Gateway to the World: Data Visualization Poetics

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Abstract

In my creative research practice, I am interested in stretching new technologies and programmable languages in order to explore multimodal digital textualities. During the last seven years, I have developed projects assisted by programmers in order to create language-art media work through the exploration of interactive grammars, aesthetics, and poetics in digital writing. My interest in new literacies, new text, the reader/writer/performer of generative texts, sound, and visual interfaces in a world of unstable, generative visual words, is reflected in my creative work, and this essay considers how these concerns have unfolded through the development of an application for the iPad. The application, titled *Gateway to the World* (2014), was developed specifically for an exhibition in Hamburg, Germany. It is an exploration of data visualization poetics that use open data to visualize the routes of the vessels arriving at and departing from the Port of Hamburg, with the names of the vessels being mapped to Wikipedia entries. This paper establishes a context for the app through the discussion of artists' and designers' works, the presentation of ideas, notions, and concerns related to the creation of data visualization projects, as well as the creative process involved in the production of the application.

Keywords: e-literature, data visualisation, open data, poetics, translation, Internet, textual remix, digital literacy, interdisciplinary, practice-based research, creative process, maritime, landscape, navigation, Hamburg.
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This essay has evolved in conjunction with the practical part of a data visualization research project, a mobile application designed to run on an iPad2/iPad mini, or later models. The application was created with the help of the developer Pacal Auberson specifically for the SILT exhibition, hosted in Hamburg, Germany, in June 2014, to which I was invited. I took this exhibition as an opportunity to explore the city of Hamburg and discovered that it had one of the largest ports in the world; the name *Gateway to the World,* therefore, seemed like a great title for the application. The vast and busy port serves here as a metaphor for the immensity of the Internet, its flow of information, its quality of openness, and its ability to connect through the World Wide Web. The aim of the application is to use maritime databases to visualize the routes of the vessels arriving at and departing from the port, as well as mapping the vessels' names to multiple search engines.

In the context of current events, such as the disappearance of the Malasia Airlines aircraft on March 8th 2014, research in travel data visualization is invaluable in helping us to understand new technologies of mapping and transportation through the visual analysis of data. Data visualization is understood as presentation of data, whether as a gathering of available data to tell journalistic stories (Gray et al.), as Van Heerden's use of metaphors to make data accessible, or as visualization of information (Klanten et al.). With *Gateway to the World,* there is the opportunity for visualization to be done in real-time, representing the data analysis of quantitative information, such as the position of the vessels, the time and day of sailing, their characteristics, the kind of vessels visiting the port, their origin, merchandise, the technical details of each vessels, and so on. However, for the first part of this artistic practice-based research, through the creation of the app as the first prototype, we have taken

the data from one day in order to experiment with the process of data visualization as a creative methodology and the use of open data as material to create a sea of visual poetics. There are times when maritime traffic is not very regular and, since the aim of the project was to explore databases as tools and data as material for artistic expression, using live data (in real-time) could compromise aesthetic possibilities and consequently visual impact. Taking the data from one day has allowed us to play with the speed of the vessels to create a maritime landscape of animated vessels represented by their names while pulling stories about each vessel from Wikipedia in the form of calligrams.

Questions addressed as part of the process included: How is this current fascination with data visualization to be understood? How can open data be used as the raw material for creative projects? How can graphic design, programming, and aesthetics be used to analyze databases? What contribution can design bring to the Digital Humanities, in general, and more specifically to the field of electronic literature where art, language, and digital technologies intersect?

Data Visualization: Design Context

Scientists, artists, and software designers are using elaborate ways to communicate data through visualizations, but how is the current surge in these kinds of activities to be understood? Is it because of the availability of open data? Does it have to do with the approachability of visual design? Or, does it relate to the fact that it is now part of our collective consciousness? Visualization has always been an effective method of communication. Edward Tufte, a pioneer of data visualization, explains how the most notable advances in information visualization began with cartography about 6000 years ago when the first map was marked into a piece of stone. The next step, he says, links to the development of real science, such as Galileo's improvements to the telescope, which has allowed previously unseen astronomic events and objects to be viewed. For example, after observing the sun for about forty days, he visualized what he witnessed by engraving images of sun spots ("The Art of Data Visualization").

