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Tanyoung Kim  
*Georgia Institute of Technology, USA*

Carl DiSalvo  
*Georgia Institute of Technology, USA*

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# Speculative Visualization: A New Rhetoric for Communicating Public Concerns

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Tanyoung Kim, Georgia Institute of Technology, tanykim@gatech.edu

Carl DiSalvo, Georgia Institute of Technology, carl.disalvo@lcc.gatech.edu

## Abstract

*Speculative design* is an emerging rhetorical strategy in design practices and research to raise public awareness in social agendas that have been little explored. As a stream of this type of research, we propose *speculative visualization* that aims to achieve speculative design by utilizing techniques from data visualization and graphic design. Specifically, speculative visualization represents socially and politically meaningful data in aesthetic ways to provoke viewers' interpretation and further elicit discussions. In this paper, we report the diverse approaches of speculative visualization by demonstrating three exemplary studies and identifying their visual rhetoric. Based on the argument, we discuss research opportunities that speculative visualization can broaden its design sphere: the aesthetic adaptation of data visualization techniques, the methodologies of assessment, and the public's engagement in design activities.

## Keywords

speculative visualization; speculative design; data visualization; visual rhetoric.

Over the past two decades, researchers have explored the capability and the role of design in increasing societal awareness, and motivating and enabling political actions (DiSalvo, 2009). This is evident in a diversity of endeavors, ranging from the work of individuals such as Natalie Jeremijenko,<sup>1</sup> design collectives such as Futurefarmers<sup>2</sup> and partnerships such as Dunne & Raby<sup>3</sup>. In their effort to empower the social and political actions, designers use visualization/graphics techniques to voice their and other's viewpoints through aesthetic displays.

We refer to this research paradigm as *speculative visualization*. In this paper, we begin by describing what we mean by speculative visualization and how it is connected to other disciplines, such as data visualization and graphic design. We also discuss its rhetorical power and thematic boundaries. Then, we present three studies of speculative visualization and exemplify how they invoke public awareness for the social and political issues that have been under-addressed. This paper contributes to the design community in two ways. First, it attempts to identify speculative visualization, the emerging phenomena across data visualization and graphic design, by identifying its core rhetorical aspects and breadth of topical diversity. Second, it provides researchers and practitioners with the opportunity to broaden their activity boundaries by opening a conversation on the potential of speculative visualization.

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<sup>1</sup> <http://www.nyu.edu/projects/xdesign/>

<sup>2</sup> <http://www.futurefarmers.com/>

<sup>3</sup> <http://www.dunneandraby.co.uk/content/home>

## Identifying Speculative Visualization

Artists and designers often express their views on political and social agendas through their work. One way they do this is through *speculative design* — the use of design products and practices to envisage possible, often critical, futures. Despite the short history, speculative design comes through a wide variety of design activities including participatory design workshops with community members, the final results in forms of product, graphic, interaction design, and conceptual proposals. The most distinctive quality of this line of research is that it provokes issues that are unconscious and hidden in people's everyday lives. It means that the design does not aim for a specific solution to a problem, but rather an open-ended discussion that is less predetermined and more unanticipated.

*Speculative visualization* is a particular group within speculative design that tries to achieve the thought-provoking work by using visual representation methods. Certainly, it is more than a piece of art, or a public display that, for example, informs you of current stock market data. Speculative visualization combines multi-disciplinary qualities; encompassing the challenging perspectives of artists, the aesthetic representation of designers, the analytic ability of scientists to interpret data, and the love for humanity of philanthropists.

This section is structured as follows. First, we situate speculative visualization in the context of other disciplines. In particular, we discuss how data visualization and graphic design helped create the groundwork for speculative visualization with regards to the resources of deliverable, representational techniques they employ and the common aesthetic languages they share. Then we discuss of the rhetorical aspects of speculative visualization that takes a central role of communication as a today's important visual medium. In addition, not to make the terminology too inclusive, we limit the thematic boundaries that the term can embrace.

## Beyond Scientific Purposes of Data Visualization

Once data visualization was regarded as an exclusive realm of, by and for scientists and engineers, since it mainly functioned as a technical tool to support accurate and fast data analysis. However in the past decade, the visualization community's interest in non-analytical uses has increased. The importance of communicative and illustrative aspects is now well known, mostly as sub research areas such as "social visualization" that seeks to convey social information in non-scientific forms (Donath, Karahalios, & Viegas, 1999), or "casual information visualization" that is used by non-expert users to depict personally meaningful information (Pousman, Stasko, & Mateas, 2007).

