities.

However, Elisabeth made it clear from the very beginning that these two temporal points of information alone *"mean nothing"*, as it strips away the cultural and social context of the history and legacy of Isadora Duncan as well as the individual teacher's way of transmitting their knowledge of the Duncanian repertoire, situated in our present-day context.

The data we finally decided to collect consisted of:

- Video and audio synchronised with the IMU recordings recorded 'in the wild' during dance rehearsals (a total of 14 dance rehearsals), with Tove focusing on capturing the three choreographies each time,

- And Tove's journal consisting of voice memos and written reflections following rehearsals and conversations with Elisabeth.

The initial intention of recording the movement data was to keep a trace of the same dance routine from each rehearsal, over a longer period of time. As such we would perhaps be able to see a change in the data as Tove progressed in her learning, and then identity potential coherence with her felt experience of progressing.

We expected the data to smooth out or become less noisy over time. And perhaps we would be able to identity a difference in learning progression between different movement qualities. Progression in intensity on one hand, might be identified in the data at an earlier stage of the learning process, pointing to it being easier to learn, than progression in fluidity and perpetual transformation and continuous movement, being more complex movement qualities, and harder to learn.

PRELIMINARY DATA MODELLING
After initial processing of the raw IMU data, where we labeled the recordings to separate and split the three choreographies, we then visually mapped the data in 2D.

We plotted line plots of raw accelerometer data over time, from the IMU on the wrist, here from ten recordings of the choreography Dubinushka. We see a clear movement pattern in the line plot that reflects the A – B structure of the choreography. The first segment, A being of lower intensity, then a high intensity segment, B, repeating 4 times.

For further analysis of the data, we filtered it with a low-pass filter showing some change in low frequency
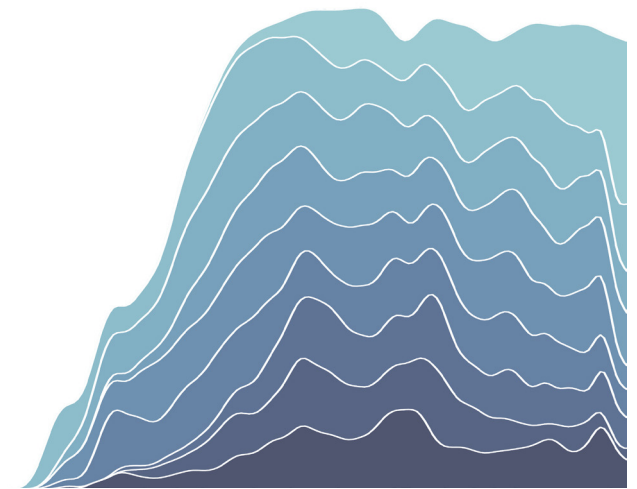
movements over time, which is something that Tove reads as a change in her understanding and embodying more subtle dynamics in low frequency movements, and her gaining a deeper understanding of Duncan's continuous and perpetual movement. We will further calculate and plot the orientation data, with the same expectation of seeing a change to low frequency movements.

Furthermore, distribution plots of the same, raw accelerometer data, as well as high-pass filtered data show a change in 'roughness' that we expect to disappear over time, as Tove progress in her learning.
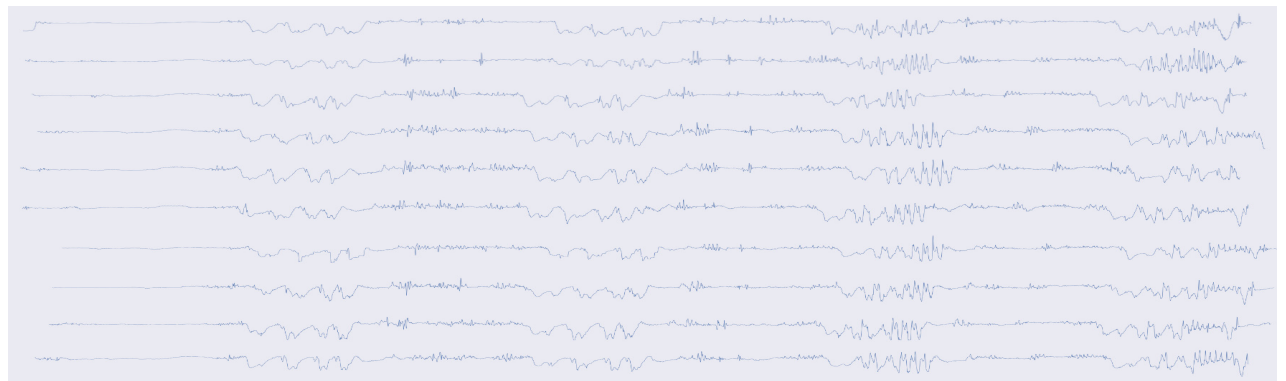
Encoding My Data Into Design

Similar to how data visualisation aims to support our understanding of (often large and complex sets of) data, **data physicalisation** aims to support exploration and communication of data, and has been defined as a *"physical artifact whose geometry or material properties encode data"* [2].

Starting with the choreography Dubinushka, we are using metaphors and imagery from dance learning [2, 3] to inform the geometry of the artefact, in addition to our quantitative data encoded into the material properties of the artefact.

We are modelling a lemniscate shaped artefact, a vase. Elisabeth often uses the imagery of the lemniscate, the infinity shape, in rehearsals, as tracing the movement of the lemniscate lays a foundation for continuous movement and creates space for dancers to work with perpetual transformation.