Needless to say, digital technologies and the web have transformed our experience of cultural objects, changing the way that we write and the way that information is published. According to Tufte, with Google maps "people are using visualization to do something" ("The Art of Data Visualization"). In the field of networks and big data, data visualization has become very popular in recent years and visual design is playing a substantial role by making the language of science more accessible and comprehensible through visual designs of text and image, metaphors, static, animated, and interactive visualizations in the form of infographics, sculptural objects, installations, and applications. Josh Smith, a graphic designer working with infographics at Hyperakt, explains in the same video how, for instance, infographics tell a story, creating a narrative by using accurate data, in a way that people can understand. He writes: "When you look at a piece. It's successful when it translates data from something that's complicated to something simple. When it communicates a message that otherwise would have taken somebody hours to digest and find in an instant" ("The Art of Data Visualization"). Infographics generally contain a mixture of text and visuals to create either static or motion graphics animations. Examining how visual

metaphors are used in design to capture and make data accessible through the analysis of a comprehensive amount of creative projects, in his contribution to Klanten's et al.'s *Data Flow: Visualising Information in Graphic Design,* Heerden writes:

> Visual metaphors are a powerful aid to human thinking. From Sanskrit through hieroglyphics to the modern alphabet, we have used ciphers, objects, and illustrations to share meaning with other people, thus enabling collective and collaborative thought. As our experience of the world has become more complex and nuanced, the demands to our thinking aids have increased proportionally. Diagrams, data graphics, and visual confections have become the language we resort to in this abstract and complex world. They help us understand, create, and completely experience reality. (5)

If this communication through visualization is becoming so popular, what is it saying about our culture? A culture of visualization of data, networks, interactivity, and virtual worlds is forcing us to think in a very different way to that of linear alphabetic representations. Manuel Castells reminds us, in *The Rise of Network Society* (2010), of the creation of the alphabet in Greece at around 700BC, followed by the translation of oral communication into language, the origination of conceptual discourse and what Havelock calls the "alphabetic mind" (qtd. in Castells 355). This is significant because, Castells writes: "the new alphabetical order, while allowing rational discourse, separated written communication from the audiovisual system of symbols and perceptions, so critical for the fully fledged expression of the human mind" (356). He goes on to explain how this system has separated literate culture, with its written form, from the world of sounds and visuals, which has then become confined to the language of the arts, and associated with the expression of emotion. However, just as in the twentieth century visual languages have taken command of mass media, he believes that we are currently undergoing a similar technological change in which different modalities become integrated in the same interactive network. It is this integration of text, images, and sound in the same generally accessible networked system in hypertextual organization that will change the character of communication.

Castells's understanding of network and information culture is one that I have shared in my practice-based research during the last fourteen years. I have been exploring multimodal textualities, starting with my doctoral thesis completed in 2003, titled "From Visual Poetry to Digital Art: Image, Sound, Text, Convergent Media and the Development of New Media Languages." The mainstreaming of the Internet at the beginning of the 1990s and my introduction to digital media and software packages in the middle of the 1990s has simplified the possibilities of developing creative research projects integrating the different modalities. I have developed projects with a vision of what new technologies and the Internet might bring in relation to the new page, reader-writer-author roles, the new text as well as translation processes from humans to animals and back to humans through the machine, referencing, in general, the future of new literacies and the interconnection of language, art, and technology. For N. Katherine Hayles, in my work "the emphasis shifts from the in-mixing of human and machine cognition to reconfigurations possible with digital technologies of the traditional associations of the sound with the mark. It was, of course, this association that inaugurated literacy and, in the modern period, became deeply identified with print technology"(*Electronic Literature* 71). Beginning with the investigation of the oral, its

translation into the mark as language, and referencing avant-garde movements (such as concrete and sound poetics), my research has focused on new digital textualities where a range of modalities would be integrated to create new languages. This exploration is only possible thanks to developments in computing and the use of software to highlight the future of the text following the advent of the World Wide Web; it is inspired by the concepts of de-centered, interlinked, and malleable textualites in the work of Jacques Derrida, George Landow, and Richard Lanham.

