

In Defense of Sandcastles Research Thinking through Visualization in Digital Humanities

Uta Hinrichs (University of St Andrews; uh3@st-andrews.ac.uk)

Stefania Forlini (University of Calgary; sforlini@ucalgary.ca)

Bridget Moynihan (University of Edinburgh; bridgetc.moynihan@gmail.com)

ABSTRACT

Although recent research acknowledges the potential of visualization methods in digital humanities (DH), the predominant terminology used to describe visualizations (prototypes, tools) focuses on their use as a means to an end and, more importantly, as an instrument in the service of humanities research. We introduce the sandcastle as a metaphorical lens and provocative term to highlight visualization as a research process in its own right. We argue that building *visualization sandcastles* provides a holistic approach to cross-disciplinary knowledge generation that embraces visualization as (1) an aesthetic provocation to elicit critical insights, interpretation, speculation, and discussions within and beyond scholarly audiences, (2) a dynamic process wherein speculation and re-interpretation advance knowledge within all disciplines involved, and (3) a mediator of ideas and theories within and across disciplines. Our argument is grounded in critical theory, DH, design, human computer interaction (HCI), and visualization, and based on our own research on an exceptional literary collection. We argue that considering visualizations as sandcastles foregrounds valuable insights into the roles of visualization as a mindset, methodology, and praxis within humanities research and beyond.

INTRODUCTION

*A Pivotal Scene: A steering committee meeting for a large-scale DH project that aims to apply visualization to help analyze a literary collection. As the discussion starts to focus on the intended project outcomes, questions arise about the visualizations. What role do visualizations play as part of DH projects? What makes them a valid contribution? One committee member brings it to the point: “Are we building **tools** or **just sandcastles**?”*

This question contrasts sandcastles—tailored, unique, often stunning yet also transient and unstable interactive visualizations—with more pragmatic, functional and transferable visualization tools. This framing is a provocation, as these approaches are not necessarily diametrically opposed, but can exist along a rich continuum. And yet, preferences toward the latter are evident in recent DH discussions (Gibbs and Owens, 2012) and in a push by funding bodies toward research with concrete, high-impact outcomes (see Wright, 2016).

With roots in cartography, statistics, graphic design, and computer science, visualization is an inherently interdisciplinary research field “concerned with showing quantitative and qualitative information, so that a viewer can see patterns, trends or anomalies, constancy or variation, in ways that other forms—text and tables—do not allow” (Friendly, 2008; 502). Defined as “the use of computer-supported, interactive, visual representations of abstract data to amplify cognition” (Card et al., 1999; 6), visualization can be considered an “external aid” to facilitate—not automate—quantitative and qualitative analysis processes (Card et al., 1999; Munzner, 2014, Chpt. 1), potentially within any research discipline or practice. It can be used to communicate existing insights, knowledge, or arguments and/or to facilitate the exploration and analysis of data in order to arrive at new discoveries (Munzner, 2014, Chpt. 3). In the

context of DH, visualization has proven valuable in the interactive representation of information from multiple perspectives in order to facilitate interpretative activities (Sinclair et al., 2013).

Across different disciplines, but in particular in the context of DH, visualizations are often referred to as prototypes or tools—means to certain ends—that are largely evaluated in terms of the concrete outcomes they facilitate. However, this overly pragmatic approach risks overlooking the research value of visualization and relegating computer science and design to service-based roles. To begin to reconsider the role of visualization in DH and to promote mutually beneficial cross-disciplinary collaborations, we recall the tool as detour through the metaphor of the *visualization as sandcastle*, and assess (retrospectively) what visualization has been in our own work:

- An *aesthetic provocation* to promote critical interpretation,
- A *speculative process* that advances all disciplines involved, and
- A *mediator* that fuels an open-ended participatory discourse between disciplines.

This article is, in part, the story of our own productive detours, and what we have learned by ‘passing through’ different visualization sandcastles. We introduce the sandcastle as a lens to practically, creatively and critically engage with visualization. While we discuss the potential of visualization sandcastles in the context of humanities research and practice, we see this potential of “sandcastling” in all disciplines that apply visualization. In contrast to “sandboxing”—a term commonly used in computer security to describe a typically simulated, (digital) space that allows for safe experimentation under secure but constrained conditions—“sandcastling”, as we see it in the context of visualization, is directly integrated into “real-world” cross-disciplinary practices. The resulting interactive visualization sandcastles are dynamic, transient, maybe playful in nature but have profound impact on the ways in which we think about data and the types of questions that they raise.

We start with a discussion of the terminology commonly used to describe visualizations and other computational means in the context of DH in order to defamiliarize and disambiguate this terminology through the metaphor of the sandcastle. We then introduce this metaphor and its characteristics, drawing from critical theory, DH, design, HCI, and visualization research. This is followed by a discussion of our own work on visualizing a unique literary collection which illustrates how the sandcastle metaphor can highlight the value of visualization processes driven by experimentation, speculation, and cross-disciplinary discourse. We assert that, although largely invisible in our resulting visualization, the many *visualization sandcastles* we built were fundamental to our process and manifest our *research thinking through visualization*. We conclude by discussing how the sandcastle can be practically applied as a mindset, methodology, and praxis drawing from existing paradigms in visualization and HCI. We hope to promote visualization as a research process that facilitates profoundly cross-disciplinary collaborations between humanities and visualization research (not engineering!): research thinking through the creation of visualization sandcastles.

TERMINOLOGY: PROTOTYPES, TOOLS, MODELS

Visualizations and other computational artifacts are often discussed as *prototypes*, *tools*, and *models* across the fields in which they are deployed. These terms are typically taken for granted, with their very ubiquity rendering them familiar and seemingly beyond the need for rigorous definition, even in technology-related fields that have predominantly shaped them. Such ambiguity compounds as these terms migrate across disciplinary boundaries into the humanities, where the swift evolution of DH has led to gaps in the critical theorization, interrogation, and use of the digital artifacts largely grouped as “prototypes”, “tools”, or “models”. Moreover, as Underwood suggests, the merit of these terms in technology-related fields has led

some humanists “to think of computer science as an instrumental rather than philosophical discourse” (Underwood, 2014) and to eschew theories from other disciplines when engaging with these terms and technologies in DH.

In order to emphasize the importance of the non-instrumental and playful intervention of the visualization sandcastle within the media ecology of prototypes, tools, and models, we first trace some of the dominant, albeit shifting, uses of these terms within DH and technology-related disciplines. Although certainly not exhaustive, this discussion reveals two crucial similarities that inform common uses of these terms and that our concept of sandcastling seeks to destabilize in the context of visualization. First, there is a repeated emphasis on scale [1] and a commitment to defined objectives as realized through stability and generalizability. Second, these terms are overwhelmingly understood as means to specific ends, suggesting an underlying instrumentalist understanding of technology—one which we would do well to reconsider, as Bruno Latour (2002) suggests.

