

Visualizing Sentiments in Business-Customer Relations with Metaphors

Guia Gali

OCAD University
100 McCaul St.
Toronto, ON M5T 1W1
ggali@faculty.ocadu.ca

Symon Oliver

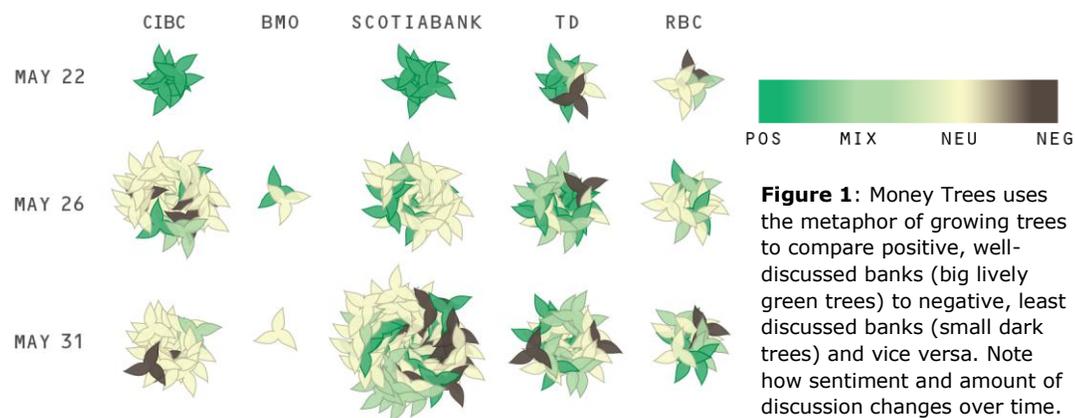
OCAD University
100 McCaul St.
Toronto, ON M5T 1W1
soliver@faculty.ocadu.ca

Fanny Chevalier

OCAD University
100 McCaul St.
Toronto, ON M5T 1W1
fchevalier@ocadu.ca

Sara Diamond

OCAD University
100 McCaul St.
Toronto, ON M5T 1W1
sdiamond@ocadu.ca



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Abstract

This project explores how the visualization of sentiments, extracted from social media posts, can foster transparency and strengthen relations between businesses and their customers. Guided by the nature of the data and an iterative design based on our end users' feedback, we examine a variety of visualization styles and metaphors as possible directions for a common set of tools to benefit both groups of users.

Keywords

Data visualization; Metaphors; Trust; Social Media

ACM Classification Keywords

H.5.2 [Information Interfaces and Presentation]: User Interfaces - Graphical user interfaces (GUI);

Introduction

With social media activity at its peak, businesses see an opportunity to deploy new strategies in monitoring, engaging with, and identifying customers' concerns [1]. Hence, social monitoring tools that assess customer opinions are of major interest to businesses recognizing the benefits of qualitative online input to inform business decisions. Additionally, social media fosters a collaborative, trust-based forum where potential clients can learn from peers' past experiences—be it positive or negative—before committing to a product or service.

In this work, we are interested in how we can leverage user-generated online posts as a means to foster transparency and strengthen relations between businesses and their customers, through sentiment analysis and visualization [11]. Based on our industrial partner's needs, we justify why such visualizations should be designed as a common tool for the differing objectives of businesses and customers. We discuss the design methodology we derived to address this goal. We then illustrate our points with a selection of sketches derived from bank-related data (see Figure 1).

Background and Motivation

Our work was developed in collaboration with social media users and our industrial partner—*Royal Bank of Canada*—who provided us with bank-related data of over 25,000 online posts that discussed each of the five major Canadian banks. Posts were collected from social network sites such as Twitter and Blogspot and news services such as Globe and Mail and Canadian Business, and later pre-processed by a text analytics company¹.

Validity of Data

The proprietary nature of the data mining company caused a black box of how variables were calculated. Likewise, the complex and nuanced nature of language was revealed by the inordinate amount of sentiment mislabeling in the dataset. For example, "Royal Bank lowers residential mortgage rates" was labeled *negative* although in context a lower rate is positive news for homebuyers. Indeed, the wealth of literature on sentiment analysis—including recent work on analysis of financial blogs [7]—proves that accurate sentiment analysis remains a challenge. Investigating these

techniques goes beyond the scope of this paper as our focus is on visualization tools. However, we strive to make our visualization generic so as to accommodate current and emerging sentiment analysis models. As more specific tools are developed, we believe our visualization could benefit researchers by making it easier to identify potential flaws in sentiment analysis.

