Interfaces and User Experience Design for Culture Analytics

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Introduction

Access to cultural knowledge and participation in cultural production, both for researchers and for the general public, is increasingly mediated by designed interfaces. Our aim in this section is to offer a brief overview of recent work on interface design as it pertains to Culture Analytics, and in particular on the work presented during our second workshop, "Culture Analytics and User Experience Design". Additionally, we will describe some challenges and future directions for the application of interface design to Culture Analytics.

Interface Design

The notion of an interface is exceedingly general; anything that mediates between entities can be understood as an interface. Our purpose here is to discuss specifically those interfaces designed by humans, usually (though not always) as software, that are relevant for Culture Analytics either as sites of cultural participation or production or as platforms for the analysis and dissemination of cultural data.

The academic study of interfaces is often viewed as a subdiscipline within Human-Computer Interaction (HCI). HCI is an interdisciplinary research program situated between cognitive science and computer science and concerned with the myriad ways that humans interact with computers. As a design practice, interface design is part of UI/UX (user interface/user experience), a branch of software design that focuses on the experience of the end user. User interface design therefore shares a genealogy with the development of "user centered design" or "user experience design". Work on interface design, whether theoretical or practical, can originate outside these particular academic disciplines or industries, of course, but anyone doing such work is thereby making contact with HCI and/or software design.

Because the human perceptual system contains several high-bandwidth information channels, HCI research has a strong perceptual component, and very often the visual is privileged over other sensory modalities. As such, the field of information visualization occupies

a significant portion of research on interface design. Not all information perceptualization is visual as increasing attention is being paid to both sonification and haptization as well. Similarly, not all interface design concerns the static perceptualization of information. The role of interactivity in interface design is steadily increasing as technological advances make possible a range of interactive possibilities that go beyond static perception.

Interface Design for Culture Analytics

Particular instances of interface design, as they pertain to Culture Analytics, can be classified according to whether (1) they are used by expert researchers or the general public; and (2) whether they are designed for cultural participation/production or for analysis/dissemination. Of course, particular designs can accommodate multiple audiences and/or purposes, but these two axes can be used to identify a more or less exhaustive set of interface types.

Interfaces, Participation and the Production of Cultural Data

Cultural participation and production happen in countless ways, but cultural products are increasingly generated in digital format and are highly dependent on digital software interfaces. In one sense, this is advantageous for cultural researchers, because born-digital cultural data are easier to analyze using computational tools. Yet it is important for researchers to be aware of the ways that such interfaces impose structure on the cultural data they produce.

Nearly all digital software interfaces for cultural production and participation are web-based, and very many are “social” in the sense that they involve interrelations between people and generate social networks. The largest social networks, such as Facebook and Twitter, allow for the production and sharing of nearly any kind of cultural output either by direct submission or indirectly through hyperlinking. Other networks focus on particular kinds of cultural output, such as Wordpress and Tumblr for text, Instagram for images, YouTube for video, Soundcloud for music, Pinterest for craft, etc. Countless smaller, more specialized platforms exist for every sort of cultural production imaginable.

During Workshop 2: Culture Analytics and User Experience Design, several speakers described interfaces for cultural participation and/or production. Dan Russell (Google) discussed the Google search interface as a site of perhaps unintentional cultural participation, treating the resulting search data as a record of how people actually answer questions. Similarly, Dana Diminescu (Telecom Paris) discussed the “digital traces” of migrants as unintentional cultural products generated by ordinary interaction with digital interfaces. Philip Beesley described architectural spaces that use sensors and robotics to respond to human movement and behavior, generating a participatory experience with designed space.

Interfaces for Education of the General Public

Creative interface design plays an important role in public pedagogy by creating situations in which the public can casually and playfully interact with data. One very well known example of a data interface used in public education initiatives is Gapminder

(http://gapminder.org). At gapminder.org, visitors can access a repository of data on the health and wealth of every nation in the world over several years (the data includes over 400 socio-economic indicators, such as GDP per capita, life expectancy, unemployment rates, energy consumption, and education). Gapminder World is an animated visualization allowing users to explore interactively relationships between two or three different measures, by country and by year.