At this stage of the study, we are exploring multiple approaches to modelling the lemniscate. Either as one artefact *per* recording, or as one artefact for *all* recordings. With one artefact per recording we are following the A–B structure of the choreography, where one full round around the lemniscate (one layer) is made up of one A and one B, making four layers in total. With one artefact per choreography we are both following this same structure with one layer made up of A–B, creating a total of 40 layers. We also model layers of one recording per layer, where one round around the lemniscate is made up of A–B–A–B–A–B–A–B.
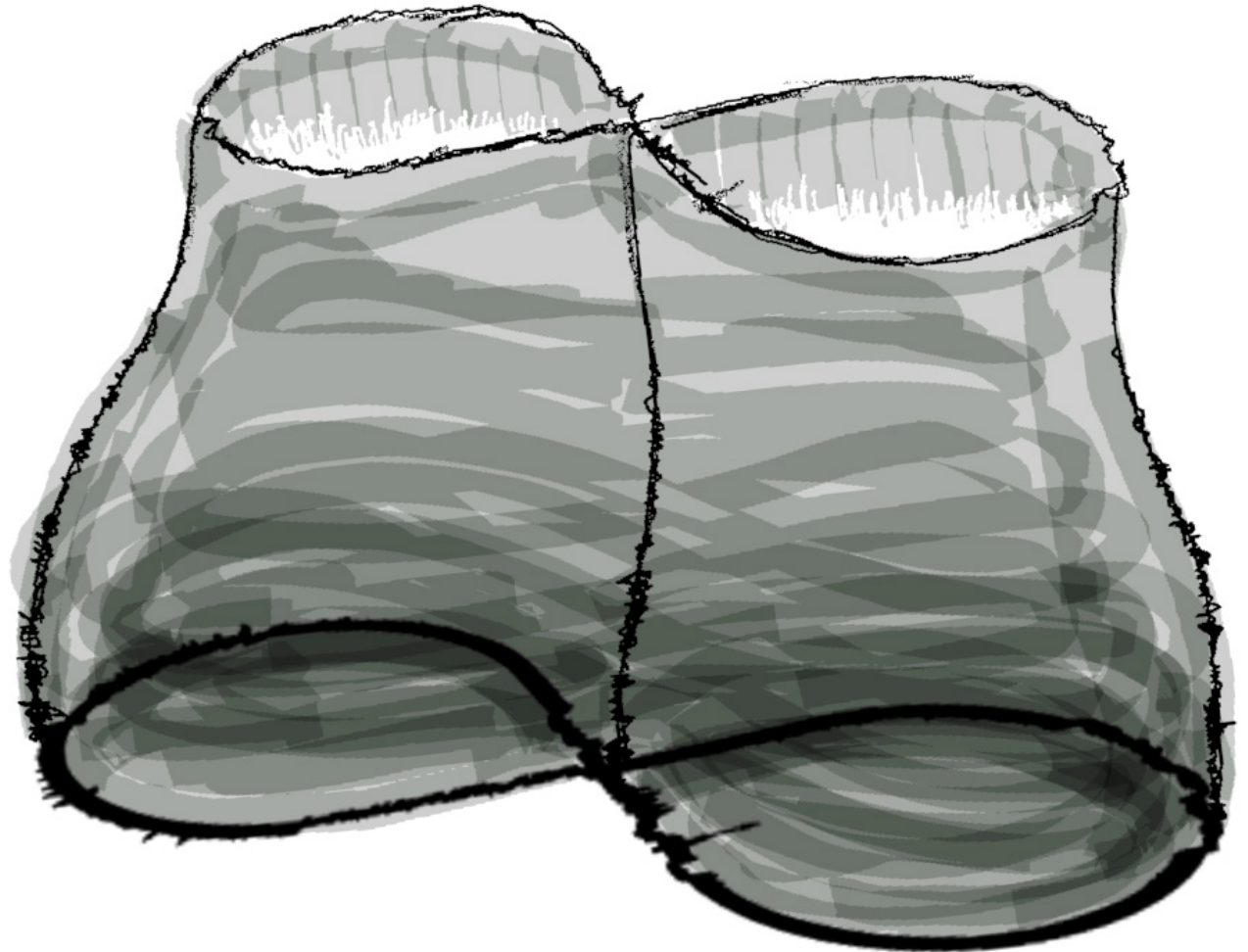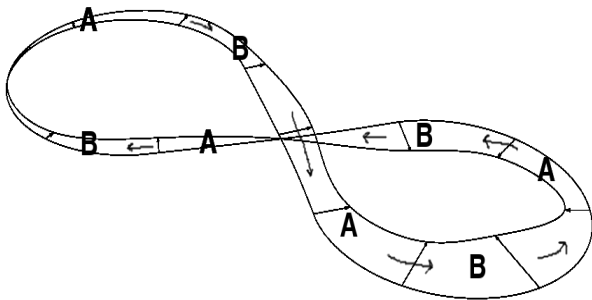
Then, orientation and/or low-pass filtered data will be encoded into variation in size or positioning/spatial distribution of the artefact. And the distribution data and/or high-pass filtered data will be encoded into the texture of the surface of the artefact.

Fabrication

In this ongoing work, we are currently testing our initial 3D models with a ceramic 3D printer to familiarise with the material and the rendering of the encoding of material properties in the clay. We will produce ceramic vases from the data physicalisation of Tove's learning progression. These artefacts encode both the temporal data recorded with the IMU, as well as the subjective, felt experience of Tove learning the dance repertoire of Isadora Duncan. Together, the quantitative and qualitative data make for a data physicalisation that invites for tactile and visual interaction with data from a rich learning experience. And the physicalisation is

constructed through a design process that value the data hunches of those involved [4], which easily can pass omitted and undervalued when working with numeric data as a material for design.

As we continue this work, we will be encoding data from the two other choreographies into physicalisations. We aim to produce unique traces of the narrative of the first author's dance learning progression.

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