10

WHERE DATA MEETS DESIGN

Visualization in the digital humanities

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Introduction

How does the act of data visualization in the digital humanities bring new insights to our research? To answer this question, I developed a conceptual framework to explore "ways of knowing" in the humanities as they relate to the representation of information. The goal of this project is to put ourselves in the shoes of designers as we take our research questions and our data and literally re-see them from new perspectives.

The framework presented here asks us to think in images **a**nd learn what happens when questions of design become central to the research itself. When working this way, we are invited to think about what our knowledge looks like, how to visualize it, and how to make our knowledge more multidimensional, more sensual, more rigorous, more relatable, more human, and more engaging to others.

The five modes of visual inquiry that comprise this framework share an alliance with Johanna Drucker's "call to imaginative action and intellectual engagement with the challenge of rethinking digital tools for visualization on basic principles of the humanities" (7). A humanistic approach, according to Drucker, "is centered in the experiential, subjective conditions of interpretation" (13). At a time when it is all too easy to be blinded by the newest technological now and the latest technological next, a slower paced, deeply human approach to data visualization privileges the interpretative nature of knowledge production. In this chapter I will share the framework, its origins, and how we put it into practice at the Digital Humanities Summer Institute, where my workshops bring humanities-based perspectives to 2D visualization, 3D visualizations, data displays, data maps, and data stories.

Origins

Ten years ago, I became interested in the possibility of how visualization tools can help us to create new insights when I was struggling with a large and messy

qualitative data set for my dissertation project. I had spent almost an entire year accounting for the ways in which people associate meaning through their aesthetic experience. The single most helpful tool in interpreting and organizing my data was my use of the data display— "a visual format that presents information systematically, so the user can draw valid conclusions and take needed action" (Miles et al. 108). Creating a data display to represent my findings helped me to visualize my emerging themes and how they related to one another. It was with the act of creating a data display (the first of many) that I began to see the ways in which my findings were connected. Each time I revised my data display, I created a more intricate picture of my case. In turn, this new picture of my case refocused my data collection, data coding, and led me to the creation of a data matrix. A matrix is a tool of visual analysis, a method for gaining a better understanding of the data set which involves the crossing of two or more main dimensions or variables (often with sub-variables) to see how they interact. The descriptive data matrix helped me to lay out my emergent themes visually and gain a better understanding of how those themes operated separately and in relation to one another. The model consisted of rows and columns that conceptualized the different possibilities for my phenomenon of interest on a grid.

Although I had been working with this data for almost a year—I was suddenly able to see my emerging themes in a new way—from the perspective of how the themes visually and conceptually related to one another. Significantly, the intersections of a visual matrix made visible the relationship of parts to wholes. Data matrices perform the concept of the intersection visually and allow for conceptual analysis at the level of individual parts as well as their relations to each other while the data matrix brings new insights to the research at hand. It is this iterative process of making research visible that has tremendous value for scholarship in the digital humanities. Making findings visible at every iteration of the research process shows where the patterns, trends, and even the gaps are—pointing the researcher in the direction for further work to be done.

Five modes of inquiry

I believe that making research visible is an important practice for all scholars in the digital humanities because this process brings us to a fuller, richer, and more rigorous understanding of our data. This is so even if the research data is not inherently visual in nature. The framework features five modes of inquiry, each devised to foster meaningful insights—new interpretations and expressions of our research, unexpected information about our research, and novel ways to represent our research.

1   **Sharpening the pencil—**how can we put design first by starting with low-tech tools and techniques?
2   **Mapping data in time and space—**how can we examine the intersections of time, space, and data to draw out the telling details of a story?
3   **Physical visualization—**how can we gain new insights from our research through the act of building 3-D data sculptures?

4   **Dat(a)ctors—**how can data displays become not only just beautiful information—but useful deliverables that create change in the world?

5   **Data Stories—**how can we collaborate to create a larger project (a web-based visualization, a physical object, installation, or interactive documentary experience) that tells a compelling story with/around/through our research?

I will describe each mode of inquiry in more detail and delve into examples of the kind of work that can grow out of each mode of inquiry, using examples from the Digital Humanities Summer Institute. My workshop there explores how the practice of data visualization can bring new insights to research in the digital humanities. We work together throughout the week to bring insights to our research using the five modes of inquiry.

