

Data Visualization as a Public Installation; An Exploration of How Physicality Impacts Visualizations

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ABSTRACT

Data visualization artifacts are often limited to digital graphics, intended to be viewed on the screens of personal devices. A consequence of this is that engagement is often confined to a solitary experience, limiting the potential for discussion and greater appreciation of the visualization and the data it represents. A physical installation, blending traditional data visualization with a more concrete medium, such as those often employed in information art, would help to define a shared experience among participants and introduce location-relevancy. This installation would represent tree canopy data and be displayed publicly in the Atlanta area.

Keywords

Data Visualization, Information Art, Data Sculpture, Physical Visualization, Installation, Digital Media

1. INTRODUCTION

1.1 Statement of Problem:

Data visualization, despite being a broad field with many different applications, is too often constrained to a single medium; The typified data visualization is generally a digital graphic, designed to be viewed on a screen. While afforded great computational power and precision to shape their content, these digital displays do not tend to explore the possibilities that more abstract mediums, such as performance art or sculpture, could. Sensory channels such as touch and sound are often omitted completely or take a back seat to the visual components. Temporality is also not a strong component of graphical displays, especially in comparison to a performance or sonification of data.

Additionally, when viewed on a personal device, a data visualization becomes an individual experience. Rarely do people gather around a laptop to view something together, as opposed to merely sending a link to the artifact they want to share. Discussion and debate are not afforded by this type of experience. The opportunity for a dynamic discussion of the data's implications, in which community members openly share their thoughts and interpretations, is lost.

2. PROPOSED SOLUTION

I propose an exploration of a different medium for data visualization which will afford public engagement and interaction with the data being presented. I would like to explore

the broader implications of presenting this data physically rather than digitally. What are the benefits and limitations? Will people become more engaged with the data? Will it have a greater impact by virtue of its tangible representation?

One benefit of this medium is that it can be viewed collaboratively by large groups of people, potentially enabling conversation about the artifact and the data it presents. All people can be brought into the realm of data in this way. Even those unfamiliar with data visualization can share their thoughts and hear different perspectives about the artifact. The installation can be interpreted openly and re-evaluated based on the discussion surrounding it, in ways that regular graphics often cannot.

Another benefit of the medium is that it will be inherently tied to a location. As stated in Cameron Cartiere's article *Exploring the impact of public art above and below ground*, "Utilising place-specificity serves as a means to highlight, preserve and present the unique social aspects of a specific location." In other words, the data used in this installation has the potential to be mutually informative with the setting, creating a greater impact and relevancy for those who experience the artifact. This is further supported in Charles Kostelnick's *The Re-Emergence of Emotional Appeals in Interactive Data Visualization*, which also cites various examples of how presenting data that has a temporal or spatial proximity to the audience creates a larger emotional appeal, and thus greater engagement.

3. REVIEW OF EXISTING MATERIAL

3.1 Explanation of Information Art:

Information art is an emerging field that blurs the boundaries between the technical and the creative. As Stephen Wilson outlines in *Information Arts: Intersections of Art, Science, and Technology*¹, practitioners of this field use technical and scientific research in their art to achieve a variety of outcomes, including the exploration of new possibilities, cultural implications, and new themes tangential to the initial research.

Like data visualization, information art is backed by technical data, but its purpose extends beyond mere utility and functionality of representation. As an extension of data visualization, information art would have a greater focus on creative flexibility and exploration, including the exploration of new mediums.

Wilson focuses primarily on information art that uses new research and emerging technologies, leaving out some mediums that are "not currently considered emerging technologies and... have well-developed aesthetic and analytic traditions of their own" (Wilson, 2002, pp. 10), such as sound art, kinetic sculptures, and light sculptures. However, there are many media not included in this definition with the potential to bring a fresh perspective to the way that data is seen. Properly executed, there is a broad range of artifact-types that could stimulate discussion and research interest in the same way that Wilson's emergent information art can; There is little reason that established media cannot be ground-breaking with the right content and context. For this reason, I

will use Wilson's definition of information art as a starting point, but not as a set of strict guidelines.

3.1 Examples of Inspirational Projects:

In my own search for examples of information art, which I will define as artifacts whose content or themes are centered around technical research and data, I have found a variety of media used. These include sculpture, sound-scapes, performance art, and more. Though I have not chosen a concrete implementation for my project yet, I believe these example projects will provide context for what information art is and the different forms in which it can manifest.

Loren Madson, known data art pioneer, has created a variety of artistic sculptures informed by data. One such example that I will cite is his District 5 piece⁹, a collection of bent metal tubes representing charts of various types of violence on decline. This particular sculpture is of interest due to its shared location relevancy with the data it portrays, as well its allusion to charts as they would traditionally be displayed in 2 dimensions.

Doug McCune's sculpture depicting San Francisco housing prices¹⁰ is also an excellent example of this medium. Like Loren Madsen's installation, it remains rather abstract in its representation, including no visible numbers or statistics as a data visualization normally would. Additionally, its form is also reminiscent of a 2-D chart brought into 3-D space.