Visualization

Corporate users were interested in visualizing sentiments in order to gauge a user's intention to purchase, to find faults in services, or compare their product against competitors [6]. While commercial softwares for monitoring social media exist (e.g. Sentiment Metrics²) they are typically designed for strategic marketing and do not create tools for consumers who make use of social media.

Users also see these visualizations as potential means to increase brand awareness: be it a bank showcasing good reviews or a customer voicing concerns. Such tools can help to establish a transparent and trustworthy platform through social media marketing [10]. Hence, visualizations should be accessible and engaging for social media users who lack business training. Existing sentiment visualization tools for such novice users either focus on fields other than finances (e.g. Blews [5]) or are artistic abstract expressions (e.g., We Feel Fine³), and hence of little practical interest to our social media using customers. Therefore, our goal is to provide visualizations that are comprehensible and engaging to online users, while being rich and descriptive enough to serve as professional tools for banks.

¹ <http://www.attensity.com>

² <http://www.sentimentmetrics.com>

³ <http://www.wefeelfine.org>

Methodology

Based on our users' needs and our observation of the ways that the consumers of their services used social media, we believe *casual information visualization* is an ideal candidate for our case. Casual information visualization shares social media's inclusive nature as it lends itself to a wider range of user demographics, from experts to novices and from work-oriented to everyday situations [9]. This visualization style can therefore facilitate a symbiotic relationship where both customers and bank analysts can collaborate on the betterment of services; the creation of well-informed and customized products, and find a shared platform for discussion [7].

With the aforementioned premise, we derived a general methodology for the design of our visualization, based on the following principles:

- ¶1 *Social transparency*: it is essential to disclose background processes in a transparent manner to establish and preserve trust in the visualization. Trust encourages cooperation, which is necessary in order to facilitate collaborative discussion and the co-creation of well-informed products and services between banks and their customers [11,12].
- ¶2 *Sentiment as judgment indicator*: "Many important trust decisions are made in affect-rich contexts" [2], such as deciding who to trust with one's money. Customers without prior knowledge of particular banks can use visualizations to help them make a decision by comparing banks' sentiment ratings. In this respect, this tool can be an effective outlet for users to rectify (or praise) bank performance. Conversely, banks with positive reviews can also exploit such tools as free advertising generated by users of that bank's services [1].

¶3 *Monitoring*: Casual information visualization lends itself effectively to an episodic type of usage with monitoring tools [9]. In our case, quick and clear indications of sentiment changes provide banks with the opportunity to take proactive decisions in remedying complications as they can check (at any time) the presence of trending topics, abrupt changes in sentiment, or simply verify assumptions made by their own financial and consumer market analysts.

¶4 *Metaphor*: using common contextual metaphors will help ease interpretation; establishing a familiar grammar that allows banks and consumers to communicate easily. While a less intuitive visualization could guard against one of the dangers of user-driven design, simply that metaphors only reiterate existing knowledge [3], at the same time tools should always be accessible in a direct and natural way, "*first to gain acceptance from the users, and second to promote unimpeded investigation of their data without having to think about the visualization methods.*" [8]

Design Sketches

Our design approach was largely charrette-based [10] over the course of three months. Featured in this paper are three sketches (of many) we have designed. Each sketch drew from the sentiment visualization of online posts regarding the five banks. Sketches are based on hypothetical situations informed by the dataset, which will be further tested in the prototype development stage as part of our extended work. Banks and social media using customers were present throughout the concept generation phase and provided feedback to identify the most promising approaches that best address their needs.

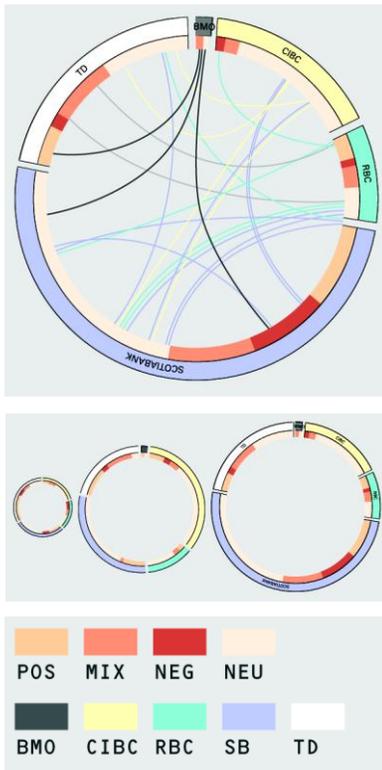


Figure 2: SentiWheel shows sentiments around a wheel that is divided among the five banks. Lines are drawn between sentiments and banks based on shared keywords. The size of wheel also changes as days pass, depending on the total number of posts.