The prototype is typically understood as a *proof of concept*, defined in computer science and design as a manifestation of an idea used “to test possibilities and share it with stakeholders (managers, collaborators, prospective users)” (Arrigoni and Schofield, 2015; 26). In the context of DH, Galey and Ruecker nuance the prototype, describing it through three functions, that of *tool*, *experiment*, and *theory*. As a tool, the prototype serves specific ends, namely “providing an affordance for people carrying out a given task.” As an experiment, the prototype functions as a process that is run to “test a theory” over an extended period of time. As an argument, the prototype serves as a “reification or embodiment of a theory or idea” (Galey and Ruecker, 2010; 19-21). Thus, prototypes grapple with scale and a desire for stabilization, whether as early or scaled-down versions of a tool, by testing smaller datasets, making data visible, or manifesting ideas in concrete form. Interestingly, in this discussion *prototype* becomes conflated with *tool*, and, even as an experiment or an argument, the prototype is determined by a desired end (to provide evidence for a theory or advance an argument), rather than being understood as an object of inquiry with its own mediating characteristics.

When we follow on from prototypes to tools, we are confronted with a similar diversity of definitions that focus on the use value of tools. For example, Donna Haraway (1991) refers to tools as “stories” that enact critical interventions; Alan Liu asserts that tools can either refer to (post)modern technologies such as algorithms that “connote precision, analytical metrics (they measure and provide feedback even as they operate)” or to earlier technologies, like axes and musical instruments, that have more open-ended uses associated with them (in Bulger et al., 2011; 273); and N. Katherine Hayles (2012) draws on anthropology to define a tool “as an artifact used to make other artifacts” (90). Recent theoretical works in DH show a particularly focused effort to segregate tools from other modes of interpretation, as seen for example in the work of Ramsay and Rockwell (2012), who argue that “where there is an argument, the artifact has ceased to be a tool and has become something else” (79). They suggest that tools be approached in such cases as “hermeneutical instruments through which we interpret other phenomena” (Ramsay & Rockwell, 2012, 79). Furthering this separation of tools and hermeneutical instruments, Rockwell and Sinclair introduced the term “hermeneutica” to refer to specifically interpretive tools—which they understand as things to think with and through [2]. They contrast “instruments—things that are used to examine something else” and that typically “become transparent” (invisible) when they work well”— and “models” or “formalized interpretations of cultural objects” (Rockwell & Sinclair, 2016, 162-163) [3]. As DH develops, then, understandings of the term tool are becoming increasingly focused on stable technologies that perform specific tasks and are being separated from the interpretive practices engendered by these tools.

Rockwell and Sinclair's discussion raises the question of models in DH, and just as with prototypes and tools, their definition and distinction from other terms are blurry. Indeed, Willard McCarty maintains that "despite its prevalence and deep familiarity in the natural sciences, a consensus on modeling is difficult to achieve" (McCarty 2008). However, McCarty offers a loose definition of a model as a "likeness" used "to gain knowledge of its original" or object of study (McCarty, 2008). Importantly, then, underlying both Rockwell and Sinclair's and McCarty's definitions is the distinction that while models are often constructed with tools, they differ in that their primary purpose is to represent and be seen (often at the expense of the visibility of the tools used to build them). For example, literary models allow for an impressive encapsulation of scale, enabling genre analysis of hundreds of texts, or language assessments on corpora of millions of words with the possibility of predictive analysis (Piper, 2017). However, these models are typically based on linguistic analysis and rely on quantitative measures, thus invisibly predetermining the mediating modes through which they represent their given "territories" (Piper, 2017). Moreover, due to the clear scientific lineage of models, they are perhaps the most entangled of the three terms with issues of stability. As soon as models are seen as objectively representing facts, they become end points to an argument, rather than generative points of departure.

Hence, while many researchers are already attempting to define *prototypes*, *tools*, and *models* with greater nuance, there remains a strong tendency toward pragmatic and instrumental definitions of the technology these terms describe, which largely ignores its mediating role. As Bruno Latour reminds us, a "tool" may appear to be a simple means to an end, but really "it is more adequate to speak about technologies in the mode of the *detour* than in that of instrumentality" (Latour, 2002; 251) since tools routinely mutate initial plans or actions from which they arise. Latour argues that a new tool opens up unanticipated and unintentional possibilities, which we then (through habituation) cease to recognize as such; the tool becomes invisible and we see only a simple means that fits a specific end [4]. Rockwell and Sinclair's "transparent" instruments are precisely those innovations that habit has familiarized to the point that their construction and use has been forgotten. However, as Latour (2002) insists, their invisibility is an "optical illusion" (252), not an inherent trait. Reviving the development process for these innovations, including development "detours", can counteract habit and reactivate our critical awareness.

The interwoven and ambiguous terminologies discussed above have significant effects as they come into contact with visualization and related technological approaches. Researchers, including ourselves (e.g., Hinrichs et al., 2016), typically describe visualizations derived as part of DH projects as "prototypes", "tools" or "models", and there are calls for more robust models and visualization tools tailored to humanities research practices. Despite the increasing application of visualization in diverse DH contexts (Jänicke et al., 2015), however, it remains a relatively new approach and a push for generalizable visualization tools—drawing on science-based use cases—risks reproducing unexamined assumptions and overlooking important nuances of humanistic data and inquiry (Drucker, 2011). Similarly, in visualization, itself a relatively young research field, calls to critically (re-)evaluate sometimes questionable assumptions (e.g., Kosara, 2016) have also been made. DH and visualization communities alike therefore need to engage in open-ended explorations of visualization as research (rather than engineering) processes. Specifically, we must develop a more nuanced, critical language and further engage with the wide range of design approaches, especially from fields such as HCI and Design, that already combine design practice and research (Burdick et al., 2012). As part of this work, we must critically examine the rhetoric of visualizations as suggested within DH (Drucker, 2011) and visualization (Dörk et al., 2013; Hullman and Diakopoulos, 2011).

In this paper, we introduce the sandcastle as a provocative new term to enable a fresh view on *visualization* “tools” and “prototypes”, highlighting their value from the perspective of (design) processes, not only pragmatic purposes. We contribute to ongoing attempts to define visualizations emerging from and driving humanities research. We draw from Design Research, which has discussed technology prototypes as provocative artifacts in their own right and as distinct from prototypes: “rather than early versions of products, they are provocative objects able to open up new directions or fields of exploration for design; instigate debate; support an investigation on people’s values and attitudes” (Arrigoni and Schofield, 2015; 27). Considering visualizations as sandcastles emphasizes their position as critical artifacts within research processes in order to enable a more critical, open-ended discussion of the role of visualization as part of humanities research and other domains.