At the user experience design workshop, we were exposed to more examples of interfaces designed for public pedagogy. Perhaps the most common form of interface design for public education is data journalism. Isabel Meirelles (OCAD) discussed advances in the use of interactive design for data journalism. Science museums and art exhibitions also provide venues for educating the public. Stephen Uzzo from the New York Hall of Science (http://nysci.org/) presented a large-scale, social, immersive, and gestural computational interface to help communicate the complexity. Katy Börner presented other examples of public education venues, including the Information Visualization MOOC (http://ivmooc.cns.iu.edu) – an online public course, and the Places & Spaces Mapping Science exhibit (http://scimaps.org), which is intended to introduce the public to data visualization and science mapping. Kim Albrecht presented a web-based interface, “Untangling Tennis” (http://untangling-tennis.net/), which allows the public to visualize and interact with data collected about tennis players. Eric Rodenbeck (Stamen Design) discussed a very recent collaboration between his firm, psychologist Paul Ekman, and the Dalai Lama (!) called the “Atlas of Emotions”, an attempt to visualize the properties of and relations among emotional states, aimed at the general public. Taylor Arnold (Yale) discussed the application of work on recommender systems to the problem of access to publicly available digital archives.

Interfaces for Public Participation in Cultural Analysis

In this age, public participation requires engagement with data. For example, many major urban municipalities and national governments have launched open data initiatives (“Open Data - Accessing City Hall | City of Toronto” 2015; “State of New York | Open Data” 2015; Government of the United Kingdom, 2015). The rationale behind these initiatives is similar, and each speaks to the need for educating and mobilizing the public. Access to data is one thing, comprehension and participation is another. Interfaces and data visualizations will play a key role in making meaning out of the data, and in enabling public participation. Civic engagement can increase a person’s sense of community and civic pride. At the user experience workshop, Mauricio Giraldo, from the New York public library, presented ‘Building Inspector’, a web-based application that allows the public to easily participate in the city’s efforts to digitize historical maps. Communities, however, need not be restricted geographically, but can be based on similar interests or common employment, and the user experience workshop included examples of interfaces that enhanced participation within such communities. Amanda Visconti from Purdue University presented “InfiniteUlysses”, an interface for James Joyce’s *Ulysses* that allows readers to share annotations on the text. Lilly Irani from UCSD presented “Turkopticon”, a platform that allows Mechanical Turk workers to communicate with one another to potentially improve their working conditions.

Interfaces for Expert Analysis

A considerable amount of work in interface design targets expert researchers. Truly, any software tools used in research fall under this head, but our focus here is on tools designed specifically for expert analysis. Several of our workshop presenters discussed such interfaces.

Sara Fabrikant (Zurich) discussed work on interfaces for time critical situations or in dilemmatic decision-making contexts (e.g., navigation, disaster mitigation and response, search and rescue, etc.). These interfaces are integrated with tracking systems for autonomic nervous activity, and are responsive to changes in such activity. Danyel Fisher (Microsoft) outlined a process of “data counseling” useful in business contexts, where the clients are domain experts seeking assistance interfacing with their data. Nicole Coleman (Stanford) offered the intriguing suggestion that Humanities researchers might find useful a suitably re-interpreted set of graphic design tools. Tim Tangherlini (UCLA) discussed several interfaces designed for use in folklore and literary studies.

Future Directions and Challenges

Evaluation criteria

One challenge in interface design, and an important area of future work in interface design, is the evaluation of the quality and efficacy of designs. In her workshop talk, Marti Hearst (Berkeley) discussed a method of evaluation deployed in her classroom that uses a plurality of assessment metrics and promises to inform future design heuristics.

Beyond the screen

Effective user interfaces must also be accessible to a plurality of people who speak different languages, come from different cultures, and have differing levels of ability. It is therefore crucial to consider creating inclusive designs to effectively communicate data across diverse communities. For example, data visualizations may not be the most effective for those with visual impairments. To this end, much work has been done on conveying data by means of sonification (cf Kramer 2010), and on creating tangible interfaces and representations (cf Folmer 2013)

Future work on user interfaces will certainly move beyond the computer screen. Humans have evolved sophisticated skills for sensing and manipulating their environment, and therefore, to optimize our digital tools, it is expected that we should start designing them to engage our sense of touch and three-dimensional space (Sharlin et al. 2004). Currently, most of our digital technology is confined to screens, pointers, and keyboards, but the standard interface is rapidly moving towards touch screens, which take advantage of our intuitive gestures and allow us to apply our sense of touch to the task (Wigdor and Wixon 2011; Weiyuan Liu 2010). The future of interfaces may start to converge with ubiquitous computing and the internet of things (Olson,

Nolin, and Nelhans 2015), using everyday objects to interact with data and using natural gestures to formulate operations.