Dataset

For demonstration purposes, our initial dataset was shortened from 39 to 14 days (May 19 to June 1, 2011) and further reduced through the deletion of every other entry to retain proportion. Three iterations later, 1000 entries were left providing a manageable size for manually producing sketches based on real data. The pre-processed dataset were classified accordingly: positive and negative (liking or disliking a product, respectively), neutral (neither positive nor negative in opinion) and mixed (equally positive and negative).

SentiWheel

Inspired by pie charts, SentiWheel presents a holistic view of a larger portion of the Canadian financial market as the five large banks represent the majority of users. This timepiece visualization takes the user through daily snapshots of online posts. The wheel is divided among five banks, with each bank's share further subdivided by its volume of sentiments.

SentiWheel balances a casual information visualization approach with pragmatic aspects of traditional visualizations by combining qualitative view of the dataset with quantitative visual conventions. In Figure 2, we can compare the sentiments derived from each bank through their portion sizes in the wheel (P3). If users desire, details are accessible through interaction as numerical breakdowns of the data are provided (e.g. Bank 1 shares 32%, with 2100 posts on May 19).

The wheel's size dynamically adjusts as the application crawls data online, reflecting the amount of posts in real time. Positioning several wheels side-by-side allows users to assess activity by comparing size and color patterns over days. Lines connect shared

keywords between banks, thus facilitating comparison of sentiments on similar topics. For instance, 'service hours' could rate as positive in Bank 1 but neutral in Bank 2. These connections allow users to determine what makes certain banks work over others.

While the design of SentiWheel attempts to incorporate ease of use and a direct sensibility, many users found the pie chart to be too difficult to analyze, in fact taking more time than anticipated to make sense of relations and proportions between banks. Hence, a stronger visual metaphor that easily conveys sentiment and difference and resonates equally with banks and their customers, may present the data in a more unobstructed and engaging manner (P4).

Money Trees

Ironically alluding to the popular saying that 'money doesn't grow on trees,' this tongue-in-cheek visualization represents each bank as a tree with leaves that vary from a vibrant living green (positive) to a murky brown color (negative), as shows Figure 1. When running in real time, the trees appear to be alive as leaves grow and fall as the dataset is updated.

While the colloquial reference to corporate money is apparent, the trees provide a popular portrayal of the hierarchical and symbiotic relations between banks and customers. We can observe how banks cultivate their customers with the goal of nurturing big green leafy trees. This metaphor downplays the seriousness of financial affairs by positioning a system where banks treat customers like a live organism, in need of careful attention. This presents banks in a positive and proactive light where they persistently strive in maintaining customer patronage.

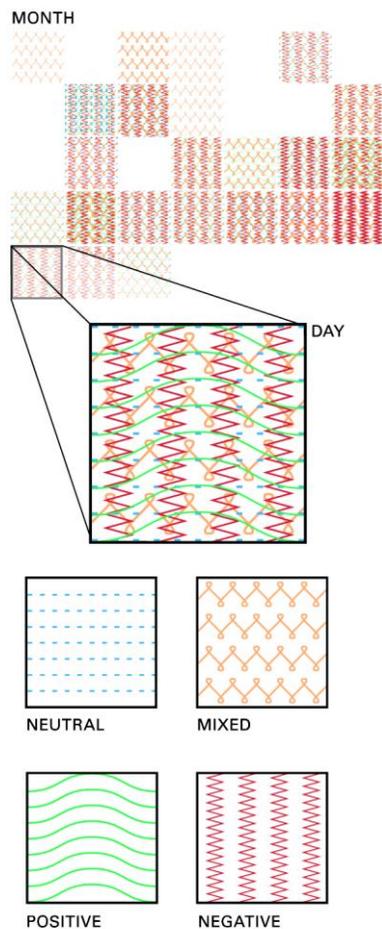


Figure 3: Emotional Tapestry uses layers of patterns to represent complexities and variance of sentiments online. As particular sentiments increase, its respective pattern becomes more dominant.