One simple but important catalyst that initiated those light-weight visualization domains is the fact that more data has become accessible. Data collected by government agencies, or by other parties paid for with taxpayer money, are now being made available (Kosara, Cohen, Cukier, & Wattenberg, 2009). The vast amount of the data is about demographics such as population change, economic growth, health related issues, and much more. These data seem more relevant to human life than any scientific data that used to be an interest of specific groups. Thus, they have potential to become "stories" when handed to creative people to become part of the cultural discourse when they are displayed to the general public. Thanks to the flourishing accessible data, recent years have witnessed the expansion of the creators who make the stories through data visualization. Beyond a simple bar or pie chart from ten by ten spreadsheet, journalists and their colleague data specialists and designers utilize much larger data and create information visualizations to fortify their reports. Politicians or activists also use visualization to strengthen their opinions.

The expanded access of data allowed us to categorize visualizations by its ultimate purposes, which are impacting on people's ways of thinking, believing and further acting. With the involvement of Human-Computer Interaction (HCI) and interaction design, visualization has become a research topic that is more omnipresent and proximate to everyday life. For example, if personal health data are represented in more graspable visualization rather than its apparently unrecognizable numbers, the visualization can help the person change their habits to favorable state. In addition, when visualizations are exposed onto journalism websites in a timely manner, they can function an editorial contents (e.g., NYTimes Visualization Lab).

Recently, more abstract representation of data is also loosely considered as information visualization. Several survey papers (Kosara, 2008; Pierce, Odom & Blevis, 2008) distinguished two general types of information visualization, namely pragmatic visualization and artistic visualization. The former is a reconceptualization of the more "traditional" types of visualization, which minimizes distortion and foster immediate understanding. Pragmatic visualizations may not seem to be correctly labeled "speculative", since they mainly support dispassionate data analysis. However, when accurate and possibly shocking data are exposed to viewers, it has potential to influence their mind by increasing awareness of what they have not had a chance to think about as deeply before (Figure 1) (e.g. Rosling, 2009). By contrast, artistic visualization presents enigmatic representation to express a point of view and further stimulate the target audience. Artists or photographers, previously thought to exist out of scientific visualization community, create artwork based on data. The goal of artistic visualization is not meant to be scientific or analytic, but rather interpretive and expressive.

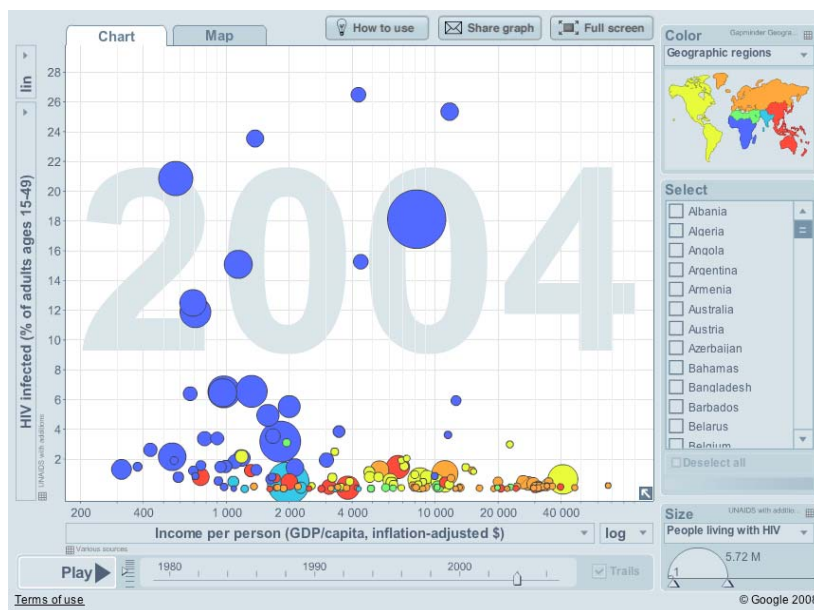


Figure 1. HIV epidemic 1980-2007 on Gapminder.org (URL: [www.bit.ly/bfrBa7](http://www.bit.ly/bfrBa7))

## Expression of Social Issues through Graphic Design

Graphic design aims to communicate intended messages to specific audiences in an aesthetic combination of text and pictures. Types of graphic design range from simple forms, such as road signs, logos, trademarks to complex information graphics and advertisements and the essential goals of the messages are diverse. In the history of graphic design, we can find numerous temporal and spatial contexts that were related to social issues.