CHARACTERISTICS OF VISUALIZATION SANDCASTLES

We propose the sandcastle as a lens through which to examine critically DH discussions of visualization design and to promote a speculative and process-oriented approach to visualization based on a robust model of interdisciplinary collaboration that advances knowledge within all research fields involved. Reversing the negative connotations of sand implied by the provocative question “tools or *just* sandcastles” in the pivotal scene presented earlier in this article, we embrace sand metaphorically as a versatile medium. Sand is malleable, renewable, humble but fascinating. It incites play and creativity. It encourages deconstruction, as well as reconstruction, of any structure built with it. It allows different scales, multiple perspectives, collaboration, and participation. Applied to the visualization and DH contexts, we argue that the *visualization sandcastle* complements existing terms, promotes ongoing interrogations of humanistic “data” (Drucker, 2011), and emphasizes how visualization can function as an aesthetic provocation, a speculative process, and a mediator between disciplines.

Aesthetic Provocation

In proposing the sandcastle, we seek explicitly to accentuate the importance of aesthetics in visualization design and use. As Johanna Drucker and Bethany Nowviskie have argued, all too often digital humanists “treat graphic design as a kind of accessorizing exercise, a dressing-up of information for public presentation after the real work of analysis has been put into the content model, data structure, or processing algorithm” (2004). In focusing on visualization as an aesthetic provocation that is also part of a speculative research process, our work aligns with their call to rethink “the way embodiment gives rise to information in a primary sense” (2004). We argue that while visualization has long been recognized as a way to “amplify cognition” (Card et al., 1999), it is important to remember that it does so through aesthetic interpretations of abstract data, by making perceptible what would otherwise be imperceptible to the human sensorium. By intervening in our ability to perceive and to make sense of that which becomes newly perceptible, visualization is inherently *aesthetic*—it is a particular mode of knowing that involves both sensory perceptions *and* sense-making abilities, as the etymology of the term suggests [5]. While Drucker and Nowviskie emphasize aesthetic provocation of end-users, we seek to make a case for aesthetic provocation as a form of knowledge production for researchers as well as end-users [6].

Rather than relegating aesthetics to a secondary concern or, as is often the case, a project after-thought, we propose that aesthetic concerns are central to the design process and can evolve as data collection (production) proceeds, such that the aesthetic elements of visualization both inform and are informed by this process. This has two important effects. First, it helps us to consider the complex role of representation throughout the data collection process. Second, it helps us consider how visualization can highlight and

problematize different modes of data categorization. This means remembering the complexity of data—not as that which is simply “given”—but as that which is necessarily crafted through innumerable decisions about, for example, what counts, how to count it, and how to represent the effect of the counting [7].

Whether we recognize it or not, aesthetics fundamentally shapes the kinds of interactions and interpretations that a visualization might invite and provoke (Hullman and Diakopoulos, 2011). Not attending to the importance of aesthetics risks invoking and imposing certain affordances (which are always also restrictions) and interpretations that should be questioned and openly debated rather than passively accepted. For example, Drucker reminds us that visualization approaches (with their provenance in the sciences, cartography, and graphic design) often project a positivist approach to knowledge generation, fundamentally at odds with “the situated, partial, and constitutive character of knowledge production” in the humanities (Drucker, 2011). We thus insist on considering visualizations as aesthetic objects with the ability to move those who encounter them and to intervene in their perceptions. The aesthetic object, often thought of as an object which arrests our attention, interrupts perceptual automatisms (Shklovsky, 1916), slows us down, inviting contemplation, and critical and playful engagement [8]. The aesthetic object, through its very form, can defamiliarize the things we most often take for granted. Why not harness the formal (aesthetic) potential of visualization to defamiliarize our data and to make apparent its constructedness, rather than pretend it is merely given? Artistic visualization—the artistic reflection, interpretation and problematization of data-driven visual representations—is one example of how visualization has been used as an aesthetic provocation (Wattenberg & Viégas, 2007; Pousman & Stasko, 2007). Our work thus aligns both with attempts to be more critically attentive to the needs of humanistic data and forms of inquiry (Drucker 2011, 2013) and with artistic uses of visualization. The sandcastle invites a critical playfulness on the part of both researchers and end-users that we make central to our research process.

Speculative Process

Applying the sandcastle metaphor emphasizes visualization as a process and highlights the value of its byproducts—transient, unstable, often unfinished and quickly discarded artifacts which are both manifestations and drivers of a (visual) thinking process through data. For any given dataset or collection the design space for visualization is vast (Munzner, 2014, Chpt. 1). Designing visualizations is largely driven by the challenge of identifying, and sometimes inventing, visual representation techniques that will best highlight or enable the exploration of the important aspects of the data at hand. Typically, this design process is driven by pragmatic considerations of human perception (i.e., developing visual representations that can be processed by the human vision system most effectively; c.f., Ware, 2012) and data and task abstraction (i.e., the identification of data-related tasks that the visualization should support in order to facilitate the data exploration and analysis; c.f., Munzner, 2014, Chpt. 3).

However, this design process is not trivial, in particular in the context of humanities data (what Miriam Posner aptly calls “a necessary contradiction” (2015) [9]) and humanities research that is often driven by open-ended and/or complex questions. Decisions and thinking processes that drive the visualization design are informed by, and continuously change through, evolving aesthetic interpretations of the data and early visualizations so transient and incomplete we may call them sandcastles. These sandcastles can take the form of mere scribbles on paper (Walny, 2015; Roberts, 2016) or computationally derived yet unstable prototypes (Arrigoni and Schofield, 2015) that, in turn, inspire the exploration of different visualization techniques and data mappings. Visualization can therefore be considered as Research-through-Design (RtD; Frailing, 1993) where making (in our context visualization) is used “as a method of inquiry in order

to address wicked problems” (Zimmerman, 2007). These *visualization sandcastles*, as transient as they may be, make important contributions to the thinking process. As Frailing (1993) framed it: “How can I tell what I think till I see what I can make or do?” (5). Building visualization sandcastles leads to findings and can raise concerns or questions for which the resulting sandcastle becomes a visible frame. This, in turn, informs new, more grounded, creations and iterations.

Each visualization sandcastle is a *manifestation of a thinking process*, of the early thoughts, insights, or questions that are easily forgotten. In the context of RtD, “thinking is, so to speak, embodied in an artifact” (Frailing, 1993; 5), and the visualization sandcastle as artifact archives some of the more ephemeral forms of thinking. Approached critically, visualization sandcastles are never “failures”—even if discarded they promote reflection and insights that advance the design process into new directions never encountered without them. However, documenting both processes and reflections for every visualization sandcastle is crucial to communicate the grounded insights in the research context and to preserve the mediating evidence of this thinking process (Zimmerman, 2007).