In the last decade, code has also played a strong part in my research. The execution of programming and the translation of code into visuals is a fascinating design process. I have referred to this code as "sculptural material," which shapes the work, a notion that is explored in my creative projects, such as "Generative Poems" (2008-11) and "Transient Self-Portrait" (2012), where invisible code becomes visible on the surface of the work. Referring specifically to codepoetry and codeworks, John Cayley, in "The Code Is Not the Text (Unless It Is the Text)," argues that the analysis of such work should focus as much on the code as on its surface execution. In other words, in order to understand "linguistic electronic language" (created by the invisible code) those reading or interacting with the work should also be able to understand how code is affecting this language (the visible part of the work). Hayles, in her article "Print Is Flat, Code Is Deep," places linguistic language and programming code side-by-side when approaching such works as Talan Memmott's *Lexia to Perplexia* (2000), which create what he describes as a creole with an interplay of code and words. Works by Mez Breeze that use her "mezangelle" text, created with symbols of computer code and language, similarly offer a sense of meaning as polysemic:

> Mezangelle initially evolved from immersion in email exchanges, computer programming languages and chat-oriented software [i.e. y-talk, webchat, and irc]. To mezangelle means to take poetic phrases, programming code, social media conventions, and other networked modes and alter them in such a way as to extend and enhance meaning beyond the predicted or the expected. (Mencia, "Digital Textualities")

Memmott's *Lexia to Perplexia* and Breeze's work, in general, highlight the importance of code as language in our understanding of the making of electronic writing. "These works," Hayles writes, "are not content to let code remain below the surface but rather show it erupting through the surface of the screen to challenge the hegemony of alphabetic language" ("Deeper into the Machine").

In similar ways, with visualization projects data is translated into visual designs through programming code; through code, data as raw material becomes the "surface-text" (Hayles, "Print Is Flat, Code Is Deep" 83). For Lev Manovich, data is always visualized through software, and, as a result, software is becoming our language, the medium in which we communicate: "Software has become our interface to the world, to others, to our memory and our imagination—a universal language through which the world speaks, and a universal engine on which the world runs" (*Software Takes Command* 2). Therefore, if code is shaping our linguistic language (how we write) and software is the interface to communicate (its grammar), then visualization is bringing a new language in which programming and software form the communication system for the production of the surface content, whether this is visual, aural, or textual. For this reason, Manovich concludes that, "there is no such thing as

digital media, there is only software" ("Media After Software" 5). Ennis B. Butler et al. state, that because data is the medium of our collective present, it needs to be the material for design. They write:

> In an era when "information overload" is a cliché, and the verb "to google" is in common use, data becomes cultural material. Networked information is woven ever more tightly into the fabric of contemporary society; data is the medium of our collective present as well as, increasingly, our history. As such it is vital that data also becomes a material for design. This means not only designing its surface or appearance, but working with its deep structures and attributes, designing its flows, interactions and representation to create new forms. (1)

In order to enable average users to create their own visualizations, artists have often embraced the idea that software should be shared. Software artist, Jer Thorp, co-founder of Office for Creative Research, in the process of his investigation into code, art, design, and science, has turned to open source software as a tool. As stated in his biographical note for the *National Geographic,* "[i]f data visualizations could be explained with words, we wouldn't need them." For Thorp, "it is a visual way of analyzing a problem. I think in code and build open source software that lets anyone get in the driver's seat and explore" ("Jer Thorp: Data Artist"). In the PBSoffbook web series "The Art of Data Visualization," Thorp explains that the purpose of data visualization is to visualize something that has not been seen before, an act that he calls revelation. His aim with his own visualizations is to share ideas with viewers so that they might be able to further enhance them in order to create something useful in culture and society. He has visualized data from a range of sources, including weather sensors, NASA databases, Twitter, and articles, aiming to develop open source software to allow people to explore new forms and to create a culture in which information and knowledge are shared.

Visual Transparency

Visual analytics are only possible in a culture of transparency; that is, if data is made available. There is much speculation about big data and open data, though these terms do not necessarily signify the same type of resource, according to Joel Gurin. Big data, as the name indicates, provides an impression of being so large that is impossible to access in its entirety (with governments alone in a position to understand it), while open data supports the need for transparency and free availability.

Although the two are interconnected, Gurin notes in his online article for *The Guardian,* open data is defined by its use, and by how this use can make big data more democratically accessible. He writes:

> Open data is accessible public data that people, companies, and organisations can use to launch new ventures, analyse patterns and trends, make data-driven decisions, and solve complex problems. All definitions of open data include two basic features: the data must be publicly available for anyone to use, and it must be licensed in a way that allows for its reuse. Open data should also be relatively easy to use, although there are gradations of "openness." And there's general agreement that open data should be available free of charge or at minimal cost.