Sharpening the pencil: how can we put design first by starting with low-tech tools and techniques?

During the workshop, I invite participants to play the role of designers as we take our research questions and our data to literally re-see them from new perspectives. We have probably all experienced data-driven design at some point (it is what happens when our data must fit within the precise boundaries of the specific tool or software that we are using). This week, we shift the focus entirely to design-driven data and discover what happens when questions of design become central to the research itself.

We begin simply with coloured pencils and graph paper because sometimes our more complex tools can paradoxically limit us and get in the way. Writing researchers Charles Kostelnick and Michael Hasset warn that technology can sometimes impede "the student's inclination to think creatively and flexibly about design solutions" (266). The authors propose low-tech strategies and project ideas, such as the hand-drawn production of logos and comics to develop students' awareness of the rhetorical situation as well as to enhance students' aptitude for creativity and invention.

Information designers Georgia Lupi and Stefanie Posavec believe that by shifting the focus away from technology we get closer to the real meaning in the data. In a year-long project titled *Dear Data*, Lupi and Posavec collected and hand-drew their personal data on weekly postcards. We use the *Dear Data* book for inspiration as we grab our pencils and manually gather a quick dataset about our previous day, which includes things we remember happening, things we remember seeing, and things we remember saying or overhearing. We take a few moments to analyse this data, looking for emerging patterns. We briefly discuss ways to organize and categorize our datasets by grouping trends into larger categories which tell a story. What patterns emerge? Why do certain things occur in a certain order? What is surprising or abnormal? Sometimes it is the outlier in our datasets that communicates the most meaningful story. Once we find a focal point of the dataset, we sketch a visual representation of our data. Lupi and Posavec suggest that designers

"explore ideas by sketching and playfully experimenting with form, colour, and materials in a freehand fashion" (288). After the creation of the data–drawings, we add legends to help others understand the meaning behind our data.

After the activity, participants spend some time in small groups, showing each other what they created and, as a welcome consequence, get to know each other better through their data (Fig. 1). To wrap up the activity we take a few moments to discuss what the *Dear Data* activity can teach us about the perspective through which we look at data.

By quantifying our previous day and sketching a meaningful visualization from a small, personal dataset, we find ourselves thinking as designers. Looking at our data through the lens of design "relies on our ability to be intuitive, to recognize patterns, to construct ideas that have emotional meaning as well as functionality" (Brown and Katz 4). This shift in focus is not comfortable for everyone. Some participants first begin by saying that they cannot draw. I respond that artistic ability is not a prerequisite to think originally about datasets—simple lines and shapes can adequately represent a range of ideas. In our discussion, the source of the discomfort becomes clearer; this activity forces us to slow down and think about how we collect, process, and relate to our data and its human story before we begin thinking about visualization tools and techniques—a process that can be unfamiliar.

Some discussion responses:

• I learned just how rigid and unused my creative muscles are.
• I thought this was about radically limiting ourselves by using only pencils and paper. Ironically, the opposite was true.

FIGURE. 10.1 *Dear Data* Gallery (DHSI 2015).

- Only when we understand what we are trying to convey should we bring technology back into the creative process.
- Although this project worked with a small dataset, the theory holds: even when we work with big, complex datasets the whole point is making it meaningful.

Mapping data in space and time: how can we examine the intersections of time, space, and data to draw out the telling details of a story?

Finding a story in the data helps participants understand the meaning in their data. Information designer Edward Tufte claims, "assessments of change, dynamics, and cause and effect are at the heart of thinking and explanation. To understand is to know what cause provokes what effect, by what means, at what rate. How then is such knowledge to be represented?" (Tufte, *Visual Explanations* 9). We quickly find that representing a story is not always intuitive. Our raw data usually consists of textual or numeric values and is often represented in the form of a table with rows of recorded entries and columns of variables. For some, it is a difficult shift to represent data in the form of a narrative. Data researcher Rahul Bhargava created a heuristic from which to draw out the telling details of a story. In the workshop, we use Bhargava's "Finding a story in the data" framework, which he developed for a "Data Therapy" project at the MIT Media Lab's Center for Civic Media. On the Data Therapy website, Bhargava explains: "People understand that stories are powerful, but don't have the scaffolding they need to turn their data into one. This activity introduces a set of "story types" that can be found in data, and uses templates to let people try finding some themselves" ("Finding a Story"). We employ the heuristic to identify different types of narratives including connection stories, comparison stories, change stories, correlation stories, personal stories, and factoid stories, which builds capacity in identifying different kinds of narratives within datasets.