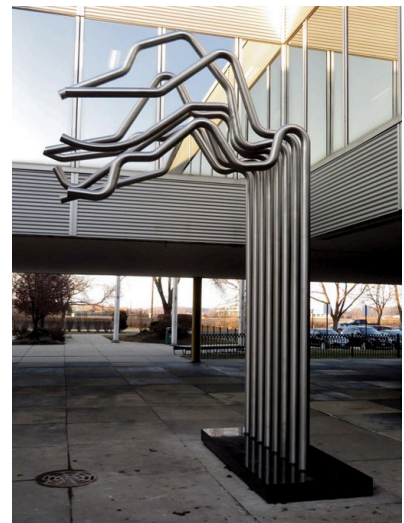


Fig. 1: Madsen's District 5; bent metal

Johannes Jacubasch and Judith Weda's Rearrangeable Display of Ice Data¹¹ offers a less abstract 3-D chart, including divisions for each month and labels for which year the

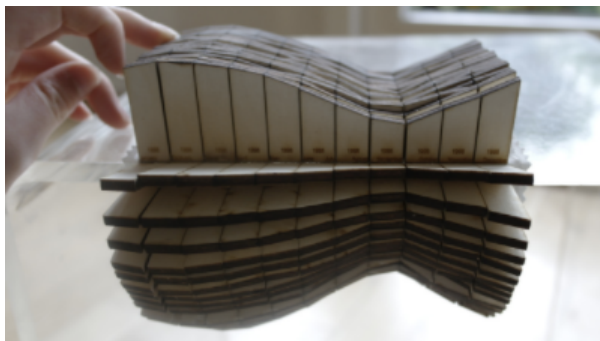


Fig. 2: Rearrangeable Display of Ice Data; laser-cut wood

shapes represent. This artifact is interesting because it raises the question of how many figures and statistics should be present in a physical visualization. This artifact inhabits a space between the minimalist sculptures mentioned previously and the label-reliant examples that we often see in graphical visualizations. The degree of text-usage is something that I will need to consider heavily in my own installation.

Dylan Halpern's Wall of War¹² is a large-scale iconographic installation representing six years of leaked war records. Each incident included in the data is shown using a complex icon to describe the events, resulting in an 85-foot expanse of color-coded

graphics. While my own installation will not be this large, the use of icons in a physical display is of note and something that I may want to consider.

There are also examples of non-sculpture data art, utilizing sound and temporality to make a point about the data. Jer Thorp's *A Thousand Exhausted Things*¹³ is an excellent example of data represented in a performance. In one segment, performers read out a list of first names corresponding to artists who have work in The Museum of Modern Art, listed in descending order from most common first name. The pronunciation of the names is split amongst the performers by gender, highlighting the disproportionately high numbers of male artists in the collection. Additionally, as names become less common, they are said in quicker succession. These qualities of the performance illustrate an excellent use of both temporality and sound to make commentary about data.



Fig. 3: Jer Thorp's A Thousand Exhausted Things; performance

David Bowen's *Cloud Piano* also uses sound, capturing a live video stream of passing clouds and sonifying it. The installation functions "as if the clouds are pressing the keys... as they move across the sky and change shape."¹⁴ Such sonification is yet another shape that information art can take, and demonstrates a possible sensory channel that my data installation could aim to explore.

4. DELIVERABLE

4.1 Final Artifact:

My artifact will be a physical non-screen-based installation inspired by and representing data relevant to the location in which it is placed. This could be as broad as "Atlanta, GA" or as focused as the specific neighborhood the installation will be displayed in.

The data set I will use has information regarding trees in the Atlanta area, including genus, species, GPS coordinates, and planting date. A record of trees marked dead or hazardous and in need of removal is also available. I will seek out additional information, such as a breakdown of tree canopy coverage by neighborhood and land-type, from Trees Atlanta, who has already aggregated this data. I believe this is a good choice of topic due to Atlanta's reputation for its uniquely large tree canopy, and the inherent relationship between the physical location of the trees and this installation.

The final implemented form of the installation is to be determined after reviewing the

data and considering the implications of different representations. Each potential form of installation will have its own inherent benefits and limitations, which I believe should be in dialogue with the way I choose to interpret and shape the data. Which materials? Will it be dynamic and interactive? How much text or iconography will be used? Will sound be used? I will need to choose the exact details along the way. However, sculpture is currently a strong candidate for my starting point.

The display will be moderately large in scale, and will likely have several sections about different areas of the data. For example, one part of the installation may depict how Atlanta's tree canopy compares to other cities in the nation. Other parts of the display could go into detail about how various neighborhoods compare and the how the tree canopy relates to other factors, such as population density and air pollution.

The goal of this display will be to inform citizens of Atlanta about this important and unique aspect of their surroundings that they perhaps have not considered before, while also exploring the implications of the data's physical representation. The social and individual impact of the project will be assessed through a structured evaluation method.