However, my interest in this paper is not in access to big data, but in the possibilities that open data presents for creative projects and how creative agencies are using openly available data with the aim of making information transparent. The organization *Visualizing.org*, for example, uses data as material for designing and instigating new forms of communication through sharing visualization projects. This organization works in partnership with data providers, encouraging coders, designers, and developers to challenge themselves by taking part in competitions, visualizing the same data set based on social issues, such as the impact of the World Wide Web or the data of hospital prices for healthcare transparency. It presents an opportunity to use data visualization to consider socio-political issues, scientific explorations, and the overall influence of data flow and networked information people share. As Andrew Vande Moere puts it, "We have an urgent need to use visualisation for socially relevant purposes" (Klanten et al. 29). Government agencies, councils, and corporations are becoming more aware of issues of data ownership and the importance of information transparency by making their data accessible.

According to Jose M. Alonso in his online article for *The Guardian*, initiatives to provide open databases are becoming common practice for governmental organizations that are seeking to provide greater information transparency. He writes:

> Open government data (OGD) is entering the mainstream. From being an obscure passion for a few geeks just five years ago, to forming the backbone of a G8 declaration, its spread across the globe has been phenomenal. The reason? OGD initiatives have the potential to spur innovation, deliver better services for less money, improve urban planning, and reduce corruption, to name but a few possibilities.

Data is unarguably becoming embedded in our lives and in society, in general, but how is it affecting our lives? Is visualization helping us to make better decisions? The Data Institute ODI runs a program of presentations and annual exhibitions questioning issues of data ownership and information transparency in order to raise awareness about public and educational issues. In addition, ODI also runs the *Data as Culture* art program. Julie Freeman, an Art Associate at ODI, and Gavin Starks write:

> *Data as Culture* raises questions about the concepts and practicalities of open data. It explores the wider implication of the culture of open data on culture itself, to challenge our understanding of what it is, and how it may affect and reflect our lives. (1)

In 2013, ODI distributes an open call for an exhibition to be curated with MzTEK, a UK-based organization of women artists engaged in new media and computing arts production; curators Freeman and Sophie McDonald explain that their interest is in works that might challenge our understanding of data, how our lives might be informed and affected by it and how we interpret it.[1] Among some of the works submitted is a vending machine created by Ellie Harrison, which releases a packet of crisps when a term related to the recession makes the headlines on the BBC News RSS feed. This seems an interesting and fun way to visualize information. Another, less utilitarian and more magical, work is Phil Archer's "Three Flames

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[1] Information about the works selected can be found in the 2013 catalogue that accompanies the *Data as Culture* exhibition.

Ate the Sun, and Big Stars Were Seen," where the viewer is presented with the drawing of an arc made with a laser light on canvas, coated with pigment that reacts to ultraviolet light. There is a point when a small flare appears and, finally, the whole image disappears. This is a poetic piece that takes data from NASA about solar eclipses that are then referenced in historical texts, representing it metaphorically on canvas, connecting natural events and new technology.

Pollution is another area that has seized designers' and artists' attention, since they are able to visualize the carbon footprint used by car users. Winchester Science Centre, for example, organizes a series of events titled "The Internet of Cars," in which artworks explore the issue of carbon monoxide emission. Curated by Helen Sloan from SCAN,[2] in collaboration with five university partners and Sixth Sense Transport, this project engages in "the development of apps and new data analysis to promote a social and shared space for people who use cars and want to reduce their carbon footprint" ("Internet of Cars"). This exhibition, being part of a two-week event, together with the partners involved corroborates the urgency for visual transparency in an attempt to raise awareness about ecological issues. In her introductory talk for this exhibition, Sloan explains that the project's title—"Internet of Cars"—playfully refers to the new phenomenon of the "Internet of Things," and that the artists in the exhibition are, in their interpretation of the data produced, confronting controversial and political issues.

The visualizations at the exhibition have involved a variety of creative forms, including installations, sculptures, interactive work, and soundscapes. One of the pieces by the internationally recognized artist Stanza's "The Accident of Negligence and the Agency at the End of Civilisation" (2014) is an art installation formed of twenty-four screens, a dozen speakers, and a labyrinth of CCTV cameras presented on a plinth. Stanza describes this work as "a real time interpretation of the data using the number plate recognition system aligned with real-time images from one hundred CCTV cameras in the region of South of England," this installation provides viewers with a visualization in the form of "a spatialised audio experience of spoken texts and generative visuals."