Once we become more familiar with identifying stories, we look at data representation from two perspectives: that of time and that of space. We examine an array of examples—many which are not digital—to learn more about how designers communicate a meaningful story through representations in time and space. Many are already familiar with Charles Minard's 1869 map of Napoleon's disastrous invasion of Russia, through the work of Tufte. We slow down to follow the width of the black line to witness the grim story of how Napoleon's army was reduced to 10,000 soldiers from the original 422,000 through the display of six types of data: the number of Napoleon's troops, distance traveled, temperature, latitude and longitude coordinates, direction of travel, and location relative to specific dates. Tufte claims that "Graphical elegance is often found in the simplicity of design and complexity of data" (*Visual Display of Quantitative Information* 177). Concise yet compact, Minard's graphic communicates a powerful story on an emotional level, as one can easily observe the devastating losses incurred.

As we delve into ways to represent data, we investigate ways to map spatial patterns with data. This includes a discussion of symbol maps, cluster maps, chart maps, and 3D map projections. We also examine the use of legends, keys, symbols, and

colours. Among the many examples, we spend some time with Fathom Information Design's country maps—created only with roadway data. "No other features—no outlines, cities, or types of terrain are marked, yet canyons and mountains emerge as the roads course around them, and sparser webs of road mark less populated areas" ("Countries"). Fathom's depiction of Canada, with its formless northern frontiers, is a particularly striking image. Fathom's maps are clear examples of how a data visualization tells a compelling story and creates meaning through the synthesis of form and content.

After a discussion of critical and creative approaches to mapping in time and space, we engage in a collaborative map-making activity. I pose the question: "What happens when 15 people draw Victoria, BC from memory?" and hand workshop participants some chalk. After a few minutes, a deep data map emerges, which says a lot about participant's experience of the city of Victoria (Fig. 2). Their data map has many layers, represents different kinds of data (from street names to feelings about ice cream), offers narratives, represents ambiguities, and offers multiple voices—not a standard map by any account.

We examine our collaborative map in relation to Lincoln Mullen's Deep Data *Maps*—a spatial humanities resource. Mullen's students created a collaborative map of Boston's religious history with the publishing platform Omeka. Their deep data map "uncovers the assemblages of a place by putting multiple media elements together on a map" (Mullen). Discussing place as a construct, rich with associated meanings and assumptions, helps participants reimagine visualization in new ways.

FIGURE 10.2 Collaborative map-making activity (DHSI 2017).

Then, only after a sustained inquiry into the nature of timelines and maps do we roll up our sleeves and attempt making our own maps and timelines with software. Participants have 90 minutes to 1) Map Data in Space or 2) Map Data in Time. I suggest using Bhargava's "Finding A Story" templates to get started.

Some mapping tools include:

TABLE 10.1 Tools for visualizations in time and space.

Mapbox www.mapbox.com/	Design and publish maps
StoryMap JS https://storymap.knightlab.com/	Tell stories with maps
Kartograph https://kartograph.org/	Build interactive map applications
Timeline JS https://timeline.knightlab.com/	Tell stories with timelines
Exhibit http://simile-widgets.org/exhibit/	Create pages with maps, timelines
Palladio http://hdlab.stanford.edu/palladio/	Analyse relationships across time
Neatline http://neatline.org/	Create exhibits with maps, timelines
Odyssey.js https://cartodb.github.io/odyssey.js/	Combine multimedia stories
Tableau www.tableau.com/	Visualize and share data

After this design activity, participants present in groups, showing each other what they created and the challenges and affordances of the software they used. When we come back together, we discuss what this mode of inquiry teaches us about the perspective through which we look at data.

