Wearable Tag Clouds: Visualizations to Facilitate New Collaborations

Daniel Steinbock, Roy Pea & Byron Reeves
H-STAR Institute, Stanford University, Wallenberg Hall, 450 Serra Mall, Stanford CA 94305
Email: {steinbock, roypea, reeves} @stanford.edu

Abstract: We describe the development and pilot testing by university faculty of Wearable Tag Clouds as a CSCL technology. Tag Clouds are 'at-a-glance' information visualizations that, in the wearable form developed here, repurpose social web technologies to support face-to-face interactions. Exploration of collaborative prospects is facilitated by visualizing the substantive emphases of researchers' written works. Pilot test results suggest wearable information visualizations can positively impact face-to-face interactions in collaborative communities.

Introduction

It has been said that researchers in the field of computer-supported collaboration spend a lot of time at conferences but rarely use the ideas and technologies from their research to make this time more productive (Borovoy, 1998). Conferences are sites of face-to-face interaction for people with common interests and offer opportunities to forge new collaborations. Through interaction, participants *learn* about each other's interests and expertise, and *evaluate* potential collaborative opportunities. To echo (Borovoy, 1998): "[The] groundwork for meaningful and enduring collaborations can be laid at such events and…encouraged with appropriate technology."

This paper presents the design and pilot testing of a wearable information visualization to facilitate face-to-face interaction, learning about peers, and the formation of collaborative relationships. The Tag Cloud visualization technique, a common sight on the Web today, is here applied for the first time in a face-to-face community: to create personal, wearable visualizations of each participant's research interests and other relevant descriptors. A Wearable Tag Cloud looks like a traditional conference name-badge, though slightly larger to accommodate the wearer's personal visualization. After a brief introduction to Tag Clouds and the technology we've developed to produce them, we connect and compare this work to related research, report preliminary observations from the pilot user trial, then discuss what was learned and how it will inform future design and research iterations.

Figure 1. Tag Cloud worn by the first author at a Stanford faculty retreat.

What are Tag Clouds?

Tag Clouds came into popular use as web-based visualizations of the keywords (so-called "tags") assigned by users to describe and categorize user-contributed content online (Mathes, 2004). A typical Tag Cloud visualizes the relative frequency of the most common tags in use and doubles as an index for accessing content categorized by each tag. To date, academic research on Tag Clouds is almost non-existent, and what does exist focuses narrowly on their use as keyword visualizations and website navigation aids (Hassan-Montero, 2006).

This paper generalizes the definition of a Tag Cloud to be any list of words visually weighted by their relative frequencies in a source text. On the Web, the source is usually a database of keywords. In our work, we wished to visualize representative research texts like curriculum vitae, research statements and publications. To pursue this research, we have developed a web-based application (Steinbock, 2006), open to the public, to generate Tag Clouds from any source text (1). The application outputs Clouds in the canonical form (see Figure 1), an alphabetic list of words whose type sizes are proportional to their relative frequency in the source text (2).

Previous Work

Well-designed information visualizations enhance cognition (Card, 1999) just as the affordances of designed objects can enhance physical, perceptual and learning abilities (Norman, 1993; Gibson, 1966; Pea, 1993). The prototypical wearable display for personal information is the conventional nametag. The affordances it provides—that is, the ways of use it makes possible—are perfectly suited to its role in social situations. A nametag dispenses information where and when it is most useful and relevant: in plain sight, during face-to-face encounters.

Researchers have developed computationally-augmented nametags in an attempt to better support face-to-face interaction at conferences (Borovoy, 1998). The devices have also been used in the CSCL community for participatory simulations (Andrews, 2002). Known as Thinking Tags, these devices store information about the wearer (interests, beliefs) and then wirelessly communicate to compute a similarity score on a five-point scale when two people interact face-to-face. The resulting numeric measure is displayed on an array of LEDs.

As wearable displays that double as nametags, both Tag Clouds and Thinking Tags dispense personal information when it is useful and relevant—during face-to-face encounters—but they differ in a number of important ways. With regard to information affordances, Thinking Tags display simple, quantitative information in dynamic response to pair-wise interactions. This approach primarily serves the goal of evaluating collaborative potential and attempts to automate social matching (Terveen, 2005). But in addition to being expensive and technically complex, this high-tech approach is more automating than augmenting (Engelbart, 1963). Collaborative potential is algorithmically reduced to an evaluation based on a five-point scale, without establishing the substantive basis for common interest. In contrast, Wearable Tag Clouds are simple physical printouts of computer-generated visualizations that, in spite of being non-computational, are more information-rich.

Wearable Tag Clouds

This predecessor technology and the theory of affordances suggested that new visualization techniques could prove useful in a facilitative role for face-to-face interactions. Recognizing that the formation of collaborative relationships involves both *learning* about others to discover areas of shared interest and *evaluating* collaborative potential, Wearable Tag Clouds were designed to support both tasks by making substantive information relevant to both goals *mutually visible*: personalized visualizations of a researcher's persona, including research interests, expertise, frequent collaborators, institutional and geographic affiliations. The content of representative texts are used as input