For example, in the early twentieth century, graphic design functioned as effective delivery methods of ideas and arguments. Politicians created and manipulated print-based graphics (e.g., posters) in order to imbue people with their ideology in a similar way as radio and newspapers. Due to the omnipresence of visual images and the easy acceptance by illiterate people, governments used posters to appeal to laymen, and even to enlighten and raise awareness. Against governmental propaganda, counter-production of posters appeared as well. A distinguished figure of this appropriation is a Dadaist John Heartfield. He used photomontage as a potent propaganda weapon and his images met with immediate identification and comprehension by the working class (pp. 248-249, Meggs & Purvis, 2005).

In the contemporary design scene, it is not difficult to find many design consultancies and graphic design firms that are specialized in designing for non-profit organizations and activists (e.g. Another Limited Rebellion<sup>4</sup>, Yippa<sup>5</sup>, Zago<sup>6</sup>). Beyond client-driven or in-house design circumstances, individual artists and designers have started to express their voices on social issues utilizing their aesthetic skills. At professional conferences such as AIGA and IxDA as well as academic research (e.g Forlizzi & Lebbon, 2002; Dilnot, 1982) have paid attention to ethics of designers and socially responsible design.

## **A Rhetorical View of Speculative Visualization**

Rhetoric is the art of persuasion. Beyond the classical Greek definition, which means public speaking for civic purposes, rhetoric exists in written, visual, and oral forms. Although visual communication does not function as a means of direct persuasion such as oral rhetoric, images are more vivid than text or speech and therefore more easily manipulated toward visceral responses. In order to fill the lack of the direct persuasion visual rhetoric requires visual “arguments” to “supply us with reasons for accepting a point of view” (p. 22, Bogost, 2007). The field of *visual rhetoric* explores the many ways in which visual elements are used to influence people’s attitudes, opinions, and beliefs through the analysis of photographs, drawings, graphs, tables, and motion pictures (p.2, Hill & Helmers, 2004).

A designed message communicates by effectively ordering and representing the common visual languages of society. Therefore, it possesses great potential to affect viewers (Buchanan, 2001; Forlizzi & Lebbon, 2002). To view a relationship between audience and visual communication, Tayler (1992) analyzed design within a theory of rhetoric. The audience is characterized not as a reader but as a dynamic participant in an argument. In this rhetorical view, visual communication attempts to persuade a specific audience through argumentation by referencing established or accepted values and attributing those values to the new subject.

The rhetorical view of communication design allows designers and viewers to actively co-construct meanings through visual messages. The common visual language is the medium through which differences are assessed, and ambiguities are reduced. The agents taking part in the dialogue can establish common frame of reference, and then build bridges to shared values. Effective rhetorical communication allows individuals to relate to each other, provides a vehicle for expression, freedom, and the discovery of truth (Buchanan, 2001; Forlizzi & Lebbon, 2002). We argue that real data added to communication design can strengthen the vehicle since it serves as an objective and more believable evidence over imagination-based visual elements. By the visual rhetoric of speculative visualization,

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<sup>4</sup> <http://www.alrdesign.com/>

<sup>5</sup> <http://yippa.com/>

<sup>6</sup> <http://www.zagollc.com/>

we expect to communicate public concerns and further change perspectives, attitudes or behaviors by creating the possibility for social agreement.

## Thematic Topics of Public Concerns

In visual and cultural studies, the discussion of *rhetoric by image* covers a tremendously wide range of activities and artifacts, from advertisements selling products to marketing, and even propaganda, promoting political candidates or causes. However, since we identified speculative design as a realization of designers' societal responsibility and its ultimate goal as promoting public awareness and engagement in social and political issues, we attempt not to include virtually all about human life.

The interdisciplinary nature of speculative visualization allowed us to establish the thematic guides employing the ideas of technological concerns. Fogg (2002) suggested a wide range of persuasive technology and application, which includes commerce, personal relationship and occupational effectiveness. We argue that these applications for personal interests and marketing should not be defined as appropriate topics of speculative visualization. Instead, we include such areas that actively require re-realization from individuals' consciousness toward socially pertinent issues so that they are expected to increase awareness and further change attitude and behavior in favor of community's well-being. Some of the relevant topics are environment conservation/sustainability, disease prevention, political issues and social responsibility/solidity. As a sub domain of speculative visualization, Eco-visualization (Holmes, 2007) is tremendously popular among HCI researchers and designers. Themes about social responsibility are not as pervasive and materialized as practical applications as sustainability and disease issues. However, there have arisen many design collectives such as NeMe<sup>7</sup>, whose projects include visualization work representing human rights in general and community related data.

## Case Studies of Speculative Visualization

In this section, we take three examples of photography, motion pictures, and media installation that can showcase how speculative visualization communicates public issues. These selected pieces all obtain the resources from the raw statistical data that may appear difficult for laymen to understand. In contrast, visualizing the data in aesthetical ways help connect the numbers to the making meaning.

