Chapter XII
Information Visualization and Interface Culture

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ABSTRACT

This text seeks to contextualize the history of and discourse surrounding information visualization. It positions visualization in relation to broader 20th century visual culture and addresses the evolution of the interface as a ubiquitous tool and the aesthetics for understanding the organization of information. A timeline of precursors to the Graphical User Interface (GUI) is developed and a survey of recent related history and theory is conducted to deliver additional perspectives on information aesthetics. The text concludes with a brief survey of several recent visualization projects to illustrate the variety of fields being engaged and enriched by contemporary information design.

INTRODUCTION

In recent years, there has been a scramble to delineate what may be a new frontier in visual culture. Artists, theorists and designers have rushed headlong into an ambiguous realm that has been simultaneously described as data art, information architecture, infographics and most frequently, information visualization. What do these terms mean? Furthermore, what range of creative and communicative activities do they encompass?

This evolving initiative to define information visualization can be largely attributed to the influence of designer Edward Tufte, who taught statistics at Princeton in the mid-1970s. His dissatisfaction with existing literature on the “graphic standards” of information design inspired his seminal text The Visual Display of Quantitative Information, which he self-published in 1982. According to Tufte (2001), information visualization is about creating “instruments for reasoning about quantitative information” (p. 9) with the utmost importance placed on clarity and precision.

Information has become an aestheticized commodity, one driven by an increasing visual literacy. Contemporary media allows users to
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cross-reference and interact with complex flows of data and statistics while registering multiple world-views. Once limited to scientific and industrial research, quantitative data analysis is now accessible “in our living rooms and at our breakfast tables” (Danziger, 2008, p. 11). This chapter will position recent interest in information visualization as resulting from the widespread proliferation of interface culture over the last thirty years. Before delving into the nuances of the interface it is worthwhile to pause and schematize a working definition of information visualization that will act as a foundation for subsequent discussion.

What constitutes information visualization? This is a complicated question to answer as identifying the boundaries of new disciplines is always a contentious affair. Using Tufte’s “instrumental” definition as a springboard, this discussion will consider information visualization as the distillation of a body of data into a meaningful graphic representation. Problematizing this notion of “informative” representations is of particular interest to media theorist Mitchell Whitelaw (2008) who has identified data as a “substrate” of information, a body of “raw material” that can be curated and contextualized into legible forms or celebrated as abstraction. For the purpose of this discussion we will consider charts, graphs, maps, and time-based interactive pieces as potential candidates for inclusion in the domain of information visualization. In many ways, visualization can be considered a “cartographic” enterprise—as the map delineates territory, the visualization renders data, connections, time and space.

DEFINING THE INTERFACE

An interface defines the boundary between two entities. It abstracts the interior language of a system and serves as an operable membrane through which this system can be manipulated. Although we tend to associate this relationship with the control of technology (i.e. software directing hardware), we can abstract the notion of the interface to read the practice of information visualization. An information “map” is an abstraction of a dataset into a more accessible, legible form that can be quickly scanned, comprehended and potentially even reconfigured by a user.

As a paradigm, interface culture is most clearly exemplified by the Graphical User Interface (GUI). The GUI is a virtual environment that has become so ubiquitous that we have become blind as to how much it colours our perception. This “hidden in plain sight” perspective on the interface as a paradigm was the subject of Steven Johnson’s text Interface Culture (published at the height of Microsoft’s power, before the dot-com bubble burst), which presciently employed the GUI as a cipher to read the sweeping economic and technological changes of the mid 1990s.

Many of the organizational qualities of the GUI have now been deployed in other forms of media. The influence of interface aesthetics can be seen in print, motion graphics and gaming and has radically altered the nature of broadcast design – one only need compare archival television news broadcasts from the 1980s to the info-blitzkrieg of present-day cable news. There has been much speculation about the wide-ranging implications of pervasive computing, a technological revolution that will shortly transform the world around us into a networked system of “intelligent” objects. This research will posit the history of information visualization as being directly tied to the proliferation of interface culture, an ideological and technological shift that has already occurred. It will also assume there is some truth to the notion that increasing bandwidth devoted to the transfer of data will demand more sophisticated frameworks for interpreting this deluge of information (Johnson, 1997).

In The Language of New Media (2001), Lev Manovich updates the thought of art historian Erwin Panofsky by referring to the database as replacing perspective projection as the “symbolic form” of contemporary culture (p. 219). In
his seminal writing on the Renaissance (1972), Panofsky identifies perspective as “picture space” and describes the transition of painting surface from a simple material underlay into a “window through which we look out into a section of the visible world” (p. 120). According to Manovich, the non-hierarchical digital inventory is now an equally important paradigm. However, does it not follow that the means through which we interact with this information is more meaningful than the structure of the backend? Secondly, can we draw any connections between the “standardized displays” and experiences associated with GUI-based operating systems and contemporary information visualization?

