

REPEATING THE PAST: LESSONS FOR VISUALISATION FROM THE HISTORY OF COMPUTER ART

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Abstract

The development of critical discourse and experimental practices in computer art of the 1960s and 1970s was informed by new forms of collaboration between artists, scientists and institutions. This paper acknowledges the debt owed by modern visualization practice to developments of this period but suggests that much of the artistic and philosophical legacy has been largely ignored in this area. It is argued that criticality in visualization practice should be informed by a number of aspects of 1960s and 1970s computer art practice, including implications for collaborative practice, thinking about mediation and the integration of aesthetics with life experience.

Keywords: visualization, computer art, media archaeology, design, collaboration, experience.

Data visualization is both a language and context of representation and communication which has enjoyed a relatively recent explosion out of its traditional fields of statistics and analysis into areas as diverse as advocacy, journalism, design and art. Recent accounts [1,2] have highlighted a lack of critical discourse around visualization. This suggests that this is an area with the exciting potential to explore new implications and directions for the field. There is also, however, a risk that such a rapid expansion overlooks existing contributions, both theoretical and practical.

In the midst of this expansion of academic territory, what lessons can be learned from the past? The application of methods or technology to new fields is not a new phenomenon and media art can look to its own history to draw some parallels. Already, studies have examined the computer art of the 1960s and 1970s in particular to document the emergence of new modes of thinking, mediation and expression of the time [3].

This paper will discuss the legacy of early computer art for later directions in art, design, and Human Computer Interaction (HCI), and ask what this might imply for visualization practice.

Paradigms and Networks: Where to Start?

Any attempt to locate a definite starting point with regards to the establishment of either computer based art or visualization suffers from some immediate problems: to identify a watershed point

before which things were or were not either creative artworks or were or were not computers risks merely reifying disciplinary assumptions about the nature of those distinctions - the very thing that such studies are supposed to challenge. The variety of early computational devices, such as Babbage's and Ada Lovelace's Analytical Engine (conceived around 1834), the Jacquard Loom (1801), and The Ferranti Mark 1 (1951) all articulate different definitions of computation. Since the focus of this paper is to provide a useful stimulus for visualization practice, it seems consistent to engage with computers from the point at which they began to support graphical displays or outputs and also began, if not to enter the home, then at least to be accessible to some degree outside the research lab. This point coincides with the exhibitions described below. I examine this 'beginning' of computation not only as a period of interdisciplinary collaboration but also because of the debt that modern visualization technologies owe to technical developments here.

At the very end of the 1960s and beginning of the 1970s, three seminal exhibitions took place in London and New York. Jasia Reichardt's 1968, Institute of Contemporary Arts show 'Cybernetic Serendipity' was soon followed by 'The Machine as Seen at the End of the Mechanical Age' at MOMA curated by K G Pontus Hultén. The latter, while not featuring computers, nonetheless added to both atmosphere and debate on computer based art. Lastly and perhaps most controversially 'Software', Jack Burnham's contribution at the Jewish Museum in New York still resonates as a problematic, provocative rite of passage for art and technology.

In summary, two concurrent historical events concern us: The development of new paradigms of computer programming and the exhibition of seminal computer art which, I suggest, was influenced by ideas expressed in the former.

Ideological Cores

Crucially, the timing of the exhibitions listed above coincides with the coming age of flexibility in computing enabled by expressive and articulate programming languages. These in turn paved the way for graphical user interfaces. Object Oriented Programming (OOP) in the form of Allan Kay's Small Talk was a breakthrough in inseparably technocreative terms. Although the first public release of the language 'SmallTalk'

would not appear for ten years after the exhibitions took place [4], it was effectively born alongside the three exhibitions described above. Programmers increasingly thought in ideational or visual terms through their programs. As Casey Alt has pointed out: "computation became a medium when the concepts of medium and interface were implicitly embedded in computation at the material level of the programming language itself, an event I locate in the emergence of object oriented programming itself"[5].