Offering another approach to visual transparency, Duncan Shingleton, digital artist and Ph.D. candidate, in his piece, "Flows" (2014), brings together six acrylic tubes, each one of them representing an Automatic Number Plate Recognition camera on the A354 in England. By recognizing the number plate, it is possible to find out about the make and the model and subsequently an estimated emission of the CO_2. Air is blown up the tube, flowing at a greater rate when the CO_2 volume increases. With LED lighting helping to color the particles in line with the standard energy efficiency classes, this is a beautiful and sophisticated piece developed from the collaboration of artists and technologists. Dutch artists, Esther Polak and Ivar Van Bekkum, explore both information visualization and sonification in order to raise awareness about CO_2 emissions. Their contribution to this exhibition, an online installation titled "Fronting Motion" (2014), is a visualization and sonification of the life data of the A354 and of the ships coming in and out of Southampton. This installation is projected in

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[2] For information about SCAN Digital art agency and Sixth Sense Transport, see the description of the project at *Internetofcars.org.uk.*

shipping containers in Southampton Guildhall square, with one side representing information relating to ships, and the other information relating to traffic from the A354.

These examples demonstrate how communities of socially conscious and creative people are trying to make complex issues more comprehensible, with the aim of facilitating transparency of information. They highlight the diversity of issues dealt with in these many visualizations, as well as the various approaches used, whether installations, sculptural objects, apps, websites, interactive installations, motion graphics, prints, or sonifications. Heerden believes that the information designer helps to "[bridge] the gap between information and its expression" (Klanten et al. 8) and "shapes an experience, or view of the data with a particular aim in mind. To clarify, confuse, inspire, towards which the chosen visual presentation can be directed" (6). It also becomes apparent how in this process of interaction, designers are looking for a more collaborative and accessible way to communicate with other cultures, similar to what Johannes Schardt describes as "the universal language of imagery, understood by everybody" (Klanten et al. 13).

Gateway to the World: Process and Visualization

The interest in developing this app has emerged from my research in the visual linguistics of image, sound, and text, which explores the in-between of language as both semantic and visual, in order to integrate rational and emotional expression. The investigation into visualization models seems to be a natural development because the translation of data into patterns, forms, and flows encompasses both the scientific language of data and its translation into visual communication. It incorporates the language of figures and a visually creative but expressive language, while enacting Castells's understanding of "a new interaction between the two sides of the brain, machines, and social context" (356).

In order to explore the above possibilities in developing *Gateway to the World,* I have undertaken research into projects that demonstrate similar characteristics in order to find out about available databases, programming languages, and the technology that they use. Among these various databases are some that represent data in a geographical space, and which at times map the motion of people moving in and out of a city.[3] I have come across numerous examples where the expression of data is mapped against a background landscape to create links of meaning production about either traffic or transport systems, emotional maps, immigration flows, some of which are considered in the edited collection by Klanten et al. "The origins of the word 'landscape' are ambiguous," this book observes, and continues:

> Its roots derive either from a combination of "land" and the Dutch work for "ship," or the German verb "schaffen"—to create. In datascapes, both meanings suggest the potency and responsibility of the designer in guiding the viewer through a complex sea of meaning. Elevating the reader from "Flatland"—the reduced, lessened experience of reality that results from subjecting real experience to two dimensional expression—they create a journey of context and interaction. Perspective is blended with graphic frameworks to bring depth and meaning to the expression of data. (97)

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[3] See, for example, Moritz Stefaner's work on the movement of New Yorkers over the last decade at his website *Moritz.stefaner.eu.*

An example of such an expression of data in interactive map flows can be found in Jo Wood's work *Chaos and Structure,* made in collaboration with the Museum of London and Transport for London and exhibited at the Digital Shoreditch 2013 exhibition, in London. Drawing on open source data provided by Transport for London, this interactive work looks at the use of London Cycle Hire Scheme and travel patterns and is concerned with the reasons that motivate these journeys across such a city. In the interactive piece we see an animation of moving lines which represent the time of the day and the area of London in which these journeys took place. The permanent traces of the bicycles are also saved as posters (viewable on the giCentre website) that resemble calligraphic drawings.