Once visualization is considered as emerging from interface culture, an entirely new historical vector is activated, one which can be used to trace the roots of visualization back more than 50 years. This enables our analysis to move beyond standard conversations of graphic clarity and timelines of recent representational techniques and software developments to frame the discipline of information visualization as emerging out of a broader sampling of 20th century visual culture.

This text will explore the relationship between information visualization and interface culture through three investigations: a historical examination of significant early technologies, prototypes and imaging techniques that anticipated the GUI, a summary of discourse and research that cuts through, informs and problematizes visualization, and a survey of contemporary work.

SIGNIFICANT RELATED TECHNOLOGIES

In tracing the genealogy of information visualization there are a number of potential historical discourses to draw from. The study of information design usually employs statistics, demographics or cartography as choice vantage points from which to consider the discipline. Recent interest in the work of William Playfair (1759-1823) and Charles Minard (1781-1870) is proof positive of the legitimacy of this backstory in the eyes of many design historians. Given that the goal of this conversation is to delineate a connection between visualization and interface culture, this analysis will instead look to early and mid-20th century imaging technology and the roots of the GUI as a starting point. What follows is a list of several key developments in imaging and interface technology that have had significant influence on information design.

It is worth noting that one of the most famous images associated with Charles Minard is his graphic detailing the ill-fated March of Napoleon into Russia in 1812-1813. It is no accident that one of the first complex information graphics schematized a military campaign, considering the longstanding tradition of technological and informational innovation being advanced by the gears of war. Instead of looking to the techniques of Minard, what can we learn from related mapping and interface endeavors from the 20th century?

This portion of the text will examine the history of radar, Vannevar Bush’s Memex, the development of the Head-Up Display in military aviation and the birth of the GUI. In tracking these developments we may better understand the intersection of 20th century informatics and imaging technologies as well as the roots of pervasive interface culture.

THE BATTLE OF THE BEAMS

Of the many battles that took place between the United Kingdom and Germany during this war, the “battle of the beams” was one of the most decisive. This conflict pitted nascent British and German radar technology against one another with aerial dominance of the skies over England hanging in the balance.

Radar was first developed by the German inventor Christian Huelsmeyer for the purpose
of collision avoidance in nautical navigation. Huelsmeyer publicly demonstrated his system in 1904—it operated by firing radio waves at targets and detecting their reflections. Over the next two decades, European and North American scientists would further develop this research and the range of radar systems extended from several to 25 miles. By the onset of the war, radar was emerging as a viable tactical tool. The crux of British-German radar warfare emerged from the German air force’s utilization of the “Knickebein” and “X-Gerät” signal transmission systems to enable nighttime bombing runs over Britain. The Luftwaffe bombing raids were executed with surgical precision and this presented a sea change in aerial warfare to which the British military had to respond. Fortunately for Britain, a rudimentary radar network had been implemented before the onset of the war and it was able to serve as the cornerstone in a comprehensive British defense strategy that would ultimately “out-visualize” their German opponents.

In 1937, a prototype radar network was set up along the perimeters of Great Britain. Dubbed “Chain Home”, the system consisted of a line of transmitter stations positioned at 50 mile intervals around the perimeter of the United Kingdom. Led by scientist Robert Watson-Watt, the British military capitalized on this system to develop state-of-the-art methods for enemy detection and fire control. This advanced mapping of the airspace over the United Kingdom acted as a “force-multiplier” allowing the British defenses to concentrate the aircraft where they were needed most and coordinate supporting anti-aircraft fire. Chain Home was monitored by oscilloscopes and operated as follows:

When a pulse was sent out into the broadcast towers, the scope was triggered to start its beam moving horizontally across the screen very rapidly. The output from the receiver was amplified and fed into the vertical axis of the scope, so a return from an aircraft would deflect the beam upward. This formed a spike on the display, and the distance from the left side—measured with a small scale on the bottom of the screen—would give the distance to the target. By rotating the receiver goniometer [a tool for measuring angles] connected to the antennas to make the display disappear, the operator could determine the direction to the target... while the size of the vertical displacement indicated something of the number of aircraft involved. By comparing the strengths returned from the various antennas up the tower, the altitude could be determined. (Wikipedia, 2008)

This imaging technology provided the British forces with an early warning system by providing realtime data tracking German aerial activity over, or approaching, the United Kingdom. Radar-based defense networks have been described as “electromagnetic curtains”, an upgrade to the medieval notion of fortification in which brick and mortar are bolstered and extended by telecommunication infrastructure (De Landa, 2003, p. 5). This technological development provided Britain with the strategic edge it required to turn the tide in the ongoing air battle against Germany. The oscilloscope based radar system would eventually give way to the Plan Position Indicator (PPI) display, which is now universally associated with radar technology.