4.2 Evaluation of Success:

The success of my project will be defined in two parts. First, did the display effectively convey what it should to participants? This is in regards to its success as a stand-alone public installation artifact. Secondly, did it stimulate greater engagement than a screen-based representation of the same data would? This part of the evaluation ties into the underlying motivation for exploring this medium at all, and is perhaps the most important of the two.

For evaluation of the artifact, I will use a method loosely based on the Matrix method, defined by the ixia and OPENspace public art evaluation guide⁷. This method begins with all stakeholders individually assigning priority ratings (high, medium, low, and not a priority) to multiple values under four main categories: artistic, social, environmental, and economic values. A compilation of these ratings is then used to facilitate discussion about the project's priorities. Afterwards, indicators of these outcomes are chosen, such as a qualitative survey of participants or monitoring certain ongoing data sets. This ensures that the implementation of the object was in line with the artist's intentions.

For this project, I will clearly document my chosen priority of values, which will likely score highly in the categories of social and environmental, and possibly artistic as well. I will keep these in mind throughout the design process, and will select realistic indicators for measuring these outcomes when the time comes to display the installation.

I believe that an on-site qualitative survey will be adequate to assess the success of the artifact. The survey would indicate whether the artifact provokes discussion and debate, was legible, and what kinds of personal reactions participants had to it. Some informal

quantitative observation at the site would also be helpful, such as recording how long people typically spend around the artifact, if they take photos, and whether they discuss it with others.

To evaluate the differences between a screen-based and physical visualization, I will create a version of both and perform an A/B test. The evaluation methods mentioned above will already include indicators for participant engagement, so I will need to conduct a similar survey for participants who view the digital graphic representation. This will likely come in the form of an online survey to accompany the visualization link, which I will send out and ask a variety of individuals to participate in.

5. RESOURCES

5.1 Conceptual Resources:

The most important resources to obtain first are the data. In addition to the tree data that I have already received from my advisor, Yanni Loukissas, I will seek out more information from Trees Atlanta. I will explore these multiple data sets and determine what categories of findings lend themselves well to this project. I will then discuss these choices with my advisor and committee, finalizing my choice for the installation's specific implementation.

I will need to do additional research of data visualization techniques in my own time. A solid understanding of data visualization is needed to guide the direction of the project, and will help me to decide the best way to display content of the installation.

After deciding on the design, I must consider how and with what to build it. I may need to learn certain skills, depending on my chosen implementation. I already have experience with using laser cutters, soldering, Arduino prototyping, some programming languages, audio interface design, sewing, and painting. The skills I may need to learn could include basic welding, carpentry, certain programming languages, or 3D printing. Until I analyze the data and decide the further details of my project, I cannot be certain. However, I feel confident in my ability to learn or get help with any of the above, whether it be from knowledgeable friends, Georgia Tech resources, or online DIY research.

I will also need a lot of guidance in creating the evaluation. I plan to take a course on research methods in the fall, which should greatly help with my survey design skills. Aside from this, I will ask for advice from knowledgeable faculty and peers on assessing the effectiveness of my evaluation strategy, iterating on it as needed.

5.2 Physical Resources:

I recognize that this project could be rather expensive. I will need a variety of building materials such as wood, metal, fabric, nails, glue, and lighting elements, depending upon the specific implementation I choose for the installation. I am prepared to pay for what needs to be bought out of pocket, but also intend to apply for funds to mitigate

these costs. I will begin research about what kinds of funding are available starting immediately.

I will also need to choose an appropriate location for the installation. Appropriate sites will be evaluated based on principles covered in the Public Art Toolkit's location analysis section⁵, including site traffic, visibility, and unique characteristics. The site's historical and modern qualities, as well as surroundings, will also likely be of great consideration. I would like to pair those traits of the site with the informative content of the installation, as much as possible. I have already begun to investigate Atlanta's procedures for applying for temporary public art permits⁶.

6. TIMETABLE

Spring 2017

- Create proposal
- Begin documenting process
- Research sites for installation
- Seek funding
- Review and collect literature and reference material
- Review and select candidate data sets
- Create a website
- Decide on specific installation design
- Create evaluation criteria (values and indicators)

Summer 2017

- Continue reviewing literature
- Analyze data sets and consider possible project focuses
- First prototype
- Apply for Atlanta public art permit (can take from 45 days up to 3 months)

Fall 2017

- Refine user experience
- Seek possible locations to display installation
- Finish creating final installation

Spring 2018

- Publicly display installation, documenting experience and evaluation
- Finish design document and website documentation
- Preliminary draft due (2/24/18)
- Final draft due (4/12/18)
- Final presentations, collect committee signatures, submit deliverables (4/26/18)

7. PERMISSIONS

I will need to obtain permission to display my installation publicly. I will also need to obtain the permission of participants to have their interactions and possibly photos used in my documentation, both for the initial prototype and the final installation. An IRB approval will be necessary for the data collection and observation.

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