3DH Report on First Phase, April-June 2016

Johanna Drucker, August 2016

Overview

In April, 2016, at the start of three months of collaborative research towards the 3DH project, Christoph Meister set us the goal of thinking about designing the next generation of visualizations in the digital humanities. Taking that vague and ambitious goal into a concrete research project involved administrative and intellectual challenges which we worked out in a coordinated and iterative manner. The initial phase of this project was used to establish the groundwork for writing a grant to create the 3DH design and implementation. We were not trying to accomplish this work in this period, but arrive at basic working concepts and parameters, define scope, and articulate a basic paradigm of what 3DH would be. Still, we tried to keep future implementation strategies in mind, cognizant that technical and functional feasibility should factor into the design process.

Since we were framing our thinking around a "next generation" of visulizations, we began by examining existing programs, platforms, and conventions. How are they limited (conceptually, technically, visually), and what we might need or want to add to them if they were to work for interpretative work in the humanities? Given the vast array of existing visualization programs and libraries, designed for a panoply of uses, we wanted to establish criteria for justifying 3DH on epistemological as well as visual grounds. Current visualizations are limited by the assumptions they embody and their modes of expression. Bluntly stated, they are based on representational paradigms. They make use of a set of elements (timelines, charts, graphs, etc.) with attributes to display, query, and facet data in visual formats. They are not environments for doing interpretative work, nor do they support a critical conceptualization driven by hermeneutic, rather than representational, principles.

Because they are representational, they are subject to another set of criticisms. Conventional visualizations are declarative statements in graphical form that obscure the intellectual processes by which they come to have the form in which they appear. Even when they support faceted search, query, and a high level of granularity in sorting what appears in the visualization, conventional platforms do not allow direct modification or interpretative input into the underlying data through the display. The vocabulary and syntax of existing graphics does not lend itself to engagement with hermeneutical principles or strategies in presentation of interpretative dimensions of humanistic arguments.

Through our discussions, the definitions the 3DH project became increasingly clear. We established a common set of use cases as reference, worked through various structured exercises, and engaged in extensive conversation and planning. (See Appendix A) In the process, we articulated a distinction between what we termed the "inside" of the 3DH frame and its outside. Inside the frame was the working space in which a visualization could be imported, created, modified, and saved. Outside the frame were the considerations of infrastructure, community, values, practices, sustainability, and institutional practices. Inside and outside are integral to each other, linked, and co-dependent. However, the structure of what is *outside* the frame (practices, communities, infrastructure etc.) resembles that of other digital projects and platforms (as is the case with Omeka, Voyant, Catma, each of which is distinct inside its frame), while the specifics *inside* the frame are distinct, a unique contribution (as with these other projects). In addition to the principle that 3DH should support interpretative activity, we endorsed the notion that it had to be able to support intellectual work across the lifecycle of a project and be a site for producing interpretation, not merely displaying it.

During the three months, we laid the foundations for work ahead, but did not have time to develop the project design, write scenarios of use, and work on implementation strategies. 3DH may result in a related set of strategies and projects, or, it may become a

specific platform with a suite of graphical features, but the conceptual frameworks and principles of the project are shared. 3DH is meant to augment existing visualization conventions in order to serve epistemological activity specific to the humanities. We are trying to create a set of graphical semantic and syntactic conventions that will support and express the partial, situated, interpretative character of humanistic approaches to research, scholarship, and knowledge. These could prove useful outside of conventional humanistic work, in areas of policy, politics, analysis, and other fields in which human experience and knowledge are in play and where positivist paradigms have been subject to substantial revision and critique.

What distinguishes 3DH from other visualization environments/platforms inside or adopted by the digital humanities, is its epistemological premise. 3DH is not a set of semantically determined widgets or elements (e.g. timelines, mapping components, charts etc.). 3DH is an environment for knowledge generation and production according to principles of critical thought. Rather than being comprised of a set of graphical components (such as, in the case of timelines, points, lines, events, and intervals), 3DH is a graphical system to be used for interpretative activities (parallax, viewpoints, annotation layers). It is made to express interpretative acts, not information, and the structural components of the system are conceived as intellectual dimensions of interpretative activity. To reiterate: 3DH is not comprised of features of a semantically encoded graphical set (such as what would show up in a map legend: roads, cities, rail lines, churches, schools, etc.) or of display conventions (map, chart, timeline, graph). 3DH is structured as a set of conceptual components to be used to create or express interpretative dimensions of hermeneutic activity. These can act on conventional images or visualization types, but 3DH strategies alter the data and data models directly. This makes 3DH a high level intellectual-graphical system to be used as a primary instrument of research, modelling, speculative and theoretical engagement with interpretation. 3DH is organized around theoretical principles, epistemological elements, graphical activators, and the active use of dimensions of interpretation. This may sound abstract, but once embodied in sketches and prototypes, the advantages of the approach should become apparent as a tool for interpretation.