A DESKTOP FOR THE AGES: VANNEVAR BUSH AND THE MEMEX

In July 1945, the engineer Vannevar Bush published an essay entitled “As We May Think” in Atlantic Monthly. This visionary text hypothesized a device called the Memex, and his description of this apparatus revolutionized thought about and the storage and manipulation of information. In outlining the Memex, Bush anticipated hypertext, the notion of personal “desktop” computing and
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foreshadowed the development of the GUI. The Memex capitalized on emerging magnetic tape technology and utilized it as a super storage medium capable of archiving vast amounts of information. The system could be loaded with thematized collections of texts and images and was operated through multiple screens that facilitated navigating and annotating this body of information. The best way to understand the operation of the text is to refer back to Bush's own words that explain a scenario in which the system might be used:

...the owner of the memex, let us say, is interested in the origin and properties of the bow and arrow. Specifically he is studying why the short Turkish bow was apparently superior to the English long bow in the skirmishes of the Crusades. He has dozens of possibly pertinent books and articles in his memex. First he runs through an encyclopedia, finds an interesting but sketchy article, leaves it projected. Next, in a history, he finds another pertinent item; he ties the two together. Thus he goes, building a trail of many items. Occasionally he inserts a comment of his own either linking it into the main trail or joining it, by a side trail, to a particular item. When it becomes evident to him that the elastic properties of available materials had a great deal to do with the superiority of the Turkish bow, he branches off on a side trail which takes him through text books on elasticity and tables of physical constants. He inserts a page of longhand analysis of his own. Thus he builds a trail of interest through the maze of materials available to him. (Bush, 1945)

The Memex facilitated the creation of connections between texts, a system for user annotation and, most importantly, a non-linear means of navigating “writing space”. Implicit in Bush’s contextualization of the device was the idea that the computer could be a tool for personal research, rather than simply facilitating institutional or commercial data analysis. More important to this discussion is the fact that the Memex provided a comprehensive interface for managing multimedia content as well as an early influential prototype for desktop computing.

A GIANT STEP FOR MILITARY IMAGING: THE BIRTH OF HUD

As stated in the discussion on radar technology, the importance of military research in helping advance 20th century imaging technology cannot be understated. The aerospace industry has been a continuous driving force in the evolution of graphic interfaces due to the complexity of aerial navigation and warfare. Another important benchmark in graphic display technology was the development of the Head-Up Display (HUD) in military aviation in the late 1960s. Originally developed by Specto Avionics, the HUD was originally proposed as a navigation aid to assist pilots with nighttime or rugged terrain landings. An article appearing in Aircraft Engineering and Aerospace Technology announced HUD to the world in 1968. This new display technology was described to be focused at infinity to appear superimposed upon the pilot’s view ahead of the aircraft. The pilot need not remove his gaze from the view ahead of the aircraft in order to obtain data about the aircraft’s performance. With conventional instruments there is a significant delay after the pilot realizes he needs data before he can re-adjust his eyes to obtain it. Obviously a display which enables the pilot to absorb data continuously without any conscious effort must be more efficient than a display that requires constant activity. (“Specto Avionics – Head Up Display”, 1968)

Ready access to information about velocity, altitude and heading made pilots more in tune with their aircraft and kept their eyes glued to the sky rather than the various display surfaces that
line the cockpit. There is an almost cybernetic subtext to the HUD, as it provides the operator of an aircraft with a mainline to the vital signs of their vehicle, imposing this data on top of their visual field, blurring the line between pilot and aircraft.

HUD information was originally projected via cathode ray tube (CRT) and has since been deployed through a range of delivery systems ranging from the commonplace (LCD) to those straight from the pages of speculative fiction (direct retinal projection).

THE GUI AND PERVERSIVE INTERFACE CULTURE

The interface was previously described as the boundary between two entities. In terms of computing, it represents a software overlay that facilitates the user interacting with lower-level functionality. It is easy to overlook the GUI, as it has become the primary means through which people interact with information on a day-to-day basis. It is not unusual for a contemporary knowledge worker to spend the day administrating commercial logistics in a spreadsheet application and follow that with an evening navigating the interlocked architectures of social networks and content management systems. The GUI is of interest to the study of information visualization because in having these systems at our fingertips, we have developed a comfort in manipulating information while simultaneously multitasking across numerous applications. These developments have led to increasingly refined expectations of visual clarity in interface design.

