Layered Interactive Visual Interface Design: 
A Visual Interface for the Navigation and Analysis of Digital Text Communications

Erica Edelman 
Wright State University 
Dayton, OH 
edelman.4@wright.edu

John Mcintire 
711th Human Performance Wing / RHCVCZ 
Air Force Research Laboratory, WPAFB, OH 
john.mcintire@wpafb.af.mil

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ABSTRACT

We describe the preliminary development of an interactive visualization tool intended to produce a multi-layered visual interface design that allows for fast, easy navigation and analysis of digital text corpora and text communications, allowing for more efficient distributed collaboration and communications in the virtual world.

KEYWORDS: information visualization, text communications, sentiment analysis, visual interface design, human-computer interaction, internet navigation.

1. INTRODUCTION

One of the weaknesses of current information technology is that it generates and presents tremendous amounts of data, but rarely manages to present both high-level overviews and low-level details of that data in a method that is intuitively understandable to a human consumer. The practice of information visualization has been applied very effectively to multiple fields of need including: sensor, scientific, medical, and financial data, and internet communications. When dealing with the latter, however, the sheer enormity of the available information is difficult for even the best tools or visualizations to convey the many intricate patterns and meanings therein. This is particularly true for text-based communications and for digital text corpora. How, then, can the vast deposit of data that can be accessed via the internet (or other digital text data) be presented in a manner that is both intuitive and useful to the information consumer and digital communicator?

Although a single visualization, while useful, may not be up to such a prodigious task, an interface consisting of multiple layers of a variety of visualizations could perhaps provide enhanced usability, rapid understanding, and more intuitive interaction. For this reason, a joint team of researchers developed the Layered Interactive Visual Interface Design, or LIVID. This work is meant to show how such an interface could be developed, to explore potentially fruitful ideas in this area, and to provide a starting point for future researchers, rather than serve as an end product itself.

LIVID uses, at its core, basic text analysis techniques to present text-based internet content or digital text corpora in a more easily-navigable and understandable manner for the everyday user, while also providing useful interactive visualizations of potential interest to researchers. Many of its envisioned visualization methods are not new (comprehensive reviews of visualizations and systems for analyzing/using online digital text can be found in [1,2]). But some (such as the WordNets) we believe are unique and may be particularly useful extensions to word-cloud-type visualizations. Additionally, this tool is specifically intended to help regular users engage with and collaborate more efficiently and effectively with their online communities and virtual worlds.

2. LIVID

2.1. Overview

LIVID consists of a series of “layers”, each representing a different zoom magnification of the internet (or groupings of information sources) as a whole. The outermost layer
For the purposes of...categories such as...Seeking Mantra: first, it's third rule: provide the user with...those other options are available: The example in the...blue. Those that fall in the middle are green. Certain pages,...videos that receive highly positive comments are yellow,...positive/negative affective scale, where blog posts and...A straightforward example would be to do a...the day. If desired, the words in the clouds can be color...interested in the titles of the five most popular articles of...want to know what shows have been added to their queue. For...previously aired TV shows and movies, the user might...last visit, that page is highlighted and moved to the top of...get rid of this need: if a page has been updated since the...visits, a single glance at LIVID's outer layer should provide a quick reference about communications or page status.

However, this is not the only method the outer layer utilizes in assisting the user in deciding whether or not to visit a page or text document: A word cloud is also visible for each page that shows relevant information of the user’s preference. For Hulu.com, a website that streams previously aired TV shows and movies, the user might want to know what shows have been added to their queue. For a blog, the user might want to know what topics are being discussed or the titles of the most recent blog postings. For an online newspaper, the user may be interested in the titles of the five most popular articles of the day. If desired, the words in the clouds can be color coded to relay additional information.

A straightforward example would be to do a positive/negative affective scale, where blog posts and videos that receive highly positive comments are yellow, while pages that receive generally negative comments are blue. Those that fall in the middle are green. Certain pages, such as webcomics, would not result in useful word clouds. For these, other options are available: The example in the...Where the word cloud contains explicit page names (i.e. article titles or video names) clicking on that name will navigate the user directly to the desired page. Otherwise, the outer layer also contains a thumbnail of the webpage’s main page that expands when rolled over by the mouse cursor. Clicking on the thumbnail will direct the user to the webpage’s main page. The middle layer is accessed by clicking on the website name.

2.3. Middle Layers

The middle layers consist of visualizations for the selected website. Due to the individualized nature of web pages, different visualization methods work best on different sites. Therefore these middle layers have to be highly customizable. The current LIVID design does not include an interface or method for customization, which is a factor future work can examine.

The example shown in Figure 2 is a visualization for Twitter which was developed specifically for this project, based loosely on the idea of Havre and colleagues’ ThemeRiver™ [2]. The map on the upper-right shows which areas have positive or negative posts. The yellow areas have an abundance of positive/happy posts, while the blue areas lean towards negative/unhappy posts. This usage of yellow-blue coding on the positive-negative scale is used throughout LIVID’s navigation. To the left of the map is a stack graph showing posting amount by state over time. It is also yellow-blue color coded.