Money Trees could be successful as an ambient monitoring tool (P3) as it is designed to accommodate episodic use. It can act as a complement to market analysis sourced by banks, and could illuminate underlying problems invisible in the statistical dataset. In Figure 1, the trees begin with a few neutral posts (dark green color). As time passes, more negative and mixed sentiments arise. Days later, negative and mixed sentiments become prominent. Such a monitoring tool can aid in damage control by spotting 'dying' trees that call for the investigation of the cause of ill.

Money Trees was well received by both industrial and social media users as it quickly communicates through culturally embedded metaphors. Interactivity will allow users to expand leaf clusters for details.

Emotional Tapestry

The success of a user-centric visualization approach led us to Emotional Tapestry that reveals the complexity of human emotions by layering sentiments on top of one another (see Figure 3). A grid symbolizing a full month—one square for each day—shows an overview of the wealth and variety of sentiments in online posts. Each sentiment is embodied by a specific pattern and color: positive values have rounded, pleasing shapes and colors while negative values are loud and aggressive. These patterns become more dominant as online posts of similar sentiment increases.

As the tapestry is populated, users can spot changes when particular squares or grids begin to look unsightly. Denser, more aggressive patterns suggest negative sentiment while lighter and calmer pattern layering indicates positive sentiment. Motion can also be added to patterns to apply a sense of urgency to

alarming sentiment situations. Similar to Money Trees, customers can influence the tapestry by posting critical comments as a means of protesting or raising attention to unfavorable services or products. This provides a potent outlet for criticism as it significantly impacts the overall visual feel of the tapestry.

The tapestry metaphor permits the presentation of a wider historical overview of sentiments as opposed to temporal snapshots like in Money Trees. With this tool, banks can display the efficacy of their actions as they listen to customers (i.e. another means of enhancing market analysis). Adding interactivity will aid users in categorizing by topics, banks, etc., thus helping banks and customers see into details as they track changes over time. In addition, it is possible to overlap tapestries to build aggregated views of overall opinions or related topics (see Figure 4).

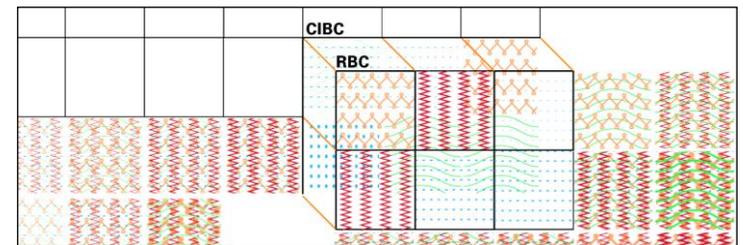


Figure 4: Overlapping of two different bank grids to generate aggregated views of opinions over a course of time.

In our example, we present a calendar-based view. However, the tapestry is versatile enough that each square can use data based on other criteria (e.g. by keywords or by online sources). Indeed, users welcomed the flexibility it provides as they see the huge potential for personalization and exploration.

Discussion and Conclusion

Overall, the visualization sketches were well received by both industrial and customer end users. Though the pie chart sensibilities of SentiWheel seemed like an understandable metaphor, we have found upon user feedback that metaphors that drew on cultural tropes had the most trustworthy and profound impact on users. Money Trees resonated culturally with both banks and customers while the personalization potential, flexibility, and ability to display complexities of emotions through layering make Emotional Tapestry equally strong and versatile. We have discovered that these visualizations facilitate interpretation of the data and establish trust between the banks and their customers. They combine ease of use with ease of understanding.

Effective sentiment visualizations, intended to foster transparency and strengthen relations could have profound consequences on how banks view or treat customers, and vice versa. By using resonant cultural metaphors, we can establish trust in the visualization, thus encouraging cooperation and collaboration through social media applications. Use of these metaphors through convenient, coherent, and customizable tools further facilitate understanding and exploration as users compare information and track changes online.

Future Work

Our team will begin developing functional, interactive prototypes for user testing. This will aid in validating the design concepts and metaphors and further refine the visualizations through iterative participatory design. In addition, the prototypes will be used to test the dataset against different emotion models and sentiment engines. Information from this research can possibly

aid in improving precision of sentiment labeling and development of more specific tools.

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