The research underpinning the GUI was conducted at the Augmentation Research Center (ARC) at the Stanford Research Institute, by a team led by Douglas Englebart. In the 1960s this team developed the “oN-Line System” (NLS), which featured an early implementation of hyperlinked text. This work would serve as the basis of the first graphical user interface for the Xerox Alto computer developed at Xerox’s Palo Alto Research Center (PARC) in 1973. The Alto featured the first deployment of now-standard features such as windows, buttons, icons and widgets and also made use of a pointing device, the mouse – also the brainchild of Douglas Englebart.

The Xerox Alto (1973) and its successor the Star (1981) were the first computer systems to embrace the now ubiquitous notion of the “digital desktop”. These systems took the idea of the desktop as a work surface and translated the administrative and research activities associated with this space, abstracting them into metaphor. This interface minimized the user’s contact with hardware and replaced esoteric methods of communication (punchcards, cumbersome “terminal” displays, etc.) by making the picture plane of the screen the site of interaction. Through the combination of fledgling visual and physical interface technologies the act of computing had become a graphical experience. Nowhere was the emergence of this visual paradigm driving the interface of personal computing more clear than in the runaway success of the Apple Macintosh in 1984.

A stripped-down version of Apple’s prototype system Lisa, the Macintosh introduced the general public to a wide variety of GUI functionality that we now consider commonplace. These included fixed-height scrollbars, the trash can, the drag-and-drop process and a file system where all content was represented graphically. The system also made significant advances in type design, visual consistency and user experience, all areas that Apple would begin to build its brand around. The Macintosh was a runaway success and while Microsoft Windows would become the dominant operating system and GUI, it was most certainly Apple who went on to set the standard in computer interface design over the next 25 years.

With the crystallization of the GUI we can identify a connection between several of the technologies that comprise this timeline. Douglas Englebart, one of the key architects of the personal
In looking to develop a nuanced reading of causes and the nature of information visualization and interface culture Lev Manovich’s scholarship on recent media history is a good point of departure. Manovich’s reading of the database is useful precisely because it searches for the roots of contemporary modes of informational organization in cinema – the dominant medium of the 20th century. In tracing recent developments in visualization this discussion will also consider the sizable influence of John Maeda, Ben Fry and provide counterpoint by way of Alan Liu’s articulate critique of information aesthetics.

LEV MANOVICH’S CALL FOR AN INFO-AESTHETICS

Lev Manovich was one of the first contemporary media theorists to critically engage information visualization and it is a subject that he has returned to often over the last decade. To Manovich, visualization represents an aesthetic project that speaks the language of the contemporary era. He identifies it as a subset of mapping and acknowledges the practice as deriving from the “new priorities” of networked culture, a society concerned with “making sense” of and “producing knowledge from information” (2005). This is similar territory to that traversed by Mitchell Whitelaw as cited in the introduction. To Whitelaw (2008), there is a world of difference between information and data, and while Manovich is speaking directly to the potential of information to illuminate the world around us, Whitelaw is invested in articulating the possibilities of data as a material. This “fork in the road” in discussions of information-fueled design or expression is worth keeping in mind as it highlights quite different destinations for any “data practice” or related aesthetics.

In The Language of New Media (2002), Manovich turned to proto-cinema directors such as Sergei Eisenstein (1898-1948) and Dziga
Vertov (1896-1954) to contextualize new media. Eisenstein’s development of montage editing and the index of experimental techniques employed by Vertov in *Man With a Movie Camera* were used to question the role of narrative in the 20th century. Manovich pointed to the production of film—the collection, storage and editing of footage—as database logic incarnate. He turns to the shooting schedule (often asynchronous to the narrative of a film), multiple takes, and material left on the cutting room floor to highlight that “production logistics” rather than the story arc yield a database of “possible films” (p. 237). This notion of an “expanded cinema” becomes a touchstone for evaluating new media.

Manovich employs a similar technique in reading the connection between certain moments in art history and visualization. To Manovich, a key by-product of the practice of visualization is an anti-sublime reading of the world. Where a romantic painter like Joseph Mallord William Turner (1775-1851) would set out to capture the incomprehensible majesty of light, space and atmosphere, a contemporary visualization would consolidate an incredible amount of data and dispassionately communicate it in a single frame or through a custom interface. Both of these creative pursuits speak to what could be described as representation and summarization, but in romantic painting there is inclination to revel where visualization merely renders. While many visualization projects celebrate hypercomplexity, this is most certainly a novel aesthetic that sits well outside the domain of classical and romantic art. The fact that Manovich considers visualization in relation to the broader history of representation is important because it allows for more engaged readings of the discipline than simply weighing the practice in relation to the history of graphic communication.