A project closer to *Gateway to the World*, because of its connection with ship data, is Ben Schmidt's visualization of the routes of nineteenth century ships which, using open data from NOAA (the U.S. National Oceanic and Atmospheric Administration), outlines the continents and shows America's major ports of the period. In addition to applying different traditional methodologies from the Humanities, his project uses data visualization as a research method drawn from the Digital Humanities for historical analysis; here it is through the illustration of data, rather than narrative discourse, that arguments can be formulated. He writes: "Digitization makes the most traditional forms of humanistic scholarship more necessary, not less. But the differences mean that we need to *reinvent,* not *reaffirm,* the way that historians do history" (Schmidt, italics in original). In *Gateway to the World*, data is similarly used as material, as content, and as a creative methodology to explore the possibilities of online and networked narratives in the production of digital poetics.

Gateway to the World is a datascape set against the landscape of the Port of Hamburg, which functions as the background for the expression of maritime data. The shaping of an experience is central to the interaction with the app: choices taken in connection with the interactive aesthetics form part of the users' exploration of a concrete poetics, figurative language, and semiotic system that allows open data to be translated into a more experiential and universal visual language.

When opening the application, after the splash screen, a map of the port of Hamburg appears with colorful signs of the names of the vessels that they represent. These signs move as if sailing along the river Elbe, and the animation of the vessels follows the routes taken from the site *Marinetraffic.com* on June 4th, 2014. As the vessels move, they act as writing tools to reveal a string of text that creates calligramatic forms from information that is drawn from Wikipedia entries about the name of the vessels.[4] Initially, this writing of generative animated text is readable, but, as more vessels pass through the same routes, the text mixes with the many other strings of texts from the different vessels to finally create a river of colorful letter flows, shadows, layers, and ripple effects. The app provides users with the ability to zoom in and out by pinching and stretching the image, and the texts can be tracked out into the North Sea and down the River Elbe.

The information gathered from the entries pulls up a textual remix that extends from factual information about vessels (containers, cargo ships, tankers, and high speed crafts) to the names of characters in literary works, plays, and mythological stories. Of course,

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[4] In very few cases, Wikipedia entries do not exist for vessels, so these have been manually updated for the purpose of the application.

although the project could only be based on factual details to provide practical information about the vessels, this information alone would not fulfill the aim of the creative project, namely the use of data and digital technologies to explore the poetics of data visualization. One example is the vessel FORTUNA, named after the Greek goddess, in respect of which the app offers relevant information about the gods and myths of ancient Greece. In the case of the vessel RITA, the application image links to information about its many uses, whether as the name of a person, the title of an opera, or the name of a martial art school.

Other vessels' names included are SUMMER FLOWER, CITY OF HAMBURG, CITY OF BEIRUT, NAGOYA EXPRESS and several with personal names, such as PETER, JAMIE, VIKTORIA, GERDA, JANA, SUSANA. Some others bring up curious information, as is the case with CMA CGM VERDI, which generates the following text string: "List of ships attacked by Somali pirates in 2011 flag Bahamas | owner Bahamas | name CMA CGM Verdi | class Container | crew unknown | cargo unknown | status Attempted attack prevented . . . 27 KB (3,831 words)—05:26, 28 April 2014 Piracy in Somalia On 28 January 2011, an Indian Coast Guard aircraft while responding to a distress call from the CMA CGM Verdi, located two skiffs [. . .]" (Mencia, *Gateway).*

Collaborative Practice

Collaborative practice is common in projects like *Gateway to the World*, where there is a combination of academic research, creative design skills, knowledge of programming, and experience in the developing of applications. Therefore, I have applied for funding in order to employ a programmer, Pascal Auberson, to assist me in the programming and development of the application. Our roles were very clear: I have come up with the concept and defined the creative project while he implemented the technical solution. The opportunity to work in collaboration with a developer has opened up an opportunity to research and understand a whole new area of knowledge and expertise, while exploring the fascinating field of data analysis as a way to understand social, political, economical, and cultural issues.

Collaborative practices in art and technology are varied and, regardless of researchers' efforts to determine different collaboration models, it is difficult to follow only one particular methodology. In this project, the process of collaboration mainly has unfolded through email exchanges. We have met face-to-face in order to view the work and consider any concerns, but our discussions have primarily taken place online. Auberson has presented a series of very valuable questions with regard to the design of the project in order to find the best programming language. There have been some constraints when it comes to the realization and performance of the work due to various factors, such as the many characters employed. In the text for each vessel there are four lines for the various zoom levels, each line has a maximum of 1000 characters, and there are around 100 lines (which correspond with the numbers of vessels represented), adding up to 400,000 characters in total. This creates some challenges for Auberson when using certain programming languages, having to integrate Open Frameworks C++ and X-Code and the programming language Ruby to establish the main structure for the project. But, ultimately, finding solutions by incorporating different programming languages to achieve the design aims is what has shaped the artwork.

