Sculpting the future of medical data visualization

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Art beyond its aesthetics can create empathy and understanding of the effects of illness, whether chronic like diabetes or triggered by environmental pollution such as water contamination. Utilizing the sense of touch, sight, and sound as a dynamic method of storytelling art can communicate where traditional spoken word and data representation fall short. For me the often invisible fluctuations of my blood glucose I experience as someone living with type 1 diabetes can be visualized and shared through "Diabetes Data Sculptures" (*Figure 1*). These sculptures take the thousands of blood glucose readings and other variables that I collect each month and consolidate them into color coded and tactile summaries of that data (*Figure 2*).

Only 12% of the US population have the adequate health literacy to understand these complicated data sets, where communicating this information to other people can be equally as difficult (1). There are many variables that are hard to understand in large data sets such as insulin levels over a month, fluctuation of continuous glucose levels, and number of times tested in a month that I am visualizing through sculpture to break down these barriers to understanding (*Figures 3,4*). I am using my art in diabetes camps, public libraries, and medical conferences to parallel their exhibition in art galleries to increase the methods people have to understand health concepts and data.

Inspired by the transformations of diabetes data the project, "Fountains" makes the stories of people affected by water pollution able to be understood scientifically and emotionally using 3D data visualization (*Figures 5–9*). I worked with mathematician and educator, Eric Dolores, and musician and coder René Paccha to create the multidisciplinary artwork. The installation features 3D scanned images of people from across the world who deal with a range of challenges including lead and *E. coli*
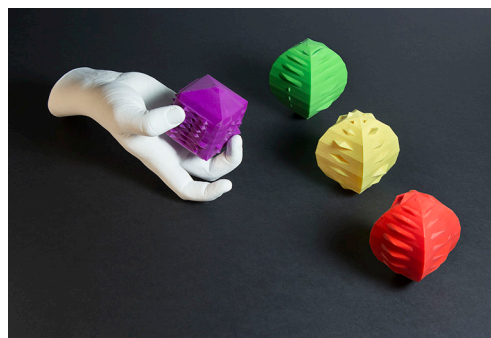

Figure 1 "Diabetes Data Sculptures", 3D-printed PLA plastic, plaster.

contamination, as well as water scarcity. We streamlined a process for people to 3D scan themselves and then animated these scans into a life size video overlaid with representations of the specific pollutants each person had in their water.

Using an experimental European Union Internet of Things device and software we drew pollution data from the US geological survey water sensors to create a sound score for the work "Fountains" (2). This sound score allowed people to hear the normal fluctuations of lake Michigan over the past three months. The particles in the water that make it harder to filter and correlate to potential bacteria spikes, known as turbidity, were represented by computer generated musical notes automatically triggered by thresholds we created in the data sets.

Engaging with diabetes patients and citizens who have become experts on water pollution such as many of the people in Flint and Detroit, MI creates exciting connections to not only personally understand but convey high impact stories to a wider audience. These projects are part of
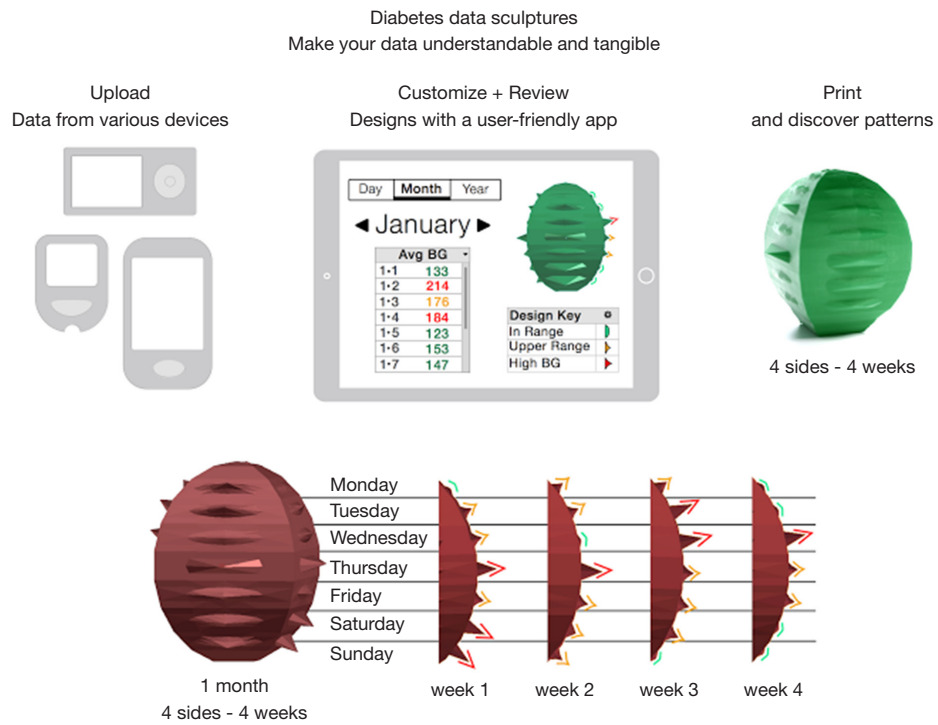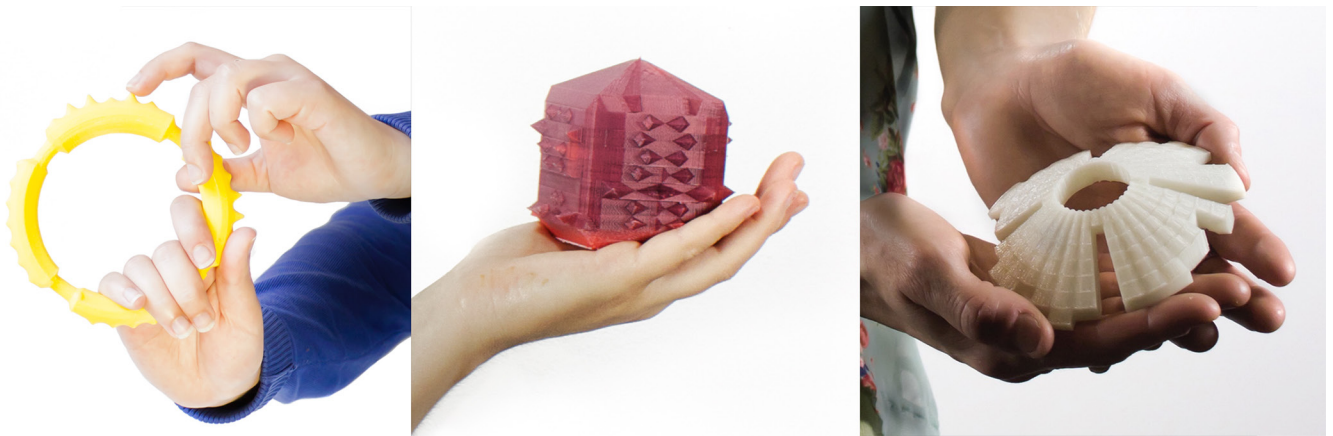
Diabetes data sculptures
Make your data understandable and tangible