Mediator

The sandcastle’s material focus aligns with and emphasizes the mediating role of visualizations. As the power of aesthetic provocation and the dynamism of speculative processes assert, the forms through which data is collected, developed, and analyzed before being represented are bound up in any argument made possible by the visualization. Attention to visualizations as mediators reminds us that, although most visualizations clearly contain information intended to advance, support, or illustrate an argument (Galey & Ruecker, 2010), the forms through which this information is delivered argues well before the reader begins to analyze the data. Furthermore, as Latour (1994) explains, translating data across media (or across sandcastles), does not simply mean “a shift from one vocabulary to another”, but rather an openness to an inherent “uncertainty about goals”, which creates “a link that did not exist before and that to some degree modifies two elements or agents” (32).

Researchers in the arts and critical design have begun to theorize explicitly the mediating role of visualization technologies. For example, Arrigoni and Schofield argue that prototypes resonate with boundary objects [10], as they “elicit discussion, facilitate the comparison of different perspectives, and contribute to the articulation and sharing of knowledge around a project [...] both proposing viable alternatives to the status quo, and enabling the diffusion of such alternatives through co-creation” (2015; 26-27). Showing a similar concern with mediation in DH, Hayles argues that understandings of knowledge creation must pay attention to the “coevolutionary spiral in which humans and tools are continuously modifying each other” (2012; 30-31) and Piper calls for a better understanding of the mediating role of models (2017).

The sandcastle continues this work, taking up the critical call for a focus on mediation. The playfulness of the sandcastling process manifested in concrete visual, interactive artifacts enables critical attentiveness to different mediations of the same data, and how these can drive a collaborative discourse about the means through which information is developed, collected, and represented. Through its playfulness and ability to be broken down and built back up, sandcastling embraces the uncertainty of goals identified by Latour, while also undermining the ends-driven approach to visualization and resisting a collapse of our visualization technologies into what Latour has termed “mere intermediaries”, or mediators mistakenly thought to “simply transport, transfer, transmit” a stable meaning (1991; 77). A research process in which the involved disciplines can contribute equally and critically is crucial for the cross-disciplinary research common in DH and visualization.

Thus, the sandcastle as mediator brings together the previous two characteristics of our sandcastle metaphor: as aesthetic provocations visualization sandcastles can promote a critical and open-ended discourse necessary for active mediators, while their unstable and process-oriented character invites discourse, speculative participation, and co-creation.

In the following, we illustrate how sandcastling can be practically applied to discuss critically the role of visualization in the context of humanities research.

ILLUSTRATING VISUALIZATION SANDCASTLES: THE STUFF OF SCIENCE FICTION

“The Stuff of Science Fiction” brought together researchers in English literature and visualization to analyze a unique, little-known collection of science fiction (SF). The Bob Gibson Anthologies of Speculative Fiction, housed at the University of Calgary’s Special Collections, consist of 888 hand-crafted fanzine-like booklets that include more than 10,000 published SF works (1840-1990) (see Fig. 1). These items were harvested from hundreds of source periodicals, compiled, bound, annotated, and illustrated by Canadian SF fan, collector and artist, Bob Gibson (1908-2001).

From a literary studies perspective, the Gibson Anthologies promise to elucidate the evolution of the SF genre as driven by popular periodicals. From a visualization perspective, this print-based collection provokes new questions about how to facilitate exploration and analysis of its digitized forms. Focusing on a subcollection of 72 anthologies including the earliest SF items (approx. 1,500), we approached these questions in an intertwined process that combined archival work and visualization (Forlini et al., 2015). The archival work consisted of reading SF items and producing metadata, which included extracting bibliographic information, writing abstracts, and manually classifying each item through an established SF keyword hierarchy (Bleiler, 1990). Through on-paper and computational visualizations, we simultaneously explored ways of visually and digitally representing the Gibson Anthologies through their emerging metadata. The result of these archival and visualization processes is what currently exists as the Speculative W@nderverse (Hinrichs et al., 2016) [11], an interactive web-based visualization implemented using the D3.js framework (Bostock et al., 2011).

The Speculative W@nderverse consists of four interlinked, interactive visualizations (see Fig. 2). An item list view shows all SF items (mostly stories) with their corresponding anthology covers. Clicking on an item provides access to its abstract. A timeline provides an interactive overview of the items’ publication years, a tag cloud shows the quantitative representation of the keywords we assigned across items, and a tree diagram shows these same keywords’ hierarchical distribution alongside established SF themes and

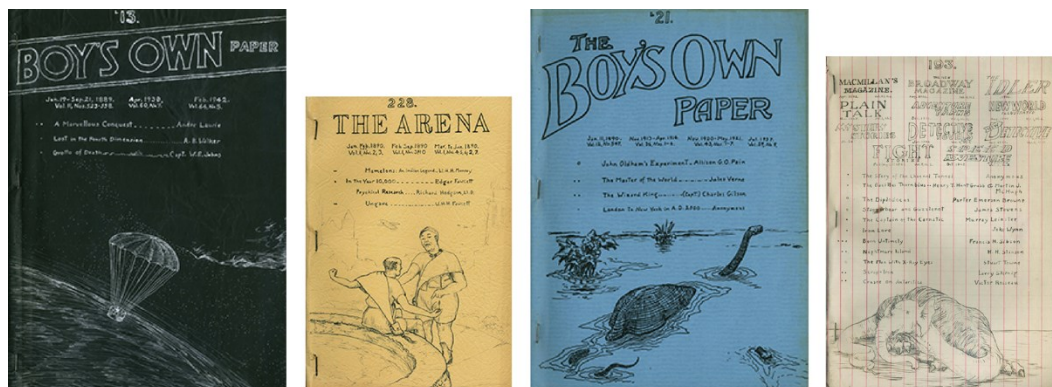


Figure 1: Four Gibson Anthologies Four Gibson Anthologies of Speculative Fiction (Gibson, Compilations Nr.228, L21, and 193).

