

Non-Representation in Information Visualization

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Abstract — Established practices in information visualization rely on a realistic view of the world, where data is treated as given representation of physical measurements or as result of empirical research. However, within humanities and the arts, information is often non-representational and co-dependent, with no rigid and straightforward semantics. Based on this premise, this survey paper explores the concept of non-representation within a framework that is mostly based on theoretical and critical texts, avoiding descriptions of specific tools or techniques in information design. It explores notions of interpretation, performativity, indexicality and discursive practice, hoping to create a solid basis and enact awareness for later practice in visualization within the arts and digital humanities.

Index Terms — information seeking behavior, information visualization, interpretation, knowledge construction, non-representation

1 INTRODUCTION

Research and practice on information design draws upon development and work on both technical and theoretical dimensions. Among the latter the issue of representation plays a fundamental role, as it is closely associated with the concept of information. However, as most of information design and visualization work is based on empirical and “measurable” data, non-representational approaches - counter to representational ones - seem to slip the required attention. Thus, the current paper attempts to give a small overview of literature on the topic of non-representation, as it relates to visualization initiatives in digital humanities and in artistic practice. More specifically - and in order to clarify various aspects of non-representation that affect information design work - the present research is split in five core dimensions: interpretation, modeling, indexicality / situatedness, knowledge construction / performativity and information seeking behavior. These dimensions are described in detail below.

2 NON-REPRESENTATIONAL DIMENSIONS

2.1 Interpretation and Data as Capta

Data is taken, not given: this is the main motto that underlines Johanna Drucker’s work (2011), as she presents humanities-based approaches to graphical displays. For Drucker and other representatives of digital humanities, representation is constructed on top of interpretation, in opposition to methodologies established in empirical studies and in statistics, which approach data as quantitative information void of hermeneutics and co-dependency. From her perspective, experience influences both the process of data creation as well as its visualization, so that we can restrain ourselves from seeing data as something given to us, unchangeable and purely objective - at

least within the realm of humanistic thought. In the area of critical cartography and critical data visualization, maps and other visualizations are also not to be seen as objective representations of pre-existing realities but rather as products of constructed-ness and subjectivity (Currie, 2020).

Anna-Lena Carlsson in her analysis of the aesthetic and poietic elements¹ in information design refers to the subjective and interpretative intervention of the designers, as they reveal in their work specific perspectives of the world, concealing others at the same time (Carlsson, 2010). For Sally McLaughlin (2009), often quoted by Carlsson, the passing on of information is also not neutral:

The issue is an ethical one, for to merely pass on information is, at best, to circulate those perspectives on the world that allowed the information to first show up and, at worst, to pass on information devoid of any meaningful context. (p. 316)

Therefore, as Drucker (2011) clearly states, “data are capta, taken not given, constructed as an interpretation of the phenomenal world, not inherent in it” (para. 8). Such an approach opens up an epistemological perspective of ambiguity, where subjective experience becomes inherent in knowledge construction, and metrics manifest themselves as products of agendas, assumptions, and conventions:

Realist approaches depend above all upon an idea that phenomena are observer-independent and can be characterized as data. Data pass themselves off as mere descriptions of a priori conditions. Rendering observation [...] as if it were

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¹ According to Carlsson, the poietic activity refers to the making of an object and the participation in the creation of its meaning.

the same as the phenomena observed collapses the critical distance between the phenomenal world and its interpretation, undoing the basis of interpretation on which humanistic knowledge production is based. (para. 1)

In her description of poietic activities under the lenses of modernist thought, Carlsson (2010) pinpoints that readers, viewers, or listeners (thus in contexts beyond visualization) participate in the signification of information and constitute a significant part in the creation of its meaning.

