CS 171/CSCI E-64: Visualization

Homework 4, Problem 5: Reading Questions

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1. Ware argues that human perception involves 2.5 dimensions. Given this assertion, when might a 3D visualization be useful and why?

   One use for a 3D visualization would be to allow the user to interface with that 3D (or 2.5D) visualization using their hands allowing manual interaction. Ware makes the point that the main purpose of stereo vision "is the precise guidance of hand movements."[1] Stereoscopic viewing is limited however and a visualization that allowed a user to manipulate it with his or her hands would be fairly complex.

   Other uses for 3D visualizations would be depicting data that is naturally three dimensional such as diagrams for physical entities such as buildings or cellular organisms. Having this data in a 3D visualization would assist the user in gaining useful information about the data being displayed, as the physical properties are one of the defining characteristics of the data being represented.

2. In Chapter 6, Ware presents some implications of pattern recognition and visual working memory on design. Provide an example that harnesses some of these principles (perhaps an advertisement, visualization, or interface) and discuss how the design takes these principles into account. Please include a screenshot, photo, or website URL.

   In the advertisement below the principal of pattern recognition would first identify that there are people, a watch and then attention would most likely be directed to the people's wrists based on the larger image/pattern of the watch.

   Given the prominent placement of the watch and the watch on the wrist that watch would make its way into our visual working memory as would the faces of the people. At this point the visual working memory is comprised of a face (or faces), a wrist with a watch on it and a larger superimposed watch. The gist of the background is somewhat general as the background is nondescript.

[1] Colin Ware, *Visual Thinking for Design* (Morgan Kaufmann, 2008), 94.

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The design of this ad takes several of Ware's principals into account. The first is to make objects easily identifiable. This is done with the larger image of the watch floating on the lower right hand side of the two ads.

The ad really does not make use of novelty or gist-image mismatch – there really is no background scene in the photos above.

The advertisement uses the company logo as a symbol, though it is small and almost in the background. The user has to see the watch, decide they like it and then almost search to see who the maker of the watch is.

The ad makes use of meaning and emotion in that the watch is seen as classy and nice, much like the ad itself and the people in it. This leads into desire where the consumer theoretically feels a desire to own that watch in the hopes that they will be as cool as Brad Pitt or Uma Thurman.

3. Pick three concepts covered in Lecture 9 - Interaction (e.g., Brushing & Linking) and relate them to the taxonomy presented in Heer & Shneiderman Table 1. How do the interaction concepts fit to their taxonomy?

Overview & Detail

In Overview and Detail the user is given a general high level overview of the data and then allows them to zoom in and filter on specific details of that data (also known as the Shneiderman Mantra) all the way down to the original data.

Overview and Detail relates to Data and View specification which specifies how the data should be visualized. Data and View specification also covers filtering which could be considered as allowing the user to drill down into the detail of the data. Additionally Overview and Detail falls into the View Manipulation category which allows for navigation of the data to "examine high-level patterns and low-level detail."[2]

Finally one could argue that Overview and Detail also falls into the Process and Provenance category, specifically the guidance portion of the group. If the visualization is well constructed the layout can guide the user through the exploration of the data to tell a story.

Brushing & Linking

Brushing is the selection of data points by highlighting (click and drag) and linking is the linkage of data points where selecting data in one view will also select the same data in another view.

[2] Jeffrey Heer and Ben Shneiderman, *Interactive Dynamics for Visual Analysis,* Association for Computing Machinery, February 1, 2012

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Brushing and Linking falls into the View Manipulation category of Heer & Shneiderman's table. Brushing allows a user to select, filter or highlight data. View Manipulation also covers the coordination of views otherwise known as linking.

Filtering
Filtering allows for the filtering of complex data down into the data the user is interested in. An example would be entering text in a search field to get the data a user is interested in.

In the Heer & Shneiderman taxonomy filtering falls into Data & View specification, specifically the filtering of data to focus on relevant information. Filtering also falls into the View Manipulation where information is selected or filtered to manipulate the display. A good example of this view manipulation would be the New York Times visualization on renting vs. buying. Entering filter information in the text boxes manipulates the view based on the data the user is interested in.

4. Cockburn et al. describe various interface design paradigms, among them the "fisheye view." How would the fisheye view improve the usability of a visualization, and under what circumstances might it not?

One type of visualization where the fisheye view might be helpful is a graphic where the overall context is important to understanding. In other types of visualizations where the user has to switch to different views the user must re-orient themselves to that new view first. A visualization such as this might be a large network graph or a visualization of social network connections. The data is enormous, but it is also very contextual so being able to see the large overall picture while at the same time zooming into specific areas would be helpful.

The fisheye view does have problems though in that it does distort the data being represented. A good example of this is the map that Cockburn et al. give in Figure 6b. The state lines of the map are distorted. The second problem with the fisheye view has to do with "challenges with target acquisition."[3] Put another way, the distortion caused by the fisheye makes it difficult for the user to select the item they want because the fisheye lens has moved it from its real location.

[3] Andy Cockburn, Amy Karlson and Benjamin B. Bederson, "A Review of Overview + Detail, Zooming, and Focus + Context Interfaces," ACM Computing Surveys, Vol 41, No. 1, Article 2, (2008), 2:12