Manovich repeatedly gestures towards the widespread deployment of digital production, editing and special effects technologies in the image arts (film effects, graphic design, etc.) in approximately 1993 as a definitive event that signaled not so much the arrival of “new media” but new thinking about media. It was at the possibilities of digital compositing that led to the contemporary image, which he identifies (2007) as being characterized by hybridity and remixability and describes as “meta-media”. In using the term meta-media, Manovich describes images comprised of some combination of live footage, animation, typography, motion graphics and information overlays. This consolidation of media and techniques lends itself quite readily to a comparison with the multiscrn/multitask experience of the GUI.

The conclusion to Manovich’s essay “Data Visualization as New Abstraction and Anti-Sublime” (2002) identifies an overt connection between visualization and science in that it can “help explain the patterns that surround us.” He points out that the utility of the medium of visualization is in its ability to highlight connections and linkages that might otherwise go undetected. Manovich ends this text with a speculation that the true potential of visualization lies in communicating our personal connection to the flows of information that surround us:

*If daily interaction with volumes of data and numerous messages is part of our new “data-subjectivity,” how can we represent this experience in new ways? How new media can represent the ambiguity, the otherness, the multi-dimensionality of our experience, going beyond already familiar and “normalized” modernist techniques of montage, surrealism, absurd, etc.? In short, rather than trying hard to pursue the anti-sublime ideal, data visualization artists should also not forget that art has the unique license to portray human subjectivity – including its fundamental new dimension of being “immersed in data.”* (Manovich, 2002, p. 12)

In using Manovich to read visualization a first instinct might be to rely only on his exploration
of the database or moving image. Ultimately Manovich sees the true value of visualization in its capacity to reflect the manner in which we as individuals engage the information around us.

JOHN MAEDA, BEN FRY AND THE ERA OF POST-VISUAL ARTS

Another key figure with a decidedly unique personal response to the information around us is John Maeda. Having reaped the benefits of a traditional design education and bolstered this with a playful engagement with technology, Maeda has emerged as one of the preeminent design educators of this generation. In the foreword to his autobiographical monograph Maeda@Media, Maeda identifies computation as having pushed us into an era of “post-visual arts.” To add fuel to the fire, he titled a 2001 show at Tokyo’s NTT InterCommunication Center “Towards Post Digital.” These provocative descriptions are not the words of a contrarian, rather the suggestion that the information revolution has already happened and that the creative class is charged with making sense of it all after the fact.

Several themes are evident across Maeda’s body of work. His software applications and multimedia design are generally process-oriented with a nuanced sensitivity towards materiality and an emphasis on engaging the means of production. Maeda is acutely aware how much the trappings of personal computing affect the way we perceive the world around us. Many of his projects revolve around developing custom, experimental tools rather than mastering proprietary software platforms. Beyond this, Maeda has repeatedly explored everyday means of interaction (mouse, keyboard, application window, desktop tower, monitor, etc.) as creative opportunities in and of their own right. For Maeda, the endgame in working with technology is to work through it, to be liberated:

There needs to be a concrete set of core advancements in the tools we use, not just incremental updates. To realize such a future, more artists must be unafraid to peer deep inside the machine and directly affect a deconstruction of the software systems that imprison all digital expressions. (Maeda, 2000, p. 225)

This statement could very well serve as a synopsis of Maeda’s wildly successful tenure at the Massachusetts Institute of Technology (MIT) Media Lab from 1996 to 2008. While at MIT, Maeda led the Aesthetics Computation Group (ACG), a design and computation studio that set out to prototype “advanced architectures and processes to enable the exploration of unimagined spaces and forms.” (Maeda, n.d.) A remarkable group of designers contributed to this fertile project, one of whom was Ben Fry, a programmer and visualization scholar who has indeed “peered deep inside the machine.”

Fry’s ACG Masters thesis Organic Information Design (2000) set out to consider how interactive visualization systems could embody organic qualities in response to flows of information (p. 13). Fry’s basic hypothesis was that while the representation of static data had been researched extensively, the relevance of this body of knowledge started to waver when computation permitted interactive time-based representations. To this end, Fry set discussed a variety of organic phenomena (e.g. adaptation, metabolism, homeostasis and reproduction) and deployed them in his Valence and Anemone projects, two incredible visualizations that constituted a large part of his thesis work. Employing a methodology similar to that of Tufte, Fry created his own archaeology of visualizations and turned to forward-thinking software projects from the early 1990s. Discussed work included Mitchel Resnick’s Starlogo (1994), Ramana Rao and Stuart Card’s Table Lens (1994), Lisa Strausfeld’s Financial Viewpoints (1995), and Martin Wattenberg’s MarketMap (1998). He also
penned an extended homage to John Conway’s experiments with simulating cellular automata through the Game of Life (1970). Fry ultimately concluded that organism in information design could allow users to “engage in an active deconstruction of a data set” and to “pull apart complexity” via the realtime manipulation of the rules driving the representation (p. 16).

