

## Workshop: *Bodies of Data*

August 6 – 9th, 2014

Lightbox Kulturhaus

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The continuous world is filled with discrete points. Dynamic streams of information come to us as sharp points of data; we classify and analyze this data in fragments, then reconnect the dots to move into the future, acting with adaptive agency.

Topological data analysis aims to understand the shape of data. It aims for big pictures that don't snag on points and lines, but rather knead data points back into forms we can understand wholly: organic, qualitative, robust.

*Bodies of Data* is a workshop bringing together mathematicians and performers – dancers, clowns, theater performers. The basics of topological data analysis (TDA) can be learned and appreciated without previous math training. The basics of adaptive and collective movement can be learned and appreciated without previous performance training. Interdisciplinary collaboration requires that independently rigorous creative practices engage in willing and open communication, in a framework of self-awareness and growth.

### **What will happen:**

The Mathematical Association of America's annual conference, MathFest, will take place in downtown Portland from August 6th to 9th. We will recruit 6 – 8 mathematicians from the conference. On each day, August 6 – 9th, from 6pm to 8pm, the mathematicians will meet with local movement artists at the Lightbox Kulturhaus studio in Northeast Portland.

We will (gently) introduce TDA, using examples and thought experiments. The group will have many opportunities to move, discuss, ask, disagree, and reflect. Starting with specific movement exercises based on math concepts, then shifting towards more collaborative micro-explorations, we will take the ideas and themes of TDA into our bodies and the space. We will engage the ideas literally, but also colloquially – finding the hidden poetry in math jargon. There will be an emphasis on interdisciplinary balance, mutual instruction and collaborative learning.

Each of the four sessions will include a balance of mathematical instruction and explanation, ordered or disordered movement activities, meta-discussion centered on bringing awareness to interdisciplinary collaborative practice, and unstructured time. Mathematically, we will discuss parameter spaces and spaces of data, data sampling and point clouds, simplicial complexes and the construction of Rips complexes from data sets, persistent homology and barcodes. Thematically, we will discuss Big Data and the data-fication of lived life; fragmentation and radii of influence; invariance, robustness, and “the place of persistence”.

The four days are (tentatively) framed from the following four perspectives:

- mathematics versus art
- continuous versus discrete
- map versus territory
- signal versus noise

Necessarily, we will engage head-on the meta-discussions of interdisciplinarity. How is it even possible for mathematicians and dancers to communicate? How to bridge the gap? Can we transcend and include?

We will focus on exploration, rather than production. Most likely, however, the last hour on Saturday will be opened to the public for witnessing. Afterwards an open-ended salon-style event will transition the evening from rigorous interdisciplinarity to merry-making.

### **A small taste of topological data analysis:**

Imagine four points, arranged as the corners of a square. Imagine fattening up each point, slowly – from points, to buttons, to pancakes – using shapes that are clear but dynamic, organic, textured. At some point the blobs overlap. At this phase, to a topologist, this clover-with-a-hole is the same as a disc-with-a-hole, and the same as a drawn circle or square. Imagine now each of the four points expands its radius of influence further, until the hole is connected and contained in each point. The larger shape is now hole-less; we have unification. TDA is interested, among other things, in the sequence of emergent shapes: isolated points, to circle, to unified meta-point. It is also interested in persistence in the face of arbitrariness: what are the characteristics that endure? What does this tell us about the original data set, and about our process of analysis?

### **Some logistics:**

Luke Wolcott will be responsible for presenting the mathematical content. Jacob Mooney at Lightbox Kulturhaus will help with guiding movement. Mathematicians will easily be recruited from the MAA MathFest conference, and the movement artists will be drawn from Lightbox's community and mailing list. On Thursday at MathFest, Luke will present a talk about the workshop, during the contributed session on Embodied Mathematics. The only cost is rental of the studio; this will come from some combination of external sources, participants, and entrance to the Saturday event.

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