Working methods

During the three months, April to June, 2016, we had weekly working sessions, attended lectures, and created documentation of our processes (see www.threedh.com and Appendixes here). Smaller, break-out sessions also took place, along with occasional engagement with visiting scholars—either to workshop an aspect of 3DH, or to address their projects to inform our own. Continual iteration and revision, rethinking and planning, were all part of the process which generated a series of work plans, including roles and responsibilities. A set of charette/studio session plans were drafted, including those that focused on the "inside" of the frame. An additional set of exercises for taking design principles into case studies and into the development of the 3DH environment were also crafted. These documents bear a strong imprint of my ambitions and goals for 3DH, though they were developed in conversation with my colleagues and the other team members. Only some of these actually resulted in concrete outcomes, given time constraints, but the documents provide directions for work ahead. (See Documentation, Appendix A)

The research team consisted of myself, Geoffrey Rockwell, and Chris Meister as faculty leads, and students Jana Berens, Rabea Kleymann, and Evelyn Guis as humanities researchers, with Marco Petris as the professional programmer/technical consultant. We conducted numerous charettes and work sessions to define the project, assess existing visualizations, consider the intellectual and technical development, work through case studies, and create some preliminary plans for longer term design implementation. We kept in mind the need to break the problem into manageable tasks (such as looking at existing platforms and projects), setting milestones, creating problem sets, keeping the

project scope in mind, and seeing our work as preparation of various modules for grant writing. Building consensus about the project ("What is 3DH?") and aligning tasks and responsibilities with interests and expertise was another aspect of the work.

Principles of Design

The development of the project was guided by several principles, also developed in conversation among the principles and the research team. These are the a commitment to the **two-way screen**, an investigation of **interpretative dimensions**, and a belief in the value of **humanistic methods**.

A commitment to the **two-way screen** suggests that it serves as a graphical environment in which interpretation takes place, not only gets displayed. (This is a principle that we adopted in the Temporal Modelling Project (UVA, 2001-5), in which the graphical interface, built in Flash, generated XML output.) This means that actions taken using any graphical feature as an act of interpretation are registered as data and/or change the data model on the fly. The screen is a two-way environment, in which the display supports direct action through the graphics. Thus the screen is a place in which to perform interpretation, not just display it. The principle is to get away from the flat screen as a space of display, adding the additional dimension of interpretative activity. This approach is not simply a matter of finer grained display of faceted search and query on existing attributes of a data set, but has to involve an explicit act of interpretation, not merely a declarative statement or presentation.

In the investigation of **interpretative dimensions**, hermeneutic work is defined in distinction from mechanistic activity. Acts of interpretation are interventions that cannot be engineered algorithmically. While recognizing that algorithmic activity is itself interpretative, grounded in (often unexposed) epistemological and hermeneutic assumptions, the 3DH environment is meant to support work that has an explicit interpretative aspect. In particular, 3DH is intended to add the dimensions of interpretation not currently supported by other visualizations. These include such dimensions as ambiguity, situatedness, historicity, contradiction, and other epistemological dimensions to be specified by individual users.

The belief in the value of **humanistic methods** is based on the idea that these (above) approaches to knowledge production are fundamentally different from those of positivist models used in other fields, notably the natural sciences, and, to some extent, the social sciences, where empirical approaches are founded in an observer-independent concept of knowledge. In 3DH, the methodological assumption is that interpretation constructs an object through inquiry in a co-dependent relation. In particular, the interpretative dimensions of humanistic methods include the realization that knowledge is always partial, situated (historically, culturally, and enunciatively), and constituted by an interpretative act (thus, non-self-identical, non-reproducible, contingent and co-dependent upon hermeneutic activity). Objects of epistemological inquiry do not exist outside of the inquiry, but are constructed by it, through activity that is situated in historical, cultural, and individual viewpoints that make arguments based on evidence (documents, artifacts, objects, etc.). Creating an environment that shows these principles and supports this activity presents some challenges, mostly to entrenched ways of thinking in conventional formats.