Beneath the state stack graph is another stack graph that is instead broken down by topic. To the right of the topic stack graph is an enlargeable color-coded word cloud of twitter topics. Fully zoomed out, it shows the main twitter topics such as Entertainment, Politics, Humor, etc. The size of the word is coded to amount of tweets. As the user zooms in on an area, sub-categories fade in and appear. Further zooming causes sub-categories of the sub-categories to appear, and so forth. For example, zooming in on “Entertainment” would show sub-categories such as “Media”, “Sports”, “Hobbies”, etc. Zooming in on “Media” would reveal “Games”, “Television”, “Movies”, “Books”, and so forth. These visualizations can be animated by pressing the play button. The map and word cloud animate via the variable time, while the red line on the stack graphs scrolls across to show where that specific time is located on the x-axis. The animation can be paused, and the red lines can be dragged on the graph to show a specific day. An example...
Figure 1. LIVID’s “Outer Layer” which Allows Users to Quickly View Sites/Content and Updates

Figure 2. Twitter Visualizations across Topics, Locations, and Time (a Middle Layer)
of how this page would be altered if using a different web site for a base is shown in Figure 3. This page draws its data from a fan blog. It utilizes three visualizations. The first is a word cloud that displays the most popular words since the user’s last visit.

The second visualization is a graph developed specifically for LIVID: The green line represents number of comments over time, while the purple line represents blog posts per time. The x-axis is time, while the y-axis is number of posts, normalized to 0-1. Areas where the green line is above the purple line are colored green. This shows where there was a relatively high amount of discussion per post. Areas where the purple line is above the green line are colored purple, and show where there was not a lot of discussion per post. When the graph is zoomed in, words appear in the colored areas that represent the topics that are most likely responsible for the popularity of the posts. These are found by looking at the words that appear frequently in the green area that tend not to appear in purple areas, and vice versa. For example, Figure 3 shows that people comment a lot on blog posts relating to HBO, Casting, and Clues, but tend not to comment on blog posts relating to Ireland and Sets.

The final visualization on this page is a word tree. This is an interactive chart in which the user can enter a word and see all the times the word appeared on the website, along with the proceeding or following content. This is an exceptional way to search a site for particular content, because it shows the word in context. If the user sees a sentence they would like to navigate to, they can click on the sentence and be directed to that location.

2.4. Inner Layers

The inner layers consist of individual web-pages, or what the user would normally expect to see on their internet browser. However, there are many ways an interface can make consuming this data quicker and easier, two of which were developed for LIVID and presented below:

Many websites such as news sites, blogs, social networking sites, or video sharing sites offer their users the ability to comment on their content. For popular sites or posters, the number of comments can reach well into the hundreds and even thousands. The above figure (Figure 4) shows a method of marking these comments to allow a reader to get the relevant information from them without having to spend a vast amount of time reading through them all.

The first thing an internet user might come to realize about comments is that many are “throwaway” comments whose sole purpose is to make the author’s presence known. Other comments exist primarily to convey a positive or negative sentiment about the issue at hand. Using html tags, the background of positive comments is shaded yellow, while the background of negative comments is shaded blue. Next, using relevancy analysis, a text analyzer should be able to tell which comments are very relevant, and which are “throwaway”. The most irrelevant comments can be made increasingly transparent so that they blend into the background, while the most relevant and important comments are made bigger, bold, and surrounded by a red border. Furthermore, when topics are changed, comments can be made indented or otherwise visually indicated. Therefore, instead of reading through hundreds of comments, a user can scroll down looking for the big red boxes and reading the contained text. As they scroll, they can note the colors to see if general positive or negative sentiment is expressed. This gives the user the general data that is normally the reason for reading comments in the first place.

The next example shows how a LIVID-type system can improve a news article page. The user can choose whether to maximize either the article page, or its visual representation. This consists of three visualizations: a Proper Noun Word Net, a word cloud, and a navigable word tree.

The Proper Noun Word Net was developed for LIVID, and is useful for larger pieces of text (Figure 4). Proper Nouns are found by looking for capitalized words that are not the first word of the sentence, then going back and seeing if any first-words match the found proper nouns, and including them as well if they do. However many proper nouns are compound and consist of multiple words, for example Lt. Bob Smith, The Great Depression, or Northern Ireland. Therefore, the analyzer then looks to find pronouns that occur next to each other. If the two occur exclusively with each other (for example if every time the word “Great” appears in the article, the word “Depression” follows, and vice versa) then they are considered to be one unit. If they occur together but not exclusively (for example if the article mentions “Wright State University” and “Ohio State University”), then they are linked via an arrow, forming a “net”. Number of mentions is coded to size of the word.

This visualization is useful in multiple ways. Firstly, it answers the specifics of “who, what, and where” for a given piece of text. Secondly, via the net function, the user can easily find relationships among specific entities. For example, they can see all the titles (Dr., Mrs., General, etc) in a piece of text and see who holds those titles. Via matching last names (Bob Smith and Jane Smith) familial relationships can be found. Links can also be found in categories and sub-categories, such as: Dayton, Ohio and
Winter is Coming

Figure 3. Comments and Posting Frequencies over Time, with Word Clouds (a Middle Layer).

Figure 4. A Word Net, a Word Cloud, and a Word Tree (Inner Layer).
Cincinnati, Ohio; The Eiffel Tower and the Leaning Tower of Pisa; or Wright-Patterson Air Force Base and Maxwell Air Force Base. In Figure 5, the user can see that many different Universities are discussed.

3. CONCLUSIONS AND FUTURE WORK

LIVID is a research prototype visualization system meant to explore potentially fruitful areas in information visualization, navigation, and interaction, and to spark future research and ideas. At this point, the interface is still predominantly in the idea-generation-and-testing phase. Future work could include creating a working model of a LIVID-style interface, or of a completely new interface design. This interface would need to add further interactive functionality, such as the ability to personalize the layout and structure of the interface; or to tailor it to more specific applications if desired. We would like future iterations of LIVID to possess the ability to include humans-in-the-loop so that the interface itself is dynamic, responsive, and adaptable to users and their unique needs and behaviors.

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