Fry further developed this body of research through his dissertation *Computational Information Design* in an attempt to reconcile data mining with interface design. He chose the field of biology, specifically the complex realm of genetic classification, as a proving ground in which to develop reactive systems for visualization. The bulk of Fry’s thesis work was coded in Processing, an open-source programming language co-developed with Casey Reas, whom Fry quoted (2004) describing their project as moving “graphics and concepts of interaction closer to the surface” (p. 126). Processing has emerged as one of the platforms of choice in visualization and the programming environment is clearly the heir apparent to John Maeda’s earlier Design by Numbers software-for-artists initiative.

**CHARTJUNK, ADMINISTRATIVE DEBRIS AND THE LAWS OF COOL**

Since this discussion started with Edward Tufte, it is useful to return to him in attempting to further parse the discourse surrounding visualization. Tufte’s vocabulary for discussing information design is packed with phrases like “chartjunk”, “wasted ink” and “administrative debris” (2008). Clearly a reductionist, Tufte values clarity and an accurate representation of the data being communicated above all else. While this reading of information design certainly makes sense considering established protocols in statistics, science and modern cartography, are there other ways that we can read Tufte’s zeal for skeletal minimalism in broader information design? The digital humanities scholar Alan Liu has developed a very useful critique of contemporary information aesthetics that can enrich and problematize Tufte’s work.

Alan Liu’s text *The Laws of Cool: Knowledge Work and the Culture of Information* (2004) presents a comprehensive dissection of interface, ideology and the workplace in the information economy. The book excavates a large body of 20th century management theory while tracking the transition of the dominant “work” paradigm from the assembly line to the cubicle farm. Nestled in the heart of this text is “Information Is Style”, a chapter that speaks directly to this exploration of visualization and the interface.

According to Liu, by the time the web had arrived we were already living in an era defined by a “single, great canvas”, one that had consolidated all of the posters, typographic experiments and, most importantly, the ethos of modernist design (p. 207). Liu identifies this monocanvas of screen, browser and application as a generalized information interface and points out that we have “imported” our aesthetics for reading this sprawling construct directly from Modernist design ideology. To Liu, there is a direct connection between best practices and usability in interface and software design and the whitewashed universality of the International Style. One noteworthy distinction between these points of reference is that where Modernism celebrated a fusion of form and function, the contemporary info-consumer is completely attuned to the separation of style and content – what can be described as the expansive divide between raw data and how we experience it on screen (Johnson, 1997). In this new milieu, design becomes a delivery device for data, and the “thirst” for stylized representations of information is the primary reason that a web page is more like a “glossy consumer magazine than cargo off a truck” (Liu, p. 215).

To Liu, information design (and the appreciation thereof) is an ideologically driven process. Liu would identify the recent widespread interest
in visualization as further evidence of a general complicity with contemporary modes of production, proof positive of the triumph of the information economy over creative domains. While this perspective is quite cynical, it is interesting to weigh against Tufte’s purist “function over form” tendencies. Viewed in this light, the practice of visualization can be read as a love affair with bureaucracy, design for “efficiency obsessed” technocrats. Can we politicize visualization? It is outside the scope of this discussion to answer that question but we should acknowledge that visualization can (and no doubt will) be subject to broader cultural discussions in the near future.

Perhaps the key paradigm in contemporary information visualization is shifting from discussions that orbit around clarity towards the possibility of depth in and the creative exploration of the interface. Seen in this light, the “means of interaction” becomes a medium, one which yields potential as an educational and communicative tool that allows the user to scan and interpret large bodies of data and be an active agent in reconfiguring the representation of this content.

The GUI has profoundly shaped our relationship with information. It has enabled rich and complex, multivalent connections to and interpretations of the “flowing data” that now permeates all facets of life. While information visualization certainly can be read in relation to statistical or cartographic traditions, it is crucial to recognize the intrinsic connection between this medium, and interface culture as a way of life and means of perception.