Some discussion responses:

- Great visualizations provide insight and use data to tell a story in a language that the audience can easily understand.
- We have to ask ourselves—is time a relevant element in this story? Why?
- For reasons of my current project, I've just deleted time from my interests because it complicates my focus on space. Of course, space can't exist outside of time. Or can it?
- Through this mapping activity, I can see that data visualizations not only serve as a way to illuminate findings but also serve as a way to help conduct research.

Physical visualization—how can we gain new insights from our research through the act of building 3-D data sculptures?

We begin this mode of inquiry by examining Mesopotamian Clay tokens, one of the earliest forms of physical data representation, dating from 5500 BCE. Used to

externalize information, "the tokens were concrete, solid, tangible artefacts, which could be handled, arranged and rearranged at will" (Harth 19). Nicole Clouston and Jentery Sayers claim that 3-D models give "researchers not only a sense of what an object may look like in 3-D space but also a feel for how it may be handled and afford certain actions and behaviors" (321). Physical visualization is one of the most helpful ways to help participants see their data in new ways. The act of physical prototyping fosters new interpretations and insights. Building 3-D visualizations sometimes brings to light a telling detail in the data that could have remained hidden or obscured by more traditional modes of analysis.

Participants are encouraged to gather an existing dataset from their research or from an archive. We then head outdoors and take about 90 minutes to get creative (and possibly messy) as we create a physical visualization, a 3-D sculpture, using an array of simple craft materials including twine, beads, foam, pipe cleaners, pompoms, sequins, glue, and tape (Fig. 3). This hand-made data activity builds capacity in translating words and numbers into tangible, structural forms. In rapid prototyping, "the act of creating forces you to ask questions and to make choices" (Kelley and Kelly 130). Workshop participants find that the physical visualization of research is itself research. When participants are given the task to create a data sculpture (a novel way of working for most) they feel a need to return to their data again and again, to understand it more carefully, to look for new patterns and new ways to represent their findings—all of which leads to paths of discovery.

FIGURE 10.3   A participant creating a kinetic sculpture that represents her research question: how can new visual representation techniques and technologies inform our understanding of urban life in the Canadian Arctic? (DHSI 2015).

After this hands-on activity, we talk about the data sculptures and what they represent. In a study on "Evaluating the Efficiency of Physical Visualizations," findings indicate that "when people physically touched the 3D objects representing the data they did a better job understanding the data" (Jansen, et al). One recent workshop participant created a data sculpture out of sequins and cardstock that represented her exercise and meditation practices over the last 60 days. Through this activity she was surprised to see the positive correlation between the exercise and meditation data; when one frequency went down, so did the other. Another workshop participant created a data sculpture to represent his research question: what are perceptions of cultural territoriality in East Harlem as seen in participation in public spaces through participatory mural art? He constructed his data sculpture as a matrix, with different coloured pom-poms and construction paper.

An ongoing theme in our discussion is how the visualizations can serve not just to communicate findings but to advance the research itself. As Laurie Gries confirms in her conclusion to "Mapping Obama Hope,"

> [t]oo often scholars wait until after their research has been completed to use visualizations to present their research findings. While useful, such research limits the potential of digital visualization techniques, which if implemented during the research process can help triangulate our data and support our own rhetorical claims"

> *(Gries)*

Some participants find that the act of creating physical visualizations changes their perspective about their data—some locate gaps in their research or revise their claims. For example, while mapping out research findings with basic materials such as differently sized pompoms, one participant was surprised to notice that she had been overlooking a second major site of her research: "I thought my research was located at one major site and a group of much smaller sites. Now I see that I have a primary and secondary site, along with a scattered group of smaller sites." This simple design activity changed the major findings of her dissertation project.

Some discussion responses:

- Physically playing around with data can be liberating, especially for those of us who can get stuck in our ways.
- I have been working and thinking in "digital mode" for so long, physical activity brought me back to the fact that creation should be holistic, something not always evident when working, (usually with just the left brain).
- This helped create a sensory connection between me and the data. At the same time, it slowed me down. I felt as though it was easier to appreciate the idea of design-driven data and put it into practice when I was (literally) building the visualization rather than if I were putting it into a computer.
- It is interesting to experience how data can be represented in 3D physical data sculpture prototypes and then transformed and remediated into a 2-D representation.

Dat(a)ctors—how can data displays become not only just beautiful information but useful deliverables that do things in the world?