### Example 1: Running the Numbers: An American Self-portrait

First example is a series of visualization by a photographer Chris Jordan. His work looks at contemporary American culture through the austere lens of statistics. The photographer's belief is aligned with what we mean by speculative visualization: "My hope is that images representing these quantities might have a different effect than the raw numbers alone, such as we find daily in articles and books... I hope to raise some questions about the roles and responsibilities we each play as individuals in a collective that is increasingly enormous, incomprehensible, and overwhelming" ("chris jordan photography," n.d.). Each piece portrays a specific quantity of mundane artifacts. For example, in *Plastic Cups* he depicts one million plastic cups, which is the exact amount of cups used on airline flights in the United States every six hours (Figure 3). If we see the image from a distance, it appears as an abstract drawing of pipelines, but in a close look, we can notice the fact that it is composed of

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<sup>7</sup> <http://www.neme.org/>

myriads of disposable plastic cups. At the moment people realize the minimal unit that makes up the massive image, they become overwhelmed and wordless, and sigh deeply.

### Example 2: What is a Black Balloon?

*What is a Black Balloon?* is a series of motion graphic advertisement as a part of statewide campaign in Victoria, Australia (Figure 2). It is a simple way to measure and visually represent greenhouse gas emissions from domestic environment such as kitchen, laundry room, dining room, as well as an entire house. The video attempts to deliver an obvious but possibly unrecognized fact: using less energy will mean less greenhouse gas emissions, and will help to reduce the impact of climate change. In the video clip appear black balloons, each of which represents a unit of measurement, 50g of greenhouse gas. A balloon pops out from a single appliance at first, followed by many others that finally fill the upper space of a house. However people except a baby in the advertisement do not recognize the existence of the balloons, the metaphor of potential threat to environment. Viewers are not expected to count the specific number of balloons and calculate the total emission of greenhouse gas. Rather they may have visceral responses such as panicking or emotionally paralyzing through the abstract and aesthetized statistics.



Figure 2 What is a black balloon? (<http://www.saveenergy.vic.gov.au/>)

### Example 3: Smog is Democratic

*Smog is Democratic* is a digital media installation that explores air pollution and particulate matter through the medium of data and photographic visualization (Figure 3). As a subject, particulate matter brings together multiple themes in contemporary society: our concern with pollution, the relationship between urban living and hygiene; the tension between scientific representation and artistic expression of information; and the desire to produce techniques of measurement against the threat of the unseen. The visualizations in the installation are based off air quality, smog, and particulate matter data from for 2008, maintained by the Environmental Protection Division of the Georgia Department of Natural Resources. This database records both predicted and observed smog alerts as well as daily ratings of the air quality index. In the video visualization, the data are used to obscure the image by pixellating video of Atlanta highways—with the amount of pixelization generated from hourly air quality measurements in 2008. By obscuring the image, the visualization attempts to dynamically reflect the ways in which air pollution and smog obscure vision. This installation is interpretive and expressive, with the goal of considering how the sources and measurements of particulate matter might be rendered in order to generate reflection, discussion, and debate. The designer's intention is to address the audience on an instinctive level and generate emotional responses that lie behind the data.



Figure 3 Carl DiSalvo and Jonathan Lukens, Smog is Democratic (source: <http://publicdesignworkshop.net/smog-is-democratic/>)

## Research Opportunities of Speculative Visualization

Because it is a nascent design genre and an interdisciplinary subject, speculative visualization has not been well investigated by design researchers. We suggest several opportunities and challenges for those who may potentially create speculative visualization and study it in a design research capacity.

## Reimagination of Data Visualization Techniques

The information visualization (Infovis) community primarily comprises researchers from HCI, computer science, and statistics. Not attracting much interest from graphic designers, Infovis has continuously created various data visualization techniques, referred to as “visual styles” in designers’ terms. The endeavor to create visualization styles has continued for the purpose of representing a larger amount of data in a smaller area for more effective analysis. Therefore, one may consider such scientists’ suggestions not innately aesthetically pleasing. In fact, however, some of their innovative techniques have been inspired by modern art and graphic design traditions. For example, text visualization techniques such as Wordle and Tag Clouds were influenced by Soviet Constructivism (Viegas & Wattenberg, 2008). On the other hand, visual designers have attempted to manipulate scientific visualization techniques in aesthetic ways by blending color and typographic tactics with techniques. Among the myriad of techniques, radial graphs commonly represent networks or hierarchies, which have typically used by scientists (Figure 4). However, the graphs are being adopted to portray complex relationships between people and issues (e.g., NYtimes.com, 2007).