**Recent Developments & Contemporary Work**

Considering the degree to which computation drives contemporary visualization, it is of little surprise that the field is evolving rapidly. Some key recent developments include the wildly successful *Design and the Elastic Mind*, a spring 2008 show at the Museum of Modern Art (MoMA) in New York City which included a diverse ray of interactive visualization projects. A few months later, MoMA added one of these pieces (a version of *Cabspotting* by Stamen Design) to their permanent collection. Also of note is the significant initiative at the New York Times to deliver increasingly sophisticated multimedia information graphics as part of their current rebranding as a “21st century newspaper”. These developments speak to the gradual shift of visualization as a hermetic tool for specialists to a meaningful visual language ready for application across mass culture. Mike Danziger’s 2008 thesis, *Information Visualization for the People*, does an excellent job of exploring the increasingly social and accessibility-oriented nature of visualization. One only need look as far as the projects making the rounds in the art and technology networks on the web to sense that we are in the midst of a significant cultural shift in terms of how we represent and communicate information.

Given the investment this text has made in a historical reading of information visualization, a suitable ending point would be to examine some choice examples of contemporary work. This selection of projects illustrates an exciting spectrum of representational techniques and points to a range of communicative, geo-locative, archival and polemical possibilities for information visualization.

Completed as a part of the aforementioned *Computational Information Design* (2004), Isometric Blocks is an application for scanning patterns in clusters of genes that tend to occur together. When comparing the genomes of two individuals, single letters will vary over every few thousand units of genetic code. These changes are called single nucleotide polymorphisms (SNPs) and tend to occur in distinct patterns that are referred to as halotype blocks. To visualize a range of halotype blocks mapping the SNPs of a sample group of approximately 500 people, Fry created an interactive application that possessed multiple modes of representing this data set. A
user can seamlessly switch between these views in an effort to understand and interpret this data and the system also possesses the ability to display additional “advanced” information for expert users.

In reading this visualization, the relative thickness of each column indicates the percentage of the survey group with a given haplotype block configuration. Moving along the x-axis, representations for increasingly rare haplotype blocks are visible. The colors in each row depict possible variations for each SNP, with the darker tones representing more common SNPs and the lighter tones rarer SNPs. Figure 1 is a 3D view of the data set rendered as an isometric projections where each block is offset in the z-axis. The bottom row includes lines noting the transitions between blocks. In the application Fry has created for presenting this data the visualization can be viewed in several other 2D and 3D modes permitting a range of scaled and quantitative means of interpreting the information. Beyond this, the visualization can be “tuned” to alter the range of information represented in a given view. All of this functionality delivers a customizable viewport for exploring this complex body of genetic information.

Ben Fry approached this project with the zeal of a cartographer rather than that of a scientist. He has noted that in dealing with extremely large, exponential bodies of data, a *Powers of Ten* style of representation is inadequate as genetic data yields “plateaus” of interest which need to be explored and developed rather than zoomed-through (quoted in Abrams, 2006.) Beyond this, the complexity of genetic information necessitates multiple viewports which allow the exaggeration, reconfiguration or muting of certain parameters. Isometric Blocks provides a window into the world of contemporary genetics that can speak to the specialist and educate and inform the lay person.

Oakland Crimespotting is a data mashup that spatializes crime statistics from the city of Oakland’s Crimewatch service across maps culled from the Microsoft Virtual Earth database.
Launched in 2007, the project is updated with fresh crime reports daily and provides a web interface for viewing the crime statistics for the last 30 days in the greater Oakland area. Crime types are categorized and color-coded to group violent offenses, property-related crime, and criminal activities that affect quality of life and the exact location of each crime is identified. The system also allows users to isolate blocks of time, types of crimes and specific police beats to provide a very flexible means of understanding how crimes play out across the city.

Oakland Crimespotting is controlled through a simple menu that spans the bottom of the screen. The left side of this interface allows you to select a timeframe and the right side allows the selection of which offenses are being displayed. Users can zoom into specific regions or beats to see detailed information for a few city blocks and zoom out to see patterns of crime distribution emerge across the entire city. Navigating this system is a purely visual exercise that is certainly much more intuitive than reading police press releases or tracking crimes covered in the traditional media. The project expands upon Adrian Holovaty’s Chicago Crimespotting project (2005-2008) with an added emphasis on user experience and an interface that is graphical rather than text-based.

Most importantly, Oakland Crimespotting allows users to cut through the rhetoric and stereotypes that can cripple neighborhoods. The project gives citizens the tools to develop an understanding of what asocial activities are taking place throughout the city and in doing so through this project they no longer have to rely on archaic civic infrastructure. Systems such as this can serve as research tools for communities to foreground issues that may not be getting adequate media coverage or political attention.