Upload	Customize + Review	Print
Data from various devices	Designs with a user-friendly app	and discover patterns

Day | Month | Year

◄ January ►

	Avg BG
1·1	133
1·2	214
1·3	176
1·4	184
1·5	123
1·6	153
1·7	147

Design Key
In Range
Upper Range
High BG

4 sides - 4 weeks

Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday

1 month
4 sides - 4 weeks

week 1   week 2   week 3   week 4

Figure 2 Summary of data sculpture process.

Figure 3 "Diabetes Data Sculptures" (series), insulin, continuous glucose monitor, blood glucose meter data sculptures.
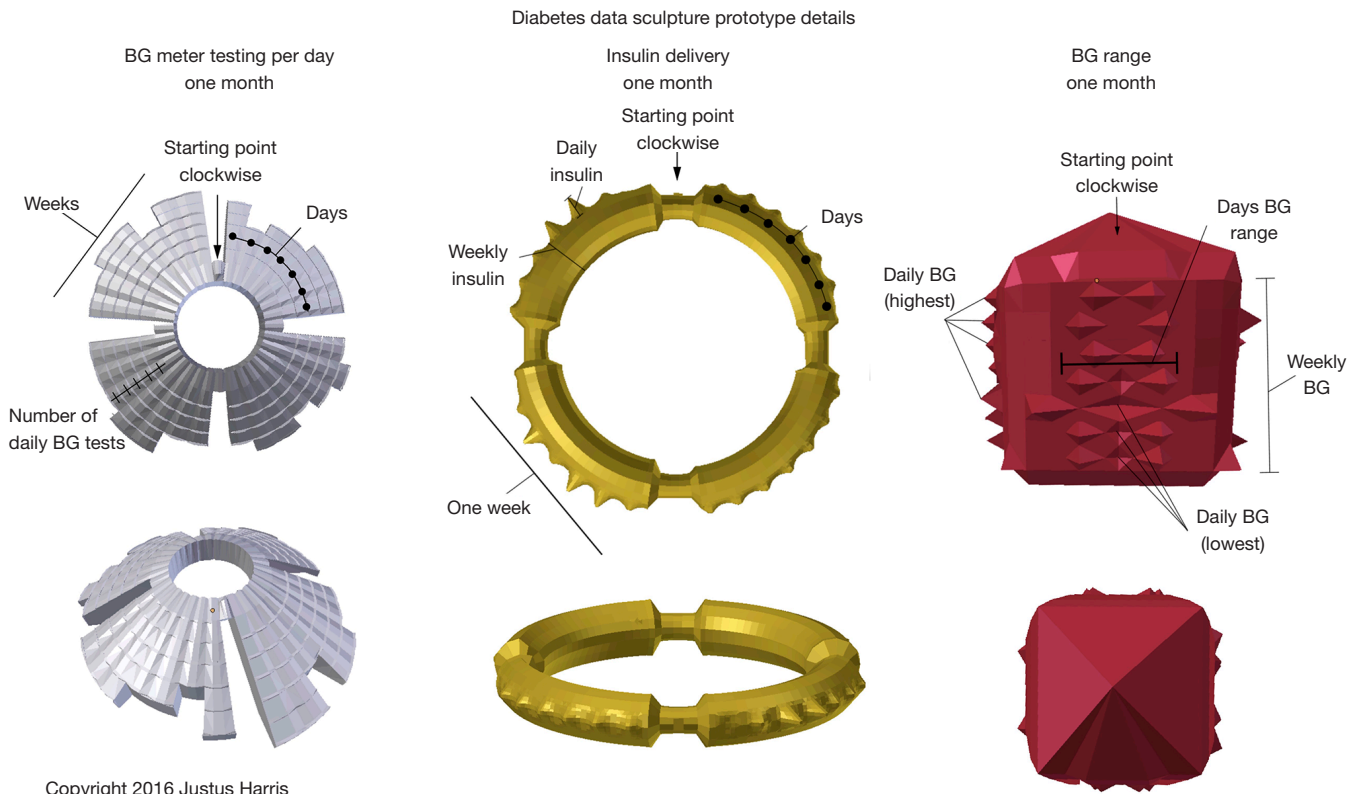
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Diabetes data sculpture prototype details