As a consequence of all these qualities, space and time transform to new conditions and gain new meanings, within this framework of humanistic thought. Drucker (2011) addresses the terms of spatiality and temporality as indicative concepts for the experience of space and time, and provides visual examples to showcase new ways of representing them as products of subjectivity and individual perception:

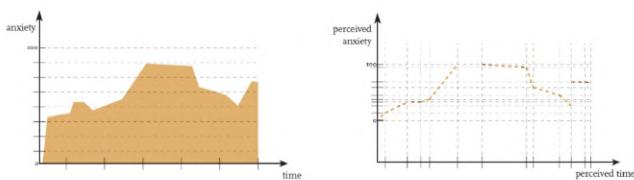


Fig. 1. Visualization of anxiety across time (fig. 12 and 13 from Drucker, 2011)

The examples above show how the traditional metrics of regular intervals can be transformed into projections of perceived values - in this case, of anxiety and time. As it is evident in the graphs, human experience and perception of anxiety and time have transformed the regular structure of traditional metrics (left) into new interval distances (right).

Similar dynamics are also developed in space visualization within a non-representational context:

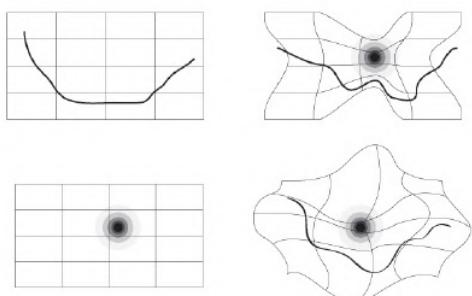


Fig. 2. Space visualization (fig. 14 from Drucker, 2011)

Here Drucker makes evident that spatial systems are prone to distortion, when "significant" objects appear, that attract attention and become the center of reference for the rest of the world that surrounds them. In these cases, the Cartesian coordinate system can be seen as only one view of the world, whereas other representational schemas take into account the perception of space and any relationships being developed, as agents of meaning come into play, act, and later go.

Additionally, smaller interferences in realistic representations, like the deliberate widening of streets for making a map more readable, are also indicative of the constructedness and the observer co-dependency in information design practice. As showcased by Tufte in his book *Envisioning Information* (1990, p. 37), Constantine Anderson with his *Isometric Map of Midtown Manhattan* (1989) broadens the streets of midtown New York in his axonometric projection to enable readability and avoid masking of some buildings by others - letting in this way the perceptive qualities of the readers influence the cartographic creation. Although metrics here are not "distorted" to the extent that the Drucker's examples show, this is still a manifestation of how interpretation and perception may influence information visualization practices.

2.2 Modeling

Closely related to data as taken (not given) is the idea of modeling, that is the practice of creating rather than representing data. Based on the notion of interpretation and its richness, modeling becomes the primary mode for creating an environment that affords a hermeneutical attitude, and enables analytical, interrogative approaches:

Modeling is a primary mode of creating an abstract scheme or structure of analysis or argument. The modeling approach uses graphical means to produce interpretative work using visual argument structures such as contradiction, ambiguity, parallax, and point of view that are fundamentally hermeneutic in character. (Drucker, 2017, p. 249)

In this context, modeling differentiates itself fundamentally from representational approaches of mapping. In opposition to a uni-directional relationship of data preceding graphical display and a functionality of visualization as data "surrogate" with semantic attributes, modeling functions as a non-declarative and conditional structure that enables interaction and affords multiple re-creations of the data. The focus is shifted away from visualization as linguistic representation and emphasis is given to discursive practices and openness:

The move toward performative alternatives to representationalism shifts the focus from questions of correspondence between descriptions and reality (e.g., do they mirror nature or culture?) to matters of practices/doings/actions. (Barad, 2003, p. 802)

In her description of dimensions for modeling and interpretation, Drucker (2017) presents twelve graphical ideas, which function beyond semantic “entities” and rather support informational “qualities”, like salience, ambiguity and contradiction. These dimensions are point of view, layers, slicing, annotation, tilt, projections, generative metrics, relative scales, fold, parallax, split, and other spatial moves, and they constitute a visual vocabulary for exploring and generating new informational patterns and discourses.