The digital humanities offer scholars a platform to engage the public and to convey the importance of the arts and humanities in everyday public life. Digital writing scholars Jennifer Glaser and Laura Micciche relate that

> A number of public humanities programs are using DH as an inspiration to participate in social justice and advocacy as well as archival activity with a social purpose and that efforts to link the humanities and digital media can construct new and evolving sites of relevance for humanities research, an outcome that is crucial for the future of the humanities.
>
> *(207)*

One way that digital humanities scholars can engage publics is through data visualizations that serve to create social change—I call these data(a)ctors. Dat(a)ctors serve as useful deliverables that are designed purposefully to foster community engagement. We examine how data displays themselves can become not only beautiful displays of information but also serve as useful, real-world deliverables with a social purpose. Rather than merely visually enhancing our research (or making it pretty), the act of visualizing data for a community can bring completely new insights and unexpected findings. We discuss a variety of dat(a)ctors, including data sculptures, data murals, and deep data maps.

Falling Fruit is one example of a data project that strives to enhance public understanding and engagement. Falling Fruit is a web app and growing resource that invites users to indicate where they locate edible food on public land. The founders of Falling Fruit—Ethan Welty and Caleb Phillips—seek to change our food system and create more sustainable cities in the future: "By quantifying this resource on an interactive map, we hope to facilitate intimate connections between people, food, and the natural organisms growing in our neighbourhoods" ("Falling Fruit"). Liza Potts, experience architecture scholar, suggests that "rather than building systems that prioritize data above experience, we need to architect archives that are focused on engagement with scholars and outreach with the public" (Potts 255). Using the publicly available Falling Fruit web app, my course participants interacted with the app, locating edible strawberries, blackberries, currants, plums, and grapes on the University of Victoria campus.

Other examples of dat(a)ctors include both historic and contemporary data murals, such as Diego Rivera's mural The History of Mexico from 1521–1930. This illustrated timeline, located in the stairwell of the National Palace in Mexico City, depicts the Mexican people uniting against a range of common enemies. Such persuasive visual representations of information contributed to the formation of a strong nationalist identity after the Mexican Revolution. Continuing the rich

tradition of murals and social change, we examine Bhargava's work with participatory murals in Brazil. Honouring the lived experiences of his participants, Bhargava's mural project "allows a community to come together to look at their own data, find a story within it that they want to tell, create a visual design that tells that data-driven story, and then paint it together as a public mural" (Bhargava et al. 198–199).

Inspired by the concept of dat(a)actors, a group in my workshop created a participatory sidewalk chalk art project during DHSI 2017 (Fig. 4). Beginning with the question: how does the DHSI community respond and express themselves through participatory art? The group invited participation from the DHSI community on the sidewalk with guiding arrows and messages as well as on social media (such as Twitter and Instagram) using the hashtag #dhsiguerrilla. Through this project, the group sought to capture the visual story of the collective DHSI experience.

In the workshop, we embark on a prototyping activity which encourages scholarly exploration and innovation. Participants are given an hour to create a proposal for a dat(a)actor project that concerns work which matters to the public and focuses on the intersections of the public, the digital, and the humanities. To wrap up the activity, we discuss our experience. How did the act of creating dat(a)actor prototypes change the perspective through which we look at data? Some discussion responses:

- One way to accomplish this is to invite constituents and stakeholders to contribute to or be involved in the data design.
- What is the best way to engage digital non-natives in digital projects?

FIGURE 10.4   The participatory sidewalk chalk art project (DHSI 2017).

- Combining quantitative data with qualitative data gives depth and a human dimension to work that matters to the public.
- I loved this section on dat(a)ctors. Something clicked, bringing all of our work, thus far, together.

Data stories—How can we collaborate to create a larger project that tells a compelling story with/around/ through our research?

To conclude our workshop, small groups collaborate on a larger project that brings together our explorations in data, design, and storytelling.

Working in skills-based teams, participants brainstorm and prototype a data story over the five-day workshop—specifically, an interactive narrative experience that tells a story with/around/about data. Options for groups include:

- Research project (new or ongoing).
- Data visualization.
- 3D sculpture.
- Interactive documentary.
- Online exhibition or installation.
- Data mural.
- Archive project.
- App (or prototype for an app).
- Informational website/resource.
- Grant proposal (for example, NEH ODH).
- Article or web-text.
- Scholarly panel proposal for a conference.
- Pedagogical/scholarly resources, class activities, syllabus.

Potts suggests that many digital humanities projects are "focused on serving up material—images, texts, and videos—rather than engaging with participants. What these archives in practice and the digital humanities in general desperately need is a sense of audience, appeal, and interaction" (255). Groups in the workshop are challenged to craft narratives that emerge from their findings and that reveal meaningful patterns, trends, and insights. Data stories strive to foster more meaningful, people-centred experiences, not only in the final product but in the research design itself.

To foster collaborative digital humanities projects, groups work from the following guiding questions:

> What is the problem we're trying to solve? What is the ultimate impact we're trying to achieve? Who are our potential stakeholders/participants? How can our audience participate or meaningfully interact with our project? What are some possible data collection strategies? How can we interrogate the data for validity? How will we craft a narrative that features stories (important patterns or trends) in the data? Which data stories will be prioritized to support our underlying narrative? How can our audience/participants contribute to
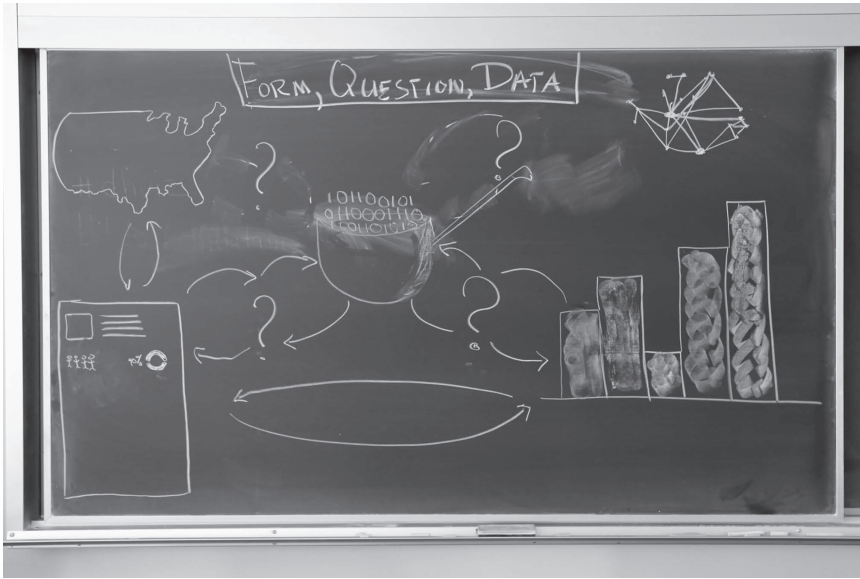
FIGURE 10.5   A collaborative visualization (DHSI 2015).

or co-create the project? How will we design a useful and engaging experi-ence with (or for, or through) the audience?

Collaborative data stories from DHSI 2017 ranged from empirical studies to imagi-nary maps. Groups presented projects on the final day of the workshop, including:

> An interactive timeline that answers the question: what is the pattern of recent refugees in Vancouver, British Columbia?
>
> A dear data project and conference proposal that answers the question: what are the lived experiences of women in academia?
>
> A collection of alternative geospatial mapping projects that answers the question: how can we visually represent imaginary places (From El Dorado in Voltaire's *Candide* to factories in Marx's *Capital*)?
>
> A mixed methods study that answers the question: how does the DHSI community respond and express themselves through participatory art? Did the DHSI community engage more in the physical environment (using chalk) or in digital environments (using Twitter and Instagram)?

To wrap up this week-long exploration of data visualization in the humanities, we discuss how our experience of creating data stories changed the perspective through which we look at data. Some discussion responses:

•   It seems that anything can be quantified and visualized now—even the way readers bond with fictional characters or the ways different readers imagine a fictional place in a text.

- Putting design first allows us to focus on the human story. Tools and methods of analysis come later, once we know the question that's driving the story.
- In storytelling, it's imperative to show the affective dimensions of data.
- A design–driven story means that you have to choose the right tool to communicate with your audience but not let the tool drive your story.

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