Regarding the use of software, Manovich argues that applications determine only the properties of digital media, not what they contain:

> With all types of data now encoded as sets of numbers, they can only be efficiently accessed by users via software applications. As a result, the "properties" of digital media (how it can be edited, shared, and analyzed) are now defined by the particular software as opposed to solely being contained in the actual content (i.e. digital files). ("Media After Software" 1)

When it comes to the content of the work, this is defined by the programming languages selected. Data is the raw material, while code translates this information into a visual language. Therefore, content and its characteristics are defined by the particular programming language that is used. The advantage of using programming instead of a specific software application is that it provides greater authorial control.

Our application, originally built as an Objective-C application, after much optimization switches to Open Frameworks/C++ mid project to minimize any processing overheads. Even this is not fast enough, so the animation moves into a custom shader[5] on the Graphic Processing Unit (GPU), especially because of the 100,000 individual characters. A series of readjustments needs to be made to enhance functionality and performance. The content, design, and programming needs to be integrated: the background map, the labels of the signs with the name of the vessels, text sizes, opacity, quality, minimum/maximum zoom levels for interactivity, revealing of text trails, layers, colors, the ratio of size of text to size of map, and data speed for animation of vessels. The application's thumbnail incorporates some relevant visuals from the project and in order to design the Splash screen I resort to Mapbox, a useful tool for designing geographical maps. For the purpose of dissemination, and since we have encountered various complications to publish with Apple's App Store, we have moved the project to WebGL (Web Graphics Library). Our decision to publish it online has made it much more widely accessible. This has given us an authorial freedom we could not find with the App Store and, consequently, we have developed different iterations for a series of site-specific exhibitions.

This essay has been able to touch on only a very small part of what is a vast creative context in which important experiments with data visualization are taking place. It is in this context that the interactive work *Gateway to the World* has been developed, with the aim of using databases as the raw material for exploring visualization poetics/aesthetics, and engaging viewers in an interactive experience of the port of Hamburg and other ports that otherwise would not have been possible. It is with projects like this, that electronic literature serves as a means to explore open data as cultural material, as a way to instigate new forms of communication to discuss social and political issues and bring transparency through hybrid forms of visual art, language, and technological advances. *Gateway to the World* in particular, explores new territories to develop electronic literature. These include the investigation of open data in the creation of data visualization poetics, e-calligrams, new literacies, networked multimodal textualities and online and mobile platforms for writing, publication and dissemination purposes.

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[5] Shaders are small programs run on tablets or PC graphics cards. They, generally, run on every vertex or every pixel on the screen. Shader programs can run massively in parallel so are much more efficient at certain sort of processing.

The creative process has allowed visualization both as a communication system and a universal language to be reviewed, as well as a questioning of how data and code are used in order to visualize information through the intersection of animation, visual semiotics, and textual poetics, and by means of interaction with a mobile application. This use of data as the material for visual communication raises questions about the availability, ownership, and access to open data in tandem with issues about transparency of information, government engagement, and the involvement of creative organizations in educational activities. Also, the examples of creative practice cited above highlight the significant role that designers play in facilitating transparency of information and, in some cases, the creation of open software as the new grammar and platform for communication. These tools for information visualization allow users to engage in the process of understanding data as culture, creating an environment in which ideas, information, and knowledge are shared. Thanks to the open source software culture, developing mobile applications is becoming simpler.

Works Cited

Alonso, Jose M. "Delivering on the Promise of Open Government Data." *The Guardian.* Guardian News and Media Limited, 6 Nov. 2013. Web. 15 July 2014.

Archer, Phil. "Three Flames Ate the Sun, and Big Stars Were Seen." *Theodi.org.* Open Data Institute, 2012. Web. 15 July 2014.

Castells, Manuel. *The Rise of the Network Society.* 2nd ed. Chichester, West Sussex; Malden, MA: Wiley-Blackwell, 2010. Print.

Cayley, John. "The Code Is Not the Text (Unless It Is the Text)." *Electronic Book Review.* Open Humanities Press, 2 Sept. 2002. Web. 15 July 2014.

Data as Culture, Catalogue, ODI. *Theodi.org.* Open Data Institute, 2013. Web. 15 July 2014.