Avoiding or managing bias[1]

Cognitive biases constitute the filter between what actually exists, and what we perceive to be true. If a UX designer or UX strategist does not go through the process of identifying and incorporating users' cognitive biases into their work, the design stands to be misinterpreted, and site goals stand to be unachieved. What many UX professionals tend to forget is that they also develop cognitive biases that influence the work they produce. If these biases are not recognized and accounted for, the produced experience could be optimized for the designer, rather than the user. A common issue in agency life involves catering an experience to the cognitive biases present in the room (the stakeholders), rather than those identified through research and ethnography. Two examples of cognitive biases are:

1. Users' Cognitive Biases: I know where it should be located / how it should look / how it should behave / what it should be called
2. Stakeholders' Cognitive Biases: I know what the user wants / what the business wants / what's technically possible / what best practices are

Making interfaces learnable[2]

Some features, especially if they are powerful, are going to have complicated interfaces even though it is not always practical or enjoyable to learn how to use a complicated interface. It is almost always more enjoyable to start using the feature right away and learn about its advanced features through productive use. If the interface must be complex, designers must offer paths to use the feature without a deep understanding of the interface, providing instant feedback so users are guided towards the results they desire and a deeper understanding of the interface. If users can iterate through potential solutions and receive instant feedback, they have the tools to learn the interface through use.

VR/AR[3]

There is still a long way to go for VR. One of the most interesting current hurdles is the user interface, a space which seems to be limited even for technology as 'different' as this. Most current systems rely on presenting a pane of options onto a virtual wall, interfaces that would look just as at home on a phone screen or within a video game. We contend that future developments in VR should take into consideration that, at its best, VR is not simply a simulacrum experience, but is in itself something real and tangible, providing a mix of the

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[1] Jordan Julien: How Cognitive Biases Shape User Experience. http://sixrevisions.com/usabilityaccessibility/cognitive-bias-user-experience/

[2] Alex Parmentier: Challenges in designing learnable UI for crowdsourced content. https://simssa.ca/assets/files/AlexP.pdf

[3] Drew Coffman: The Beauty of Virtual Reality, and the Challenge of User Interface. https://extratextuals.com/the-beauty-of-virtual-reality-and-the-challenge-of-user-interface-5817979595c8#.290nrzef2

familiar and the new. Consequently, VR provides remarkable possibilities for applications in the study of culture. Such applications are already being explored in the context of archaeological recreations and virtual museum tours. We believe that there are almost limitless opportunities in the application of rich VR environments to the analysis of cultural data.

Relation to Other Groups

Interfaces communicate information across disciplines and across levels of expertise within collaborative projects. Good interface design is a crucial component of fostering effective collaboration and translational data science for Culture Analytics. It will also be a crucial aspect of creating accessible cultural archives for practitioners of the field. The development of coherent shared datasets and baseline methods can act as both a resource and a guide for new and extant practitioners; interface design will play an important role in disseminating such tools.

Beyond facilitating collaboration (see White Paper: Collaboration and Translational Data Science for the Study of Culture), and connecting researchers to common archives (see White Paper: Cultural Archives), interfaces can be helpful for probing cultural phenomena at multiple scales (see White Paper: Cultural Phenomena at Multiscale and Multiresolution: Powers and Perils), for exploring heterogeneous collections of visual and sonic data (see Workshop 1: Culture Analytics Beyond Text: Image, Music, Video, Interactivity and Performance), and for understanding language structure in literary data (see White Paper: Language and Culture Analytics).