Beyond these relatively less complex techniques, interpreting the advanced formations of data visualization techniques with the touch of designers’ creative minds and hands will open opportunities for managing a greater volume of data and interactivity. Only a single datum can be impressive enough to generate viewers’ visceral stimuli as we earlier discussed in the case studies. Alternatively, we can anticipate that large data sets across regions and over periods may enhance complex feeling and in-depth discussion. In addition, supplementing layers of flexibility and interactions will provide audiences with more options to explore when



compared with two-dimensional graphics. Several interaction techniques in formatted infovis such as Treemaps, Nodemaps and stacked graphs are now widely used to incorporate diverse data sets (Wattenburg, et al., 2008).

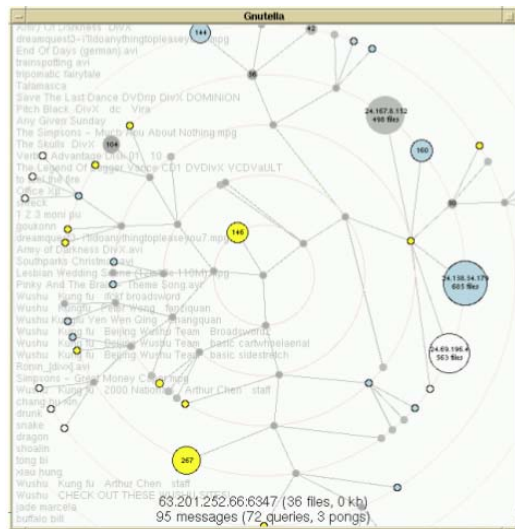


Figure 4 Example of Network Visualization on Radial Graphs (Yee, Fisher, Dhamija, & Hearst, 2001)

## Grounds for Assessment

When targeting visualization systems for analytical tasks, we have well established evaluation methods such as usability testing. However, evaluating the rhetorical aspects of visualization, even in collective and public situations can be challenging. The first impression of visualizations may be observed relatively easily through reading user comments or running simple surveys. For example, timely visualization of the stimulus bill passed by the U.S. congress led to some very emotional comments on a visualization authoring website, ManyEyes (Kosara et al., 2009). However, the influence on viewers' awareness, attitudes, perspective, and behavior was neither visible nor immediate. This situation opened up a new research opportunity: How do we design evaluation methods for a long-time experience rather than time and space constrained cognitive matters? In particular, how do we observe the social and cultural phenomena related to speculative visualization?

## Engagement of Public in the Process of Design-making

It has been a rigid belief that the creativity of visual communication designers comes solely from personal intuition. However, if designers attempt to persuade audiences through visual messages without properly understanding whom they are designing for, inappropriate outcomes can result (Forlizzi & Lebbon, 2002). Understanding audiences does not require only traditional user research techniques. It also requires that designers envision methodologies that elicit the direct participation of the audiences. One possible way is inviting citizens in the process of data collection employing participatory design methodologies as discussed in a project by DiSalvo, et al. (2008). In this project, citizens engaged directly by collecting data from their local area, such as sound, air quality, humidity and temperature using sensing technology. Another manner of participation is people themselves becoming makers of the final artifacts as suggested by Gaver and Dunne (1999). Participating in the conceptual art work, senior citizens in a suburban city of poor reputation express their history of life, emotion, and the pride of the community. Finally the project acts as a socio-cultural intervention at personal, community, or political levels.

## Conclusions

Visualization is what makes data accessible, intelligible, and interesting. When data visualization and graphic design meet together, each actively fills its absent traits with the advantages of the other; graphic design strengthens its arguments with objective and real data, while data visualization empathizes visual aesthetics adopting the principles of graphic design. Interconnecting the two realms in this way, speculative visualization makes data meaningful, insightful, and influential. To shed light on this emerging design research and practice field, we discussed its disciplinary traditions and rhetorical and communicative power with exemplary projects. Our attempt served to initiate a new research domain crossing visual design, rhetoric, and visualization community.

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## **Author Biography**

### **Tanyoung Kim**

Kim is a Ph.D. student in Digital Media in the School of Literature, Communication and Culture at the Georgia Institute of Technology. Her research interest is design of persuasive digital media for citizen engagement. She holds M.S. and B.S in industrial design from KAIST.

### **Carl DiSalvo**

Carl DiSalvo is an Assistant Professor of Digital Media in the School of Literature, Communication and Culture at the Georgia Institute of Technology in Atlanta, Georgia, where he directs The Public Design Workshop. He earned a PhD in Design from Carnegie Mellon University in 2006 and was a visiting fellow in The Studio for Creative Inquiry and The Center for the Arts in Society from 2006-2007.