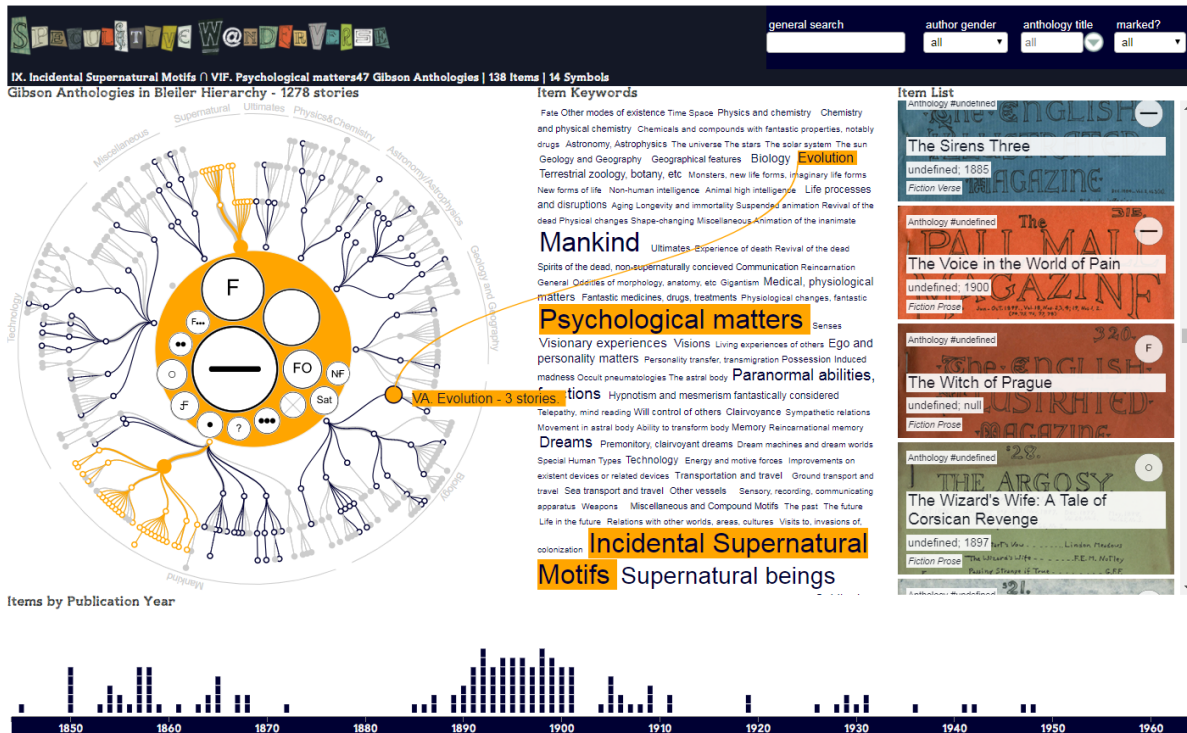


Figure 2: The Speculative W@nderverse visualization (Gibson, Compilations Nr.319, 315, 320, s28, s21).

subthemes. Integrated into these visualizations is a bubble cluster, which shows the symbols Gibson himself applied to most items and that represent his own unique yet undocumented SF classification system. These interlinked visual views, alongside additional search filters, enable open-ended explorations of the Anthologies as well as visual analyses of particular aspects, for example, the meaning of selected Gibson symbols, or SF themes present in this subcollection. Changes in one part of the visualization act as filters for the other views (Hinrichs et al., 2016).

An Instrumental Perspective on the Speculative W@nderverse Visualization

From an instrumental perspective, the Speculative W@nderverse has helped answer initial research questions. For example, the visualization highlights “the supernatural” as an important topical branch of the earliest SF items (1840-1900); the tree map view shows its quantitative prominence in the Anthologies. It also highlights the intersection of this topic with other, more traditional SF themes: selecting “the supernatural” in the tree view highlights its co-presence with topics such as technology, mankind, or astronomy and/or astrophysics within the same items (see Fig. 3). These findings suggest that supernatural themes have influenced the evolution of the SF genre more than previous research acknowledges.

We were also able to confirm some hypotheses about the meaning of the Gibson classificatory symbols. For example, through our archival work we suspected that the “filled dot” symbols likely stand for a ranking system where more dots signify items with better or more SF content. Filtering by symbol in the W@nderverse, we see indeed more items with a single dot. Only a single, highly recognizable SF story by H.G. Wells receives “four dots” from Gibson. We also suspected that the stylized “JF” symbol likely represents “Juvenile Fiction” items. Filtering by this symbol reveals only stories for children (see Fig. 4).

Through its different views of the Gibson Anthologies, the W@nderverse has helped us identify the research potential of this collection. However, in general, it raises many more questions than it can answer. For example, how does the content of the Anthologies relate to the corresponding source periodicals? Also, the material and physical qualities of the Anthologies remain underrepresented in the W@nderverse,

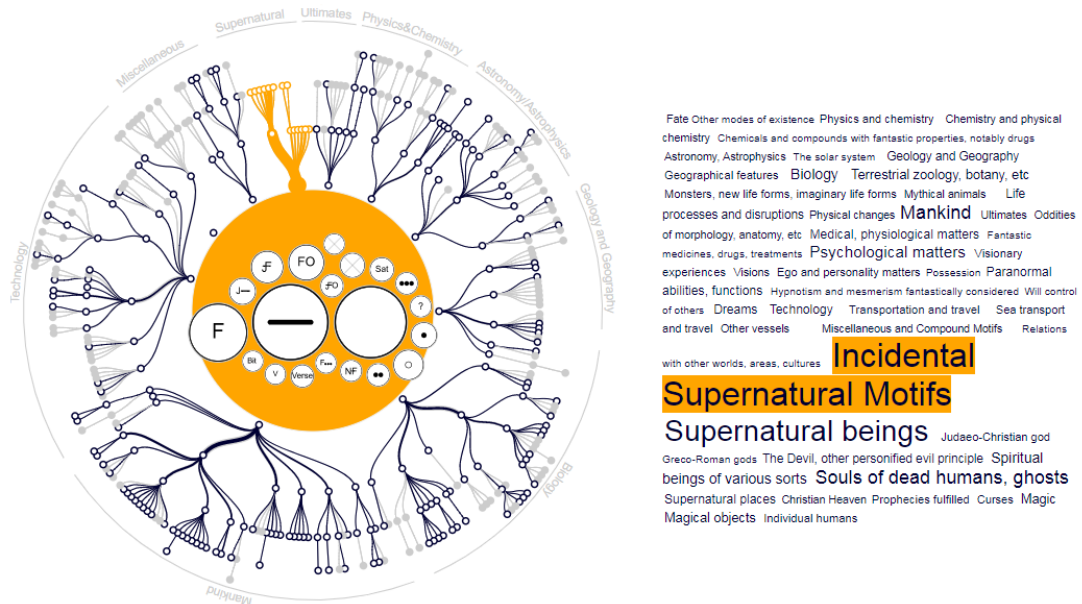


Figure 3: Selecting the “supernatural” branch in the tree view highlights its intersection with more traditional SF themes.