Focus on "Inside the Frame"

My research is focused "Inside the Frame," so I will discuss this aspect of the project in more detail here (supplemented by the Appendices, below). From my perspective, this is the core of the project, the place where the intellectual and design components come together to create an innovative approach to visualization. The "inside" of the frame refers to the bounding of a work area, a visualization space, which is necessarily connected to data streams and sources, human communities of users, platforms and infrastructure, practices, institutional sites, and considerations of sustainability. These

aspects of the project are not to be discounted, since no project can develop without both. But the innovative strength of 3DH is in the ways the various components "inside" the frame express the epistemological design of the project. Each has implications for the data models to be used and generated by the activities that take place in the working environment. Each component is part of a systematic analysis of visualization strategies that sets up an equally systematic approach to design and implementation at the intersection of conceptual/epistemological and functional/technical requirements.

The "inside" components are articulated independently. Though they are all part of a single integrated environment, they have different design requirements. The first, **epistemological dimensions,** had to be defined conceptually and also linked to graphical/visual strategies. The **visualization types** have to be used as a basis of testing the epistemological dimensions, as well as the **graphic activators**. The graphic activators (or strategies) are the design variables in static and dynamic environments, and the methods of activating **three-dimensionality** are a means of integrating the epistemological and interpretative moves in an innovative approach to incorporating humanistic principles into visualization.

Epistemological / Interpretative Dimensions: Some of our earliest conversations concerned the identification of interpretative dimensions. These are the dimensions that can be shown in 3DH and that cannot be shown in other visualization programs or platforms. These dimensions organize the conceptual structure of 3DH as a set of implementable interpretative moves. They are linked to graphical strategies and to data models. How, for instance, can "ambiguity" or "contradiction" be visualized as an aspect of an argument in relation to evidence? The list of epistemological dimensions we came up with is not exhaustive; it is a starting point. It is extensible, and customizable. The graphical elements can be accompanied by labels as well as making use of inherent or suggestive aspects of graphical features. In our final design charette, we worked through one set of experiments that generated some ideas about how a semantics (iconography or graphical attributes) and syntax (relations among elements or elements over time) might intuitively signal some of these dimensions. The results of that charette are online. Our representative list included:

Parallax
Unreliability (inconsistency)
Contradiction
Ambiguity
Uncertainty
Incompleteness (partial knowledge)
Analogy
Probability
Salience

In each case, imagine that the visualization is meant to answer the question, "How would you show _____?" The visualization is meant to be a dimension added to a graph, chart, diagram, map, timeline, rendering, or other conventional image of data, information, or evidence, not a simple set of icons or elements. These components are not meant to be representations of "contradiction" but performances of it within an interpretative strategy. Each interpretative dimension has implications for the data models required or created (interpellated, discrete, continuous, partial, incomplete etc.). (See Appendix D).

Visualization Types

We made a systematic list of the visualization types commonly used in digital humanities work. Each of these will be explored in connection with the interpretative dimensions (above) and the graphical generators (below).

Facsimiles (images, texts, prints, photographs, pictures, manuscripts etc.)
Tables (structured data in tabular formats and relations)
Charts (graphical expressions of quantitative information)
Graphs (directed nodes/edges)
Maps
Timelines
Simulations/Renderings

Graphical activators or features
These features comprise a basic paint-box within the 3DH environment. These may be applied to the visual surface of any visualization. They carry semantic value, but their value is not necessarily fixed since it can be customized for individual projects or uses. They are culled from Jacques Bertin's "Seven graphic variables," and Leland Wilkinson's *Grammar of Graphics*, which extends the static graphical components of Bertin's analysis to a dynamic visualization environment. In the future, these will be the subject of a systematic analysis and exploration in relation to the other components inside the frame.