BG meter testing per day
one month

Insulin delivery
one month

BG range
one month

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Figure 4 Summary of *Figure 3*, data sculpture features.

Figure 5 "Fountains", installation view 1.

Figure 6 "Fountains", video excerpt of San, Ahmedabad India, *E. coli*.

Figure 8 "Fountains", video excerpt of Till, Berlin, Germany, calcium/magnesium.

Figure 7 "Fountains", video excerpt of Jan, Chicago, USA, corrosion.

synthesizing art, science, and medicine into a form of teaching about some of the most impactful environmental and health challenges we are facing today. Making the personal success of people's health reflected through their data as tangible as their medical devices, such as insulin pumps and continuous glucose monitors, can transform the experience of living with incurable illness into a creative act *(Figure 10)*.

Arts and medical research can merge now more than ever with technologies that allow more collaboration around meaningful data and traditional storytelling. Have you ever asked a patient how they understand their body or the data that they collect to manage their illness? What kind of questions could be answered by both medical experts and patient experts working together?

Justus Harris (US, b. 1990) combines medical data visualization and 3D modeling to understand health trends. His work is inspired by using continuous monitors for his type 1 diabetes. The 3D printed "Diabetes Data Sculptures" and public health data projects that come from his research have been featured internationally at venues including the Stanford School of Medicine, Theorizing the Web (New
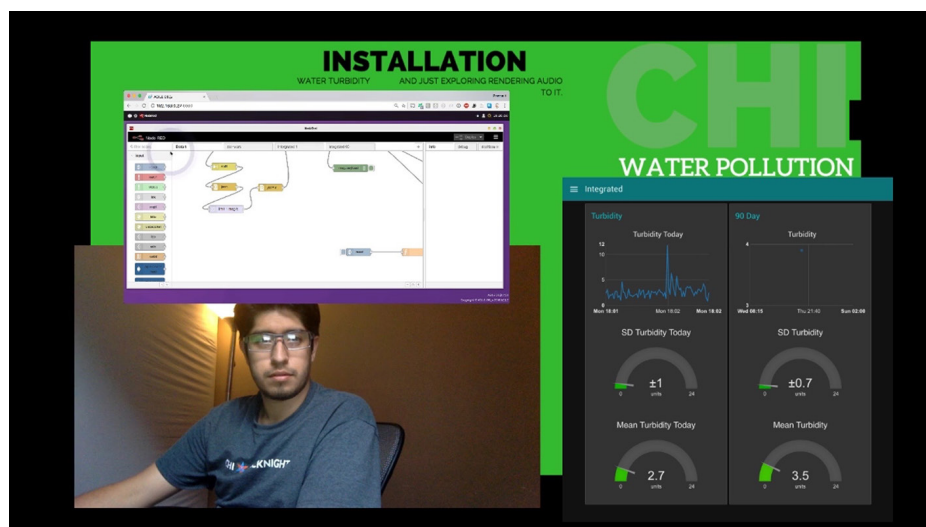
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Figure 9 René Paccha, augmenting USGS turbidity data to create sound score for "Fountains".

Figure 10 Justus Harris with 3 months of his diabetes data as "Diabetes Data Sculptures".

York, US), the Harold Washington Chicago Public Library where he was the inaugural Maker in Residence, and at the European Commission's Internet of Things exhibit 'Adaptation' (Berlin, Germany). He is a portfolio reviewer and alumni of the School of the Art Institute of Chicago (BA, Visual & Critical Studies). Justus has participated in five artificial pancreas research studies and is currently using a DIY artificial pancreas system.

Footnote

Conflicts of Interest: The author has no conflicts of interest to declare.

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