OOP was the development which allowed artists and programmers to truly think through and with computers as they underwent a transition from tool to medium. It is true to say that visualization practice as we know it would certainly not exist without this development and, as Whitelaw [6] has pointed out, the conceptual organization of information into formal structures (called ontologies), made possible by OOP, has strong analogues with philosophical ontologies. It is not an exaggeration to say that the ideological core of visualization, even now instantiates a concept technically realized in this period. Visualizations are based on visions of the organization of information into discrete but interacting units, each with interfaces to one another, for example through such devices as search filters. This is, in fact, the essence of OOP: the power to create independent code objects with the capacity for independent interaction with each other.

I emphasize this techno-historical point not for nostalgia's sake but to underscore the point that visualization is technically and conceptually founded on object orientation. It is at the level of data ontology, not interface, that the most crucial decisions are made by designers. The ways in which data objects are composed and interact with one another constitutes the performativity of a visualization: it determines its action.

With the collaborations that came with 'Software' and 'Cybernetic Serendipity' came access for artists to lower levels of computational technology. By using the term 'low' I refer to the distinction in computer science of low and high level programming languages. Low-level programming languages operate very close to the basic functionality of computers. Operations such as memory management or manipulation are described in fine detail by the programmer. In contrast to this, high level languages abstract common operations (such as the stages of

saving a file to disk) for the sake of convenience.

I have described how the most fundamental concept of visualization systems, the data ontology, was a product of developments which allowed users to formulate conceptual abstractions [7] and by doing so, achieve a new kind of expressivity. I suggest however that this movement has also resulted in a mounting lack of criticality over the nature of mediation in visualization. In a sense, visualization has been its own worst enemy. The expressivity afforded by abstraction has emphasized the design of smooth interactivity and fashionable styling. The job of visualization has come to be oriented to the front end (the interface) to the detriment of the back end (the ontology and computation).

A focus on fine points of style and usability has also occluded more fundamental developmental questions for the field. By 'developmental questions' I mean those which seek to contextualize visualization in relation to other forms of cultural production, which interrogate its most basic visual/physical forms, and which question and experiment with the forms of agency it embodies in different networks. I suggest that such questions are articulated best at the furthest edges of what can be called visualization practice. Many of the works in the exhibitions mentioned earlier were agnostic to the label of 'art' but pursued individual research questions. This afforded an expanded and inclusive sense of creative possibility which later proved to be seminal for both art and design. For instance *Seek* [8], produced by the Architecture Machine Group at M.I.T., had both practical and metaphorical dimensions. It was at once an experiment in sensing and adaptive behavior, and a figurative gesture towards a world of integration between humans and computers, hence their statement, 'if computers are to be our friends, they must understand our metaphors' [9].

Definitions of art were both influenced and subverted by ideas from new sciences, such as Norbert Wiener's cybernetics and the Pragmatist philosophy espoused by John Dewey [10]. We can describe a period of art and computing characterized by a number of factors: a strong interest in systems and their permutations (from cybernetics and systems art), a desire to more closely interweave art practice with everyday life (from Dewey), and a new sense of mediated expressivity.

Convoluting Collaboration

In the 'Software' show, many works that incorporated programming were created through collaboration and sponsorship. For example this was true of *Labrynth: An Interactive Catalogue*, by Ned Woodman and Theodore H. Nelson with assistance from Scott Bradner (Art & Technology Inc. Boston), Digital Equipment Corporation, which was an early hypertext experiment. It was also true of Agnes Denes' *Matrix of Knowledge and Trigonal Ballet* (1970), which was created with assistance from Members of the R.E.S.I.S.T.O.R.S. Pennington N.J John Levine, Nat Kuhne, Peter Eichenberger and from Theodore Nelson [11]. This kind of collaboration gave a convoluted kind of agency to artists. On the one hand, their capacity to engage with and shape public consciousness about the emerging medium of computers was enabled. On the other hand, their reliance on corporate sponsorship or technical assistance financially and practically curtailed the possibilities engendered by this expansion into new realms of art making.