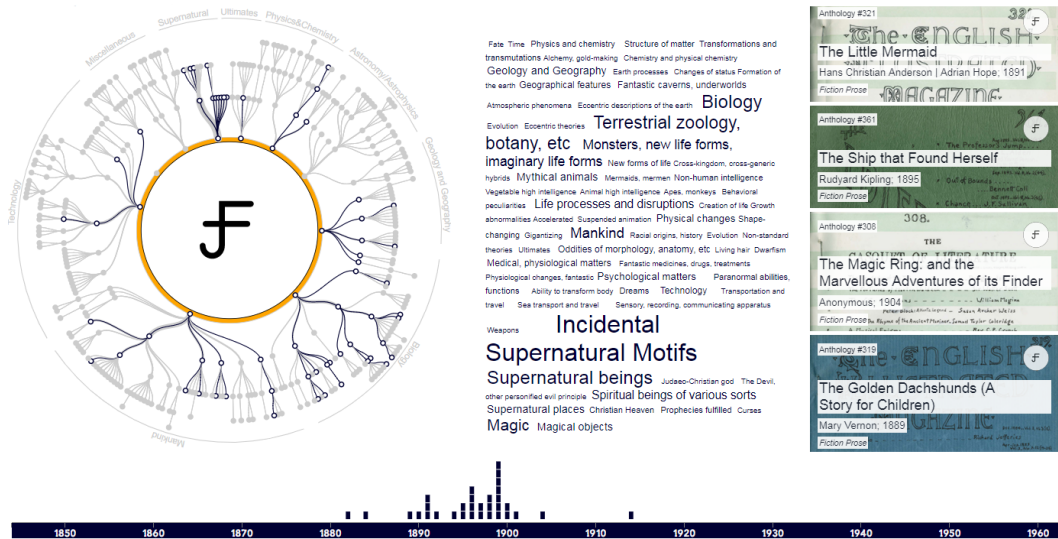


Figure 4: The stylized JF symbol likely stands for “Juvenile Fiction” (Gibson, Compilations Nr.321, 361, 308, 319).

although these may provide important insights, not only into Gibson’s practice as a collector, but also into the publication history and intended audience of the corresponding SF items. The W@nderverse in its current design cannot help the exploration of these aspects. Including additional views to allow such explorations would require a re-design of the visualization. The W@nderverse was not designed in a modular way, but it has been created on-the-fly to fulfill our research interests and questions in the moment. As such it is hard to maintain, modify, and expand to represent additional metadata or views. Considering this lack of versatility, generalizability, and stability, one may say that the W@nderverse is not a *tool*, not even a prototype in the instrumental sense, although initially described as such (Hinrichs et al., 2016).

However, as we discovered through reflection on the W@nderverse and our design process, evaluating this visualization solely from an instrumental perspective misses the point. Besides the insights on the

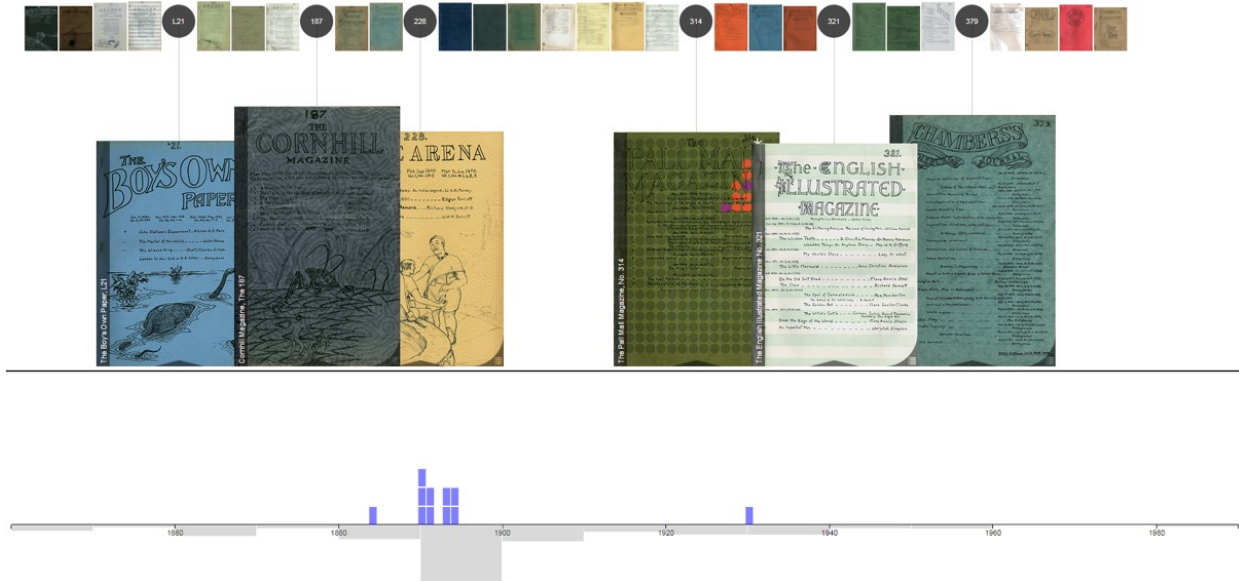


Figure 5: An early interactive visualization focuses on the Gibson Anthologies as visual artifacts (Gibson, Compilations Nr. s21, 187, 228, 314, 321, 379).

Gibson Anthologies and the new perspective on SF these provide, the value of the W@nderverse lies in the *thinking processes* that have led to its creation. Considering the W@nderverse not as a means to an end, but, rather, through the provocative lens of the sandcastle, highlights that it stands in line with a number of *visualization detours* that have helped us critically discuss and shape our research perspectives on the Gibson Anthologies, as well as our collaborative process, combining research in literary studies and visualization in meaningful ways. In the following paragraphs we discuss these visualization detours and describe the W@nderverse as a visualization sandcastle.

The W@nderverse as a Visualization Sandcastle

As described earlier, our production of metadata through archival work and the visualization process took place in parallel. We did not have much metadata to work with when we started our visualization process. Early interactive visualization sketches, therefore, focus on the Gibson Anthologies as visual artifacts (see Fig. 5), for example, highlighting the Anthology cover pages while preserving their aspect ratio and relative size and enabling fluid browsing.

As we produced more metadata, we explored how to visualize the Gibson symbols and their relation to the keywords we applied to each item, to begin deciphering the meaning of these symbols. We first created a number of representations that showed each symbol individually, surrounded by the different keyword branches that characterize the SF items corresponding to each. The result is a “footprint” that visually and contextually represents each Gibson symbol (see Fig. 6). This exploration raised our curiosity about possible relationships between symbols based on the keywords of their corresponding items (see Fig. 7).

As the data set grew, we became interested in additional questions such as characterizing our subcollection of Anthologies based on SF themes. Figure 8 shows corresponding visualization sketches and iterations of a hierarchical tree visualization that highlights the prominence of the topical keyword branches present in our subcollection. SF items are first represented by their symbols, later by story titles (resulting in a messy view) and in subsequent iterations by their symbols again, in aggregated form, shown in the center of the tree diagram.



Figure 9: Early version of the W@nderverse which allows multiple views on the Gibson Anthologies.