Data as Culture 2, Catalogue ODI. *Theodi.org.* Open Data Institute, 2014. Web. 15 July 2014.

Butler, Ben, Sam Hinton, and Mitchell Whitelaw. "Playing with Complexity: An Approach to Exploratory Data Visualisation." 2011. ACUADS. Conference Paper.

Freeman, Julie, and Gavin Starks. "Data as Culture." *Theodi.org.* Open Data Institute, Mar. 2014. Web. 15 July 2014.

Gray, Jonathan, Liliana Bounegru, and Lucy Chambers. *The Data Journalism Handbook.* 1st ed. Sebastopol, CA: O'Reilly Media, 2012. Print.

Gurin, Joel. "Big Data and Open Data: What's What and Why Does It Matter?" *The Guardian.* Guardian News and Media Limited, 15 Apr. 2014. Web. 15 July 2014.

Hayles, N. Katherine. "Deeper into the Machine: The Future of Electronic Literature." *Culture Machine* 5 (2003): n. pag. Web. 15 July 2014.

—. "Print Is Flat, Code Is Deep: The Importance of Media Specific Analysis." *Poetics Today* 25.1 (Spring 2004): 67-90. Web. 15 July 2014.

—. *Electronic Literature: New Horizons for the Literary.* Notre Dame, Ind.: University of Notre Dame, 2008. Print.

"Internet of Cars: A Distributed Exhibition." *Internetofcars.org.uk.* SCAN, 2014. Web. 15 July 2014.

Klanten, Robert, et al., ed. *Data Flow: Visualising Information in Graphic Design.* Berlin: Gestalten, 2008. Print.

Manovich, Lev. "Media After Software." *Lab.softwarestudies.com.* Software Studies Initiative, 2012. PDF. Web. 15 July 2014.

—. *Software Takes Command.* New York; London: Bloomsbury, 2013. Print.

Mencia, Maria. "Gateway to the World: Data Visualisation Poetics." *Lumacode.com/projects/gttw.* Pascal Auberson, 2014. Web. 8 April 2016.

—. "Digital Textualities: A Showcase of 12 Digital Works by Women Writers Artists, Poets, Researchers, Academics and Educators." *Mariamencia.com.* Maria Mencia, 2013. Web. 15 July 2014.

—. "Transient Self-Portrait." 2012. *Mariamencia.com.* Maria Mencia, 2013. Web. 15 July 2014.

—. "Generative Poems." (2008-11). *Mariamencia.com.* Maria Mencia, 2011. Web. 15 July 2014.

—. "From Visual Poetry to Digital Art: Image-Sound-Text, Convergent Media, and the Development of New Media Languages." Ph.D. Diss., University of the Arts, London, 2003. PDF. Web. 15 July 2014.

Memmot, Talan. *Lexia to Perplexia. Electronic Literature Collection 1.* Electronic Literature Organization, 2006. Web. 15 July 2014.

Mez, Breeze. "Bio-graph." *Hotkey.net.au,* n.d. Web. 15 July 2014.

Polak, Esther, and Ivar Van Bekkum. "Fronting Motion." 2014. *Polakvanbekkum.com.* Esther Polak and Ivar van Bekkum, 2016. Web. 31 May 2016.

Shingleton, Duncan. "Flows." *Internetofcars.org.uk.* SCAN, 2014. Web. 15 July 2014.

Schmidt, Ben. "Reading Digital Sources: A Case Study in Ship's Logs." *Sappingattention.blogspot.gr.* Awesome Inc., 15 Nov. 2012. Web. 15 July 2014.

Stanza. "The Accident of Negligence and the Agency at the End of Civilisation." *Internetofcars.org.uk.* SCAN, 2014. Web. 15 July 2014.

Stefaner, Moritz. "Map your Moves." *Moritz.stefaner.eu.* Moritz Stefaner, 2010. Web. 5 Jan. 2015.

"The Art of Data Visualization." PBS Digital Studios. *YouTube.com.* YouTube, LLC, 9 May 2013. Web. 25 Aug. 2015.

Thorp, Jer. "Jer Thorp: Data Artist." *Explorers: Bio. Nationalgeographic.com.* National Geographic Society, n.d. Web. 15 July 2014.

Visualising.org. "Galleries," n.d. Web. 15 July 2014.

Wood, Jo. *Chaos and Structure.* Digital Shoreditch Exhibition, 2013. Web. 15 July 2014.