Whatever the problems such collaborations had, their occurrence signaled a new kind of integration of creative thinking and technological possibilities. Burnham described the whole process as an integrated, aesthetic whole: 'this is a different age in which we are beginning to read esthetics into budgets, planning procedures, and priorities - and not so much into finished products' [12]. For visualization practitioners now, as for artists then, the implication is that it is important to consider the entire production process as one of aesthetic continuity, rather than focusing only on the finished design. Collaboration can be thought of as taking place not only between different roles, but as something which should exist between every stage of the visualization pipeline.

Creating Contexts

Tufte's book *The Visual Display of Quantitative Information* [13] offers (before its unfortunate proscription turn towards the end) a candid description of the way that early visualizers (such as Playfair, Minard, Apianus) created languages, syntax, lexis, and indeed whole contexts around their work. Their contribution was technical and innovative, for instance in Playfair's development of the bar chart [14], as well as expressive. Indeed, the expressivity of these early works relied on an interrogation of basic

forms and data processing and representation. In this sense, the defining feature of the most seminal visualizations was their autopoeitic quality - their ability to create something - themselves, a medium - out of nothing. Their responsiveness to, and engagement with the world stretched and created definitions. It is therefore ironic that examples such as the Cholera outbreak map by John Snow [15] or Minard's Napoleonic death march [16] are trotted out with such torpid regularity at visualization events to demonstrate good interface design rather than as embodiments of new kinds of knowledge.

A key problem for visualization to overcome is its self-referentiality, that is, researchers' emphasis on perfecting a decontextualized vision of interface design. The latter halves of otherwise interesting papers from visualization conferences are too often filled with narrowly defined usability studies. I suggest that what is absent is a focus on lived experience. This situation is comparable to that faced by first wave HCI research:

"First Wave HCI was seen as having a technological focus on interactive applications running on workstations engaged with by individual users. First Wave HCI predominately used the methods and theories of experimental cognitive psychology to understand such scenarios" [17].

A transition has occurred in HCI from a focus on task-oriented users, to those in working in social settings and more recently to broader life experience:

"the Third Wave is characterized by non-work settings and topics such as lived-experience, intimacy, pleasure and embodiment. [...] For many writers, this combination of ubiquitous technology and interest in user-experience requires a reorientation of our research methods" [18].

This orientation towards a dialogue or co-extensiveness with quotidian experience is strongly reminiscent of 1960s conceptual art practices which sought to blur the boundaries between art and life. A focus on performativity was foundational to this: I have previously argued that, '...the main contribution of this period was a focus on formal ways in which art could be said to act rather than represent.' [19]

The “action outside the frame” (i.e. the capacity of artwork to transcend its immediate context) also found its expression in computer art of the 1960s and 1970s. Burnham’s Catalogue essay [20] for ‘Software’ makes for provocative reading not least because it pays little attention to specific art objects and talks at length about art’s function in a changing world:

“Software is about experiencing without the mental cues of art history. Instead it is saying: ‘sense your responses when you perceive in a new way or interact with something or someone in an unusual situation’. For this reason Software regards the perceived appearance of the art object as a fraction of the entire communication structure surrounding any art” [21].

In Theory and Practice

The most interesting work and, in both senses of this word, ‘critical’ writing on visualization (for example, Whitelaw [22], Sack [23]) is ‘extrospective’ and inclusive. Sack, for instance, rejects a limitation of visualization in art contexts to a role of ‘prettying up’ or making readable existing data sets. Crucially he pushes visualization practices into dialogue with other fields, including the politics of administration and bureaucracy. Much of the work discussed by Sack (such as *Index 01*, by Art and Language [24]) is visualization in only the loosest sense of the word, but it is at this juncture that visualization work becomes its most crucial and agential.

Conclusions and Future Work

This paper has sketched a partial and selective account of visualization. Its core argument is that visualization’s chief stumbling point has two main (related) elements. First: a focus on style, layout and usability occludes more fundamental questions of context and agency. These are related to an unhelpful separation of front and back ends, which undermines the critical potential of data structures (ontologies) and processes. Second, visualization theory and practice is not sufficiently informed by lessons from other related disciplines, and needs to take an experiential turn, following Dewey’s [25] proposed aesthetic continuity between art and everyday life.

The implication of this disjuncture, I suggest, is that visualization practitioners must be educated and must develop in circumstances which are truly trans-

disciplinary. This transdisciplinarity should not only entail contact and dialogue with other researchers, but should involve actively prototyping, developing and speculating about visualization’s role in, and connection to, other disciplines, real life scenarios and the creation of new strains of research.

References and Notes

1. Viégas, Fernanda B, and Martin Wattenberg. "Artistic data visualization: Beyond visual analytics." *Online Communities and Social Computing* (Springer, 2007) 182-191.
2. Dörk, Marian. "Critical InfoVis: exploring the politics of visualization." *CHI'13 Extended Abstracts on Human Factors in Computing Systems* (ACM, 2013).
3. Gere, Charlie, Nicholas Lambert, and Catherine Mason. *White heat cold logic: British computer art 1960-1980* (MIT Press, 2008).
4. Kay, Allan. "The Early History of SmallTalk" (*ACM SIGPLAN notices* 8, no. 3, 1993).
5. Alt, Casey. "Objects of Our Affection: How Object Orientation made Computers a Medium." In *Media Archeology: Approaches, Applications and Implications*, edited by Jussi Parikka and Huhtamo Erkki (University of California, 2011) pp.278-301.
6. Whitelaw, Mitchell, Mark Guglielmetti, and Troy Innocent. "Strange ontologies in digital culture." *Computers in Entertainment* 7, no. 1 (2009).
7. Alt [5].
8. Architecture and Machine Group, M.I.T. in "Software, Information Technology: its new meaning for art." Edited by Theodore H Nelson, Nicholas Negroponte and Les Levine (1970).
9. Burnham, Jack, in "Software, Information Technology: its new meaning for art." Edited by Theodore H Nelson, Nicholas Negroponte and Les Levine (1970).
10. Dewey, John. *Art as Experience*. (Toronto: Perigee, 2005).
11. Nelson Theodore H, Nicholas Negroponte and Les Levine *Software, Information Technology: its new meaning for art.* (1970).
12. Burnham [9].
13. Tufte, Edward R. *The visual display of quantitative information*. (Cheshire, CT: Graphics press, 1983).
14. Tufte [12] p.33.
15. Snow, John. "Cholera Map." *Fielding School of Public Health*. 1854. http://www.ph.ucla.edu/epi/snow/snowmap1_1854_lge.htm (accessed 7 7, 2013).
16. Tufte [12] p.41.
17. Bowers, John. "The logic of annotated portfolios: communicating the value of research through design." *Designing Interactive Systems* (ACM, 2012) p.68.
18. Bowers [17] p.68.
19. Schofield, Tom, Marian Dörk, and Martyn Dade-Robertson. "Indexicality and Visualization: Exploring Analogies with Art, Cinema and Photography ." *9th ACM Creativity and Cognition*. (Sydney: ACM, 2013) p.177.
20. Burnham [3].
21. Burnham [3] pp.10-14.
22. Whitelaw [6].

23. Sack, Warren. "Aesthetics of information visualization." In *Context Providers: Conditions of Meaning in Media Arts*, edited by Margot Lovejoy, Christiane Paul, Viktorija Vesna Bulajić and Victoria Vesna, 123. (Chicago: University of Chicago Press, 2011).

24. Language, Art and. *Index 01*. Lisson Gallery, London.

25. Dewey [10].