All these visualizations led us to design the Speculative W@nderverse in its current form (see Fig. 2). Although not all of them found their way into the W@nderverse, each *detour* led to insights about the collection and its many facets and informed ideas of what metadata to collect, what aspects to visualize and how. They also brought to the fore new research questions to pursue through our archival work and visualizations, and insights about our own disciplines (literary studies and visualization) with their corresponding assumptions. Considering the W@nderverse as a means to an end risks overlooking or obscuring these values. The visualizations described above are not driven by concrete goals, neither are they linked in a cohesive way, and so cannot be prototypes or tools in an instrumental sense. Some could be considered computational sketches, but others are incomplete yet elaborate explorations of ideas, not the result of a dedicated ideation process (e.g., one suggested by Roberts, 2016). Instead we consider these visualizations as *sandcastles*—playful, speculative, yet rich explorations that have driven and visually manifested our thinking processes throughout this project. Re-visiting the general characteristics of visualization sandcastles, we illustrate how these led to the W@nderverse and still inform our research and cross-disciplinary collaboration today.

Visualization as an Aesthetic Provocation

Considering visualizations as aesthetic provocations highlights the value of engaging in visualization processes even as the underlying data is still being produced. Many of our visualizations are produced on little and/or incomplete data, but they were invaluable for defining and refining ideas on visualization and metadata production. Visualization sandcastles also remind us of the interpretative quality and rhetoric of visualization. As Drucker (2011) has argued, visualizations and their underlying data are strong situated interpretations. As an aesthetic (visually provocative) artifact each visualization we produced promoted a discussion about visual design decisions. Such discussions, for example, led us decide to arrange the thematic keyword branches in a circular way that does not suggest a particular ordering, and to juxtapose this view with a tag cloud, which highlights not the keyword hierarchy but their quantitative representation in the collection, and with Gibson's symbols.



Figure 10: The W@nderverse as a visualization sandcastle embedded in a speculative process (Gibson, Compilations Nr. s63,190).

Each visualization, through its aesthetic qualities, including interactive features, has influenced our own and other people’s interpretation of the Gibson Anthologies. From this perspective the W@nderverse has limitations, as it emphasizes the content of the Gibson Anthologies over their visual and material qualities. Many people—literary scholars, visualization experts and the general public—suggested a stronger emphasis on the Gibson Anthologies as artifacts. As one literary scholar who visited one of our open house events put it: “Gibson created these as a way to understand the content”. The W@nderverse’s aesthetics provoke such critical considerations and, in this process, also inform new ideas for subsequent visualizations as discussed below.

Visualization sandcastles as aesthetic provocations therefore address the members of the research team themselves, as well as people from the outside that experience the produced sandcastles.

Visualization as a Speculative Process

Visualizing an untapped collection like the Gibson Anthologies to enable its analysis and exploration is a challenge, and it is only through different visualization sandcastles (driven and inspired by our archival work) that we arrived at certain research questions and visualization ideas. Each sandcastle represents our then thoughts and interests while advancing our speculative design and research process. The W@nderverse itself is a sandcastle; it is not an endpoint of our research-through-visualization, but, through its own limitations, it points to new questions and in this way inspires new visualization sandcastles (see Fig. 10).

Visualization as a Dynamic Mediator

Our visualization sandcastles functioned as mediators between disciplines, facilitating equitable immersive collaboration where neither discipline is in the service of the other. Coming from different disciplines (literary studies and visualization) we had to understand each other’s research interests and approaches in order to collaborate successfully. Each visualization we created helped us in this process as the visualizations became visual manifestations of individual ideas and disciplinary assumptions that we could grasp and collaboratively and critically reflect upon. Closely related to this, our visualization sandcastles helped us to engage in a collaborative design process where all members were able to participate in the visualization process through discussion, whether or not they had technical knowledge, while also contributing to a more reflective and critical perspective on visualization.

These practical examples show that considering visualization through the lens of the sandcastle helps recognize and unpack the value of visualization as a process and of sandcastles as artifacts in their own right that—no matter how incomplete, unstable, or speculative—influence interpretations and change (research) perspectives.

THE VIRTUES OF SAND

Having discussed our own sandcastles as aesthetic provocations, speculative processes, and active mediators, we return to our sandcastle metaphor to situate it within specific design and DH practices. First, we re-emphasize the virtues of sand that inspired our metaphor. Sand's transitory nature can mark it as something to be avoided, as seen, for example, in Robert Kosara's (2016) caution against building "empires on sand" when referring to the need for empirically tested visualization techniques. Likewise, Latour (1986) has contrasted the profound power of a paper map (an immutable mobile) with the negligible impact of a map drawn on the sand. In contrast, we argue for the sandcastle as a provocative yet productive perspective that reclaims sand as a versatile medium (not for building empires as Kosara and Latour imply—that's not our goal), for weaving critical thinking throughout the visualization design process, and for forging a productive space for curiosity-driven, cross-disciplinary research. Parting from the notion of a "sandbox" as used in computer science to provide a safe yet constrained environment to learn and play without real-world impact, we offer "sandcastling" as a metaphor for a *mindset*, a *methodology*, and a *praxis* that is integrated into real-world impactful cross-disciplinary research practices:

As a *mindset*, sandcastling calls for a distancing from narrowly instrumental understandings of visualization in order to be newly aware of their aesthetic provocations. As such, the key difference between sandcastling and prototyping or sketching is that sandcastling takes an exploratory, undirected and non-instrumental perspective on the visualization design process, which is guided by emerging ideas, questions, and criticisms as they appear in-the-process, rather than by pre-defined goals and design requirements.

As a *methodology*, sandcastling calls for a renewed focus on visualization processes, including a need to openly embrace speculative design, while also documenting and critically reflecting upon the sandcastles (mediators in their own right) that arise within these processes. In contrast to exploratory visualizations, typically described as artifacts or "tools" that allow researchers to explore data in open-ended ways in order to facilitate discoveries (see Munzner, 2014; Chpt. 3), sandcastling can be described as a formative exploratory visualization methodology that may or may not lead to exploratory or explanatory visualizations, but will definitely reveal insights and new questions.

As a *praxis*, sandcastling does not exist in isolation. Rather, it is a reinvigorating process that can be practically integrated into a number of existing design approaches, such as feminist approaches in HCI (Bardzell, 2010) and visualization (D'Ignazio and Klein, 2016), speculative computing (Drucker and Nowviskie, 2004), generous interfaces (Whitelaw, 2015), rich-prospect browsing (Ruecker et al., 2011), the flâneur in visualization (Dörk, 2011), as well as approaches to prototyping in art and critical design (Arrigoni and Schofield, 2015). Although we contrast sandcastling to the often instrumental process of sketching, sketching can in fact be part of sandcastling if applied in an open-ended way that allows for experimentation, critical discourse, and mediation between disciplines.