This shift from the display mode to the rhetorical one coincides also with the meaning of information as “giving form or shape”, as it is nicely formulated in the following excerpt by Alexander Galloway (2011):

Information [...] stems from the Latin for the act of taking form or being put into form. So, in contrast to data, information stresses less a sense of presence and giving-forth, and more a plastic adoption of shape. Information exists whenever worldly things are ‘in-formed’, or ‘put into form’. [...] Thus if data open a door into the realm of the empirical and ultimately the ontological (the level of being), information by contrast opens a door into the realm of the aesthetic. (p. 88)

Starting from the premise that interrogation and hermeneutics enable multiple ways of representation, visualization apparatuses should be designed in such ways that would enable user interaction or cultivate acceptance for multiplicity in information design.

2.3 Indexicality and Situatedness

Visualizations carry references and associations of presence that are not easy to discern at their first readings. They function as indexes to the spatial, temporal or cultural contexts that have given birth to them and are exposed to audiences, which are also qualified by their own histories. As indexical mechanisms, they achieve contiguities between the physical world, the collected data and their reception and they are “situated” in a relational space of multiple causalities and interactions.

As a result, context awareness is a significant component that needs to be afforded via tools and methods, like the use of narratives accompanying images and charts for clarifying possible misinterpretations (e.g. in journalistic visualizations). Other useful mechanisms are the incorporation of comment and annotation functionalities for enabling user-generated contexts (or making them visible) and visualization comparisons that add new perspectives in understanding already made decisions. Moreover, visualizing with provenance in mind is well indicated for making any steps along the data gathering process fairly transparent.

Karolina Uggla in her essay on interpreting information visualization (2021) references Roland Barthes and his

work on the *Rhetoric of the Image* (1964), where it is made clear that images are to be seen as “polysemic”, with their meaning depending on context. According also to Carlsson (2010), the heideggerian perspective brings indexicality and situatedness to the discussion, too, as the world shows up “related to our interests”. Finally, an interesting perspective opens up with the analogy of visualization to art, cinema and photography. New insights, inspired by conceptual art and regarding a non-contextual and isolated production of visualization, come into existence, or there are also “representations without resemblance” and indexes to the unreal, that are related to cinema and modern photographic techniques (Schofield et al., 2013).

2.4 Knowledge Construction and Performativity

Visualization is also performative. From an epistemological perspective, it is an act of knowledge making; a process that entails change and unsettlement rather than a mere artifact. As has been the case with performativity in linguistics, where words act beyond description and may bring change,² visualization can be also handled as a discursive modality that affords re-comprehensions of the world it represents. In the domain of critical cartography, Currie (2020) explains how knowledge construction operates:

Maps and data visualizations are consequently performative in that, through both their construction and use, they shape the objects, geographies, and identities they purport to represent, while also shaping the agency of the viewer, who now comprehends the world through these constructions. (p. 3)

Additionally, Kitchin and Dodge (2007) view maps as ongoing processes that are brought into stability through “learned and constantly reaffirmed” practices (p. 335). Visualization creates new knowledge that feeds back to the design process and acts as a source for new understandings of the world. It becomes discursive, in the way that Karen Barad (2003) defines it:

Discourse is not a synonym for language. Discourse does not refer to linguistic or signifying systems, grammars, speech acts, or conversations. To think of discourse as mere spoken or written words forming descriptive statements is to enact the mistake of representationalist thinking. Discourse is not what is said; **it is that which constrains and enables what can be said**. Discursive practices define what counts as meaningful statements.” (p. 819; emphasis added)

Therefore, visualization becomes the instrument of enunciation and subjective expression that may constantly

² See: Austin, J. L. (1975). *How to Do Things with Words*. Harvard University Press.

change depending on new understandings of the world and consecutive inputs. Such a non-static approach to data, statistics and images, which "show up as resources to be organized and presented" (McLaughlin, 2009, p. 303), calls for user interfaces that can combine graphical elements for displaying different versions of the data and multiple dimensions of contrast, parallax and point of view. An interface like this can resemble Drucker's wireframe proposal (2017), which is here provided:

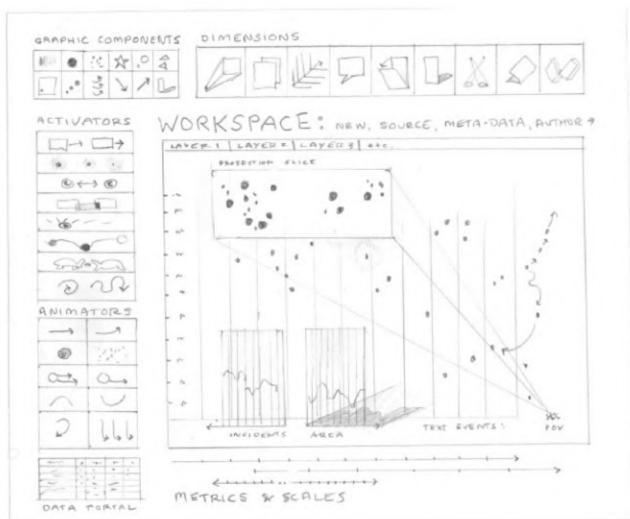


Fig. 3. Wireframe scheme (fig.16 from Drucker, 2017)

2.5 Explorability and Information Seeking Behavior

Explorability is also a key concept for information visualization that goes beyond representational restrictions and entails chance, curiosity and creativity. As example of its range, a persona of "information flaneur" is used by Dörk et al. (2011), in order to help understand the interaction that may take place while looking for and at information. It is a user profile that provides insights for designing intuitive interfaces and encounters, since "information seeking is an inherently complex human experience that includes a wide range of emotions and motivations beyond a particular problem or need." (p. 1216)

Experience, imagination and reflection constitute significant elements of information seeking behavior and cannot be overlooked. Starting from the example of a city flaneur as curious explorer, critical spectator and creative mind, we move onto the "information flaneur", who is ready to explore unfamiliar places, has an open and questioning mind, and exudes enjoyment and pleasure, as he/she keeps navigating across the vast ocean of information.

Dörk et al. (2011) in their description of the information flaneur model call for open-ended experiences that combine an overview ("horizontal exploration") of information spaces with details of particular resources ("vertical immersion"). In this description they recognize the contribu-

tion of three important aspects - cognitive, perceptual, and affective - which are briefly explained here.

The cognitive aspect is related to information behavior. Here it is important to ensure a sense of orientation, where the interface - or combination of visualizations - can help gain a sense of overview and direction. Additionally, visual cues can be employed for guiding the user from one resource/stage to the next, while other elements can be also incorporated for supporting explorability. Indicative examples can be serendipitous displays or faceted navigations.

Then comes the perceptual component, which refers to visual perception attributes. Here concepts like preattentive processing or the preference for salient and new elements influence the visual focus, while appropriate graphical elements may give momentum for discerning and moving through different visual stages and situations.

Finally, on the affective plane it is about emotion and motivation, which play a significant role in information seeking behavior. Here space is given to pleasure, uncertainty and curiosity, which enable exploratory experiences and provide a stage for "getting lost" and seeking actively for answers. The idea of pleasurable experiences has been a topic of extended research, however it would extend the scope of the current paper to go further in detail on it.

3 CONCLUSION

Non-representational elements in information visualization are omnipresent and cannot be ignored in analyses of visualization practices or information design initiatives. Visualization functions not only as surrogate for pre-existing entities or as empirical representation. It rather mirrors a variety of intermingled factors that are associated with context, interpretation, content modeling, discursive practices and exploration - among others. This is mostly evident in digital humanities and the arts, however it is not exclusive. More research on information aesthetics as well as on further dimensions of non-representation and their applicability to all domains of scientific knowledge and artistic expression should be extensively pursued - both in theory and practice.

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