Tone (white to black/brightness)
Value (saturation)
Color (hue)
Transparency
Texture
Shape
Orientation
Position
Size
Resolution
Blur
Direction of motion
Rate of movement
Acceleration
Rate of change
Duration
Form
Surface
Motion
Sound: tone, volume, rhythm, voice
Text

Techniques for using 3-dimensionality (and 4th—time/change/animation)
The inside of the 3DH frame includes explicit and systematic use of techniques for adding 3-dimensionality—literally and figuratively—to visualizations for the explicit purpose of showing interpretative dimensions of scholarly work. These are culled from pictorial conventions in the visual arts, architecture, animation, and speculative computing. Each is enacted through specific graphic techniques and visual effects whose semantic properties draw on historical conventions of pictorial work. They also introduce conventions that are intuitively legible (based on user testing and design work) such as splitting a screen, adding vanishing points, using projection, tilting or rotating a visualization, slicing through displays, and arranging information along arrays and vectors in various ways. Again, this list is not meant to be exhaustive:

Perspective
Orthogonal use of z-axis
Projection (one plane to another, or coordinate mapping)
Dimensionalization (rendering/movement around)
Shadow casting
Scale change
Multiple views (top, side, etc.)
Tilt
Generative metrics
Relative scales

These **epistemological dimensions, visualization types, graphical activators** and **3-dimensionalizations** are the basic components of a 3DH system that is a graphical approach to interpretative work. Laying out this system, and outlining its components, was the core of the work in the first phase for "Inside the Frame" planning. In addition to this distillation, and alongside it, as part of the initial exploration, I designed a set of exercises to explore 3DH concepts and develop the designs. (see Appendix C).

Future work

The first phase of the 3DH project was extremely generative, and the systematic outline and distillation of the "inside" of the frame was echoed, to some extent, in thinking about what is "outside" the frame—in particular, the need to develop use cases, scenarios, personae, to develop the landscape scan on existing programs and platforms, and to think about the implementation strategies and approaches. Again, these components are not specific to 3DH (all projects need them), but must be developed for it with some specificity. We spent some time looking at the difference between a "Grammar of Graphics" programming approach to creating visualizations and "Notebook" model of scripting in collaboration with descriptive activity. Implementation seems far off, at present, since the inside of the frame needs considerable development first. Too many humanists imagine that design is the implementation of intellectual activity, a solution to a well-worked out problem, rather than the generative zone of activity itself. I believe the graphical development is the core of the intellectual 3DH project.

My goal is for us to develop the 3DH project in a concentrated work/studio environment where the inside of the frame components can be explored systematically, user tested, and applied to case studies as a proof of concept. I see a number of ways for this to happen, in collaboration with researchers/colleagues at home or abroad, in short term focused studio work sessions or more distributed environments or in contexts with longer duration. We have an outline for this development, but the design work that it is fundamental to the epistemological principles of the project is still ahead. This work requires expertise in visual, graphical, and computational design so that the development of the epistemological principles aligns models of data production with graphical activity.

My own, inadequate, sketches are posted in a gallery online as a way of beginning, at least, to think about what we might explore ahead.

Appendices

A. Documentation

We documented much of the work planning, and these documents are available online:

> **3DH Workplan and Roles:** An Overview of the Project stating the contribution we are trying to make, some of the principles guiding its development, the need, state of the field, some project design specifics, and research/work tasks.
>
> **3DH Charette Planning**: A plan for the final weeks of phase one, with plans for work sessions on 1) graphical activators; 2) case studies; 3) inside/outside the frame tasks; 4) future planning.
>
> **3DH Inside the Frame:** A focused outline for developing the A) Case studies, B) Epistemological dimensions; C) Across Visualization types on the design and conceptual issues); D) Graphical Generators; and E) Techniques for 3-dimensionality.

B. Cases

We chose a set of specific cases to guide our speculative work. This allowed us to consider particular issues rather than general ones. It gave us common references for discussion and also gave us a checklist of visualization types and intellectual problems (mapping, mark-up, twitter, timelines, graphs, charts, and diagrams). Without going into elaborate detail, here are the cases:

- Jamaican Slave revolt: History (map, timeline, texts), relation of argument to evidence; specific geographies, partial knowledge (already interpretative—but can we supply a way to make the argument apparent—argument layers?) This is a project originally executed by Vincent Brown at Harvard, with whom I had been in discussion. We used it as an example of the relations between evidence, argument, the rhetorical force of mapping, and need to expose the historical specificity of information as well as the agency of landscape.
- Twitter: Data vis, social media (charts, plots, network graphs) Can visualizations be designed to see into the original "data" and deal with "mass data" and the hairball problem, use faceted search/query, and then return interpretation through the graphical interface. While this is in many ways a granularity and mechanistic visualization problem (display of faceted query), the engagement with the two-way screen and ability to inflect the data through a graphical markup makes it integral to the 3DH project. This is Geoffrey Rockwell's Voyant project.
- Goethe, Abstinence, and Irony: (text also data, mark-up) Visualizations will be used for analysis, to show where, how often, and in what ways irony can be detected and called to attention in Goethe's later work. The markup will have to be a deliberately interpretative act, since irony cannot be detected mechanistically. Input of secondary levels of interpretation once the marked text is displayed would push the use of 3DH back into mark-up at a metalevel. This is Rabea Kleymann's research project, supervised by Chris Meister.
- Archaeological site: Objects, classifications: Archaeological: Fluid/diverse taxonomies / resource allocation / naming (tables, maps, classification system, dating) Figure out the data types, parameters, visual annotation etc. A speculative project, but one that put objects into 3DH, as well as providing a test case for diverse taxonomies.