Sandcastling is formative, exploratory, and process-oriented. It invites researchers from different backgrounds and with different levels of training to experiment with possible ways of perceiving, reconceiving, and interpreting data. The term is meant to suggest playfulness and immediacy, but the process itself is not necessarily easy or quick. It often involves re-orienting roles and forms of collaboration and may lead researchers to defamiliarize and "drift" away from their home discipline (Hinrichs et al.,

2017). Sandcastling reminds us of technology's kinship with art while also alerting us to all the detours that must be forgotten in order to see a tool as a simple means to a specified end.

We are not suggesting the sandcastle perspective as the only way to approach visualization as part of DH research. In fact, we believe that the notions of visualization tools in their instrumental sense and visualization sandcastles can be interrelated; both can be implicated in the same research project (at different stages or in parallel). What we offer through sandcastling is a new perspective on visualization that complements more common pragmatic approaches, and we strongly believe that this perspective is applicable and generalizable to a variety of domains in the sciences and the humanities. In the humanities context, in particular, visualization is still a new approach, and as such we argue that it is important to stay open to the possible roles that visualization may be able to play in DH—as a critical design practice, a theoretical perspective, a practical engineering approach, or innovative research in its own right. Through our discussion of the sandcastle as a mindset, methodology, and praxis we seek to facilitate this reflection and invite additional critical play.

With this paper, we aim to stimulate others to re-consider the visualization (tool) they have designed themselves from the perspective of the sandcastle and reflect on the detours that have led to these. It is these (often neglected) detours manifested in visualization sandcastles that can reveal early discoveries about the data and collections at hand, but also assumptions and early “lessons learnt” that can be considered as contributions in their own right and are worth reflecting upon and sharing—within the research team and beyond. Reflecting and reporting such insights that arrive from the visualization design process is important, in particular considering that visualizations in DH are often criticized for the lack of novel insights they reveal in light of the effort and cost it takes to create them. Applying a sandcastling approach will help to tap into insights that arise from the visualization process, showcasing visualization sandcastles in whatever forms these take as generative rather than final.

The metaphor of the sandcastle can also help foster a freer approach to visualization that is driven by curiosity rather than pragmatism, that emphasizes reflection on process throughout, not only at the end of a visualization project, and that invites the sharing of visualization sandcastling practices, and the different collaborative constellations that these engender. Sandcastling is not bound to certain visualization methods, techniques or tools, and does not necessarily require a prohibitive time investment, especially if detours are considered valuable (and publishable) contributions in themselves [12]. Sandcastling is not about the creation of a particular type of visualization, but about reflecting on the processes that have led to its form at hand. It is a way to stimulate an increased awareness of the transient nature of visualizations that, while they may appear fixed and solid, are always situated interpretations, much like the data that they mediate.

NOTES

[1] As Latour points out, the question of scale is crucial to almost any visualization, whether a simple diagram or a complex navigational map. The ability to process and/or represent large quantities of information quickly in a stable, modifiable, yet reproducible way that can be easily read gives the prototype, the tool, and the model their power (Latour, 1986).

[2] Rockwell and Sinclair claim that the humanities have been so focused on discourse that they have neglected the ways “things” bear knowledge and/or theories, but there are rich humanistic traditions of thinking with things which remain unacknowledged in *Hermeneutica*. For example, we might think of what historian of science, Lorraine Datson, has called a “mode of thinking with things”, referring in part to French anthropologist Claude Levi-Strauss who singled out certain things as ‘good to think with’ (Datson, 2004; 20), or, more broadly, we might consider the “new materialisms” of the last 20 or more years that emphasize social, cultural, technical aspects of things. Moreover, there is a robust tradition that acknowledges “we think through, with, and alongside media” (Hayles, 2012; 1).

[3] Rockwell and Sinclair refer to McCarty who “argues that modeling is the paradigmatic activity of humanities computing” and highlight his use of the term to refer to both a thing and an activity with “active and tactile aspects” (Rockwell & Sinclair, 2016; 164).

[4] Latour explains this by discussing the experiences of the beginner and the innovator, each of whom “discovers between himself and his aims a multitude of objects, sufferings, apprenticeships which force him to slow down, to take one detour after another, to lose sight of the initial aim, to return hesitatingly, to take courage, etc.” (Latour, 2002; 251-52). And yet once the invention becomes an innovation that is absorbed by industry and the market, this process is forgotten and “we end up by being able to count on a unity of action which is so reliable that it becomes invisible” (Latour, 2002; 252).

[5] As Jacques Rancière reminds us, the root of the term in the Greek *aesthesis* refers to both “the faculty of sense, the capacity to *both* perceive a given *and* make sense of it” (Rancière, 2009; 1, emphasis added).

[6] Our approach to visualization (especially our use of aesthetic provocation and speculative practices) shares some of the same motivations as those forcefully expressed by Johanna Drucker and Bethany Nowviskie. In particular, we share their contention that “Digital humanities projects are not simply mechanistic applications of technical knowledge, but occasions for critical self-consciousness” (2004). However, our terms (“aesthetic provocation”, which we adapt from Design Research, and “speculative practice”, which we adapt from science fiction as a form of exploring by enacting through imaginative play the question “what if...”) are distinct in their provenance and meaning from Drucker and Nowviskie’s notion of aesthetic provocation and speculative computing (2004), though ultimately compatible with them. Moreover, our practice is not ultimately driven by the desire to build a certain kind of visualization tool, but rather it is a process of research play and discovery. This means that we emphasize the importance of aesthetic modes of defamiliarization as a way for researchers (and others) to get to know data (and its limitations) by responding to aesthetic defamiliarization of data representations and active play with possible new ways of sensing and making sense of it.

[7] Several critics note the complexity of data and the need to interrogate our construction of it. See, for example, Drucker (2011), Posner (2016), and Liu (2012) in DH, and others outside DH, including Feinberg (2015) and Lupi (2017), among others.

[8] See, for example, Elaine Scarry’s *On Beauty and Being Just* (1999), Isobel Armstrong’s *The Radical Aesthetic* (2000), and Peter de Bolla’s *Art Matters* (2001), among others.

[9] “When you call something data, you imply that it exists in discrete, fungible units; that it is computationally tractable; that its meaningful qualities can be enumerated in a finite list; that someone else performing the same operations on the same data will come up with the same results. This is not how humanists think of the material they work with.” (Posner, 2015).

[10] Boundary objects, coined by Star and Griesemer (1989), are defined as “objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites.”

[11] <http://stuffofsciencefiction.ca/vis/Wonderverse/>; Best viewed in Google Chrome Browser.

[12] In fact, in a different project, we have utilized Tableau Desktop to rapidly create a number of visualization sandcastles in order to explore an archive of bibliographic records (Vancisin, 2018).

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