Visualization Frameworks

The design space for developing aesthetically pleasing yet insightful visualizations is high-dimensional and inherently complex. Many different proposals exist on how to structure this space to make it easier to navigate and manage. Major visualization frameworks include:

- Bertin, Jacques. 1983. *Semiology of Graphics*. Madison, WI: University of Wisconsin Press.
- Börner, Katy. 2015. Atlas of Knowledge: Anyone Can Map. Cambridge, MA: The MIT Press.
- Engelhardt, Yuri. "Syntactic Structures in Graphics (Links to an external site.)." See also Engelhardt, Yuri. 2002. "The Language of Graphics: A Framework for the Analysis of Syntax and Meaning in Maps, Charts, and Diagrams." PhD diss., University of Amsterdam.
- Few, Stephen C. 2012. *Show Me The Numbers: Designing Tables and Graphs to Enlighten*. Burlingame, CA: Analytics Press.
- Harris, Robert L. 1999. *Information Graphics: A Comprehensive Illustrated Reference*. New York: Oxford University Press.
- Horn, Robert E. 1998. *Visual Language: Global Communication for the 21st Century*. Bainbridge Island, WA: MacroVU, Inc.

- MacEachren, Alan M. 2004. *How Maps Work: Representation, Visualization, and Design*. New York: Guilford. 271.
- Meirelles, Isabel. 2013. *Design for Information: An introduction to the histories, theories, and best practices behind effective information visualizations*. Beverly, MA: Rockport.
- Munzner, Tamara. 2014. Visualization Analysis and Design. AK Peters Press.
- Pirolli, Peter, and Stuart Card. 2005. "The Sensemaking Process and Leverage Points for Analyst Technology as Identified through Cognitive Task Analysis (Links to an external site.)." In Proceedings of the International Conference on Intelligence Analysis, 2–4. McLean, VA: MITRE.
- Shneiderman, Ben. 1996. "The Eyes Have It: A Task by Data Type Taxonomy for Information Visualizations (Links to an external site.)." In Proceedings of the IEEE Symposium on Visual Languages, 336–343. Los Alamitos, CA: IEEE Computer Society.
- Wehrend, Stephen C., and Clayton Lewis. 1990. "A Problem-Oriented Classification of Visualization Techniques (Links to an external site.)." In Proceedings of the 1st Conference on Visualization, 139–143. Los Alamitos, CA: IEEE Computer Society.
- Wilkinson, Leland. 2005. *The Grammar of Graphics (Links to an external site.)*. New York: Springer.
- Yau, Nathan. 2011. *Visualize This: The FlowingData Guide to Design, Visualization, and Statistics* (Links to an external site.). Indianapolis, IN: Wiley.

Key facets/properties for organizing visualizations:

- Analysis Types (when, where, what, with whom)
- Levels of Analysis (micro to macro)
- Visualization Types (reference systems)
- Data Overlays (modify reference system, add records & linkages)
- Graphic Variable Types (to visually encode data)

For example Visualization Types comprise:

- **Charts:** No reference system—e.g., Wordle.com, pie charts
- **Tables:** Categorical axes that can be selected, reordered; cells can be color coded and might contain proportional symbols. Special kind of graph.
- **Graphs:** Quantitative or qualitative (categorical) axes. Timelines, bar graphs, scatter plots.
- **Geospatial maps:** Use latitude and longitude reference system. World or city maps.
- **Network graphs:** Node position might depends on node attributes or node similarity. **Tree graphs:** hierarchies, taxonomies, genealogies. **Networks:** social networks, migration flows.

Several speakers from WS2 started a book project that reviews major frameworks in an attempt to update Bertin's *Semiology of Graphics* 50 years after it was published in 1983.

Conclusion

In order to best design the next generation of technologies to enhance communication, collaboration, and cultural understanding, and to prepare for unintended consequences, we need to incorporate a robust understanding of human and social capabilities with deep technical and mathematical skills. To accomplish this, researchers, developers, and designers must demonstrate a willingness to transcend disciplinary concerns. Questions of ethics, privacy, and sustainability are essential components of this process as more and more people spend increasing amounts of time in technology-rich environments. User experience design requires more than a thin interface veneer on top of an algorithmic layer. The shape of the user experience must be rooted in the computational structure from the beginning and co-designed along with the statistical and machine learning algorithms for data exploration and analysis.

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