This interactive visualization, completed in 2008, is both an index of the radio spectrum of electromagnetic (EM) frequencies and a database of art projects that utilize this bandwidth. In reading the visualization, a viewer can switch back and forth between two views, with each privileging a specific body of data (EM frequencies or projects). The x-axis utilizes a logarithmic scale to spatialize a very broad range of frequencies (1kHz-100GHz) transforming an enormous data set into a manageable range of information that
can be quickly scanned. The interface underneath the primary viewport can be used to adjust the amount of bandwidth visible at a given time, allowing the user to zoom in and out and examine specific swaths of frequency. This interface is annotated with additional information about the EM spectrum, and provides a range of “landmarks” (e.g. the bandwidth employed by mobile phones).
to aid in contextualizing the information within the radio and broader EM spectrum. Providing the viewer with information about the frequency associated with mobile phones and other recognizable technologies helps make this information slightly less abstract.

While the project of representing the EM spectrum is a worthy endeavor in visualization, the Atlas also indexes a number of media art projects that rely on these frequencies. This interface provides a means of comparing the frequencies employed by creative projects in relation to the greater range of EM bandwidth as well as one another. Without having any understanding of the EM spectrum, a user can quickly identify a range of bandwidth, connect it to a common use, and then see what creative work is being done with these same frequencies. The Atlas functions not just as a visualization, but an archive.

The introduction to an award winning competition entry for the 2008 White House Redux Architectural Competition, this graphic condenses a significant amount of American history into a single image. The mandate of labRAD’s (designers Arielle Assouline-Lichten and Wayne W. Congar Jr) vision of how a 21st century White House might work revolves around an exhaustive study of the American government, the legislative process, and speculation as to how public opinion might more directly influence governance.

This visualization consolidates several swaths of data, which is all represented in the main graphic on the right. First, the size of the federal workforce since 1792 is offset against public access to governance (right and left in the central bar graph). This information is referenced against the political history of America, tracking the political designation of each ruling party since 1792 (the hatched fields on the left). This data is drawn in perspective and the end of it butts up against a circular graph which communicates the relative size of federal departments, agencies and bureaus by category (i.e. infrastructure, judicial, environment, etc.). Branching off of this primary graphic are “architectural annotations” and elevation drawings recording various alterations to the White House over the last two centuries. While all of this information is combined into a composite graphic, it is also viewable as individual graphs on the left, and in the case of the information on government departments, expanded upon as a detailed list at the top.

When combined, this research yields a sophisticated analytic tool which serves as a timeline,
political index and a people’s history of America. This research was deployed as part of a larger narrative which positioned a 21st century White House as a nexus of visualized data which could provide the administration with a real-time window into the thoughts and opinions of Americans. The project addresses the rich history of polling and demographics and proposes that visualization can be deployed as an aid in the everyday practice of democracy.

This interactive visualization documents the spending habits of designer Burak Arikan over the course of two calendar years. Arikan collects receipts on all purchases in order to build up a database of financial transactions in an effort to analyze spending habits and develop a system for predicting future transactions. On opening the Transaction Graph, the viewer is greeted by a complex weave of interconnected points that map out purchases for the most recent day archived in the system. A timeline running along the bottom of the image allows the user to scroll back in time, and doing so makes the graph dance across the page while reconstituting itself in reference to new base data. The project is a playful exercise in self-surveillance that not only aims to represent everyday patterns of expenditure and consumption as an interactive application, but also attempts to algorithmically predict future transactions based off spending habits. The statement for the project identifies these “found” future transactions, aligning the intent of this predictive venture with Marcel Duchamp as “if readymades are found in the past, predicted objects are found in the future.” (Arikan, 2008)

In engaging with this visualization we are indirectly considering our own spending habits. Beyond this, the visualization elevates everyday activity (e.g. a trip to the laundromat), taking the “artifacts” from these events and turns them into raw informational material for an aesthetic experience. This brings to mind the words of David M. Levy (2001), who in extolling the virtue of the receipt as a document worth studying reminds us of “a bigger challenge to look closely and respectfully at the lowest and homeliest of documents” and that the search for “beauty, depth and power” in receipts is most certainly a great accomplishment (pg. 8). Exploring this visualization forces the user to reconsider the aesthetic potential of banal transactions and indirectly questions the nature of commonplace financial documents such as spreadsheets and credit card statements into question.

REFERENCES


**KEY TERMS**

**Data:** Quantitative facts, figures or statistics provided without context.

**GUI:** A visual means to facilitate human-computer interaction, often employing familiar “graphic standards” such as windows, icons, menus and widgets to represent available information and actions.

**Information:** Organized data that increases the knowledge of the individual consuming it.

**Information Visualization:** The distillation of a body of data into a meaningful graphic representation.

**Interface:** An operable membrane that defines the boundary two entities (i.e. an operating system mediates the relationship between computer hardware and the user).