- Catma_heureCLÉA: Text analysis The structured data / markup makes the hermeneutical dimension very explicit, but highly layered and complex. The visualization serves to make it legible, and allow the mark-up to be queried, studied, and altered. This was Evelyn Guis's project, with Chris Meister.
- Alphabet historiography: This project uses materials from the historiography of the alphabet to expose various models of historical time that do not conform to a single, contemporary, baseline and vague geographies that cannot be mapped conventionally. The challenge is to create multiple, diverse, models of historical timelines and models of temporality and geography. I call this a relative (or diverse) taxonomies problem.

C. Exercises for working through the design problem (see Charettes for details).
Problem sets were designed for the charettes, and though they were not systematically explored, they were written out as a basis for more work. They were meant to be used as the basis of storyboarding activity.

- Exercise for Cases: Take the Slave Revolt map as a case, look at it, ask how do you implement the graphical display of each of the epistemological/interpretative primitives? TO do this, work through the graphical primitives systematically. Repeat for each of our cases;

- Exercise for Graphics: Work through graphical exercises and see what is suggested (intuitively) by each graphical feature (blur suggests what? Mis-alignment suggests what? Etc.)

- Exercise for Epistemological/Interpretative Primitives: link to graphical exercises, but also, work from these into graphical language/syntax.

- Exercise for Visualization Types: Apply graphical approaches and epistemological/interpretative primitives to visualization types; include the 3-dimensionalization techniques in particular.

- Exercise for 3-dimensionalization: Play with these techniques and explore what they suggest in terms of how they can hold/carry interpretation as a third dimension (literally, but also, conceptually).

- Exercise for use cases/personae: Design user personae and create scenarios for use of the 3DH platform.

D. Data models and Epistemological/Interpretative Dimensions
This is a crucial piece of the "inside the frame" thinking. The concepts elaborated here, while not exhaustive, are meant to suggest some fundamental dimensions of interpretative work, dimensions that are simply not supported or visualized in any way in current information visualizations. They have to be understood in or linked to data models. What kind data do they generate, express, or depend on? Because of the importance, and conceptual complexity, of these dimensions, I'm sketching some ideas here rather than including them in the text above.

Parallax:
: Expressed as a single data point, but existing within two intersecting systems—parallax on a word might be grasped as a word that functions medically and metaphorically, depending on use

Unreliability:
: Could be expressed as inconsistent values, or values that change based on a set of conditions, not always predictable or under control, thus, according to a random variable or a conditional variable.

Contradiction:
: Expressed as two values simultaneously occupying the same or related positions. This is a both/and situation but should carry some negating force in the relation of each term to the other.

Ambiguity:
: Also expressed as two values simultaneously occupying the same or related positions. Could be more than two values—something might be ambiguous in a number of ways, not just two—but both/all are held as valid.

Uncertainty:
: Expressed as a matter of degree, with a value attribute.

Incompleteness:
: Partial data, missing values, missing structural features in the table, array, or other structure. Can be an incompleteness in relation to an implied whole (defined incompleteness) or in relation to an undefined whole (undefinable incompleteness).

Analogy:
: Expressed as a correlation of some feature, attribute, or property held in common between data models, but stopping short of complete redundancy.

Probability:
: Expressed as a set of conditions and their likely distribution across a curve.

Salience:
: Expressed as an attribute value on a scale that can be discrete or continuous, labeled or graphical.

E. Reports Online

I reported on this work several times in Spring 2016, during the Phase I period: University College London May 25, the Fachhochschule in Potsdam, June 13, and in a lecture at the Universität in Hamburg on June 6 (accessible online). Geoffrey Rockwell produced blog entries for each of the Thursday lecture. And a considerable amount of material is publically available through links to the 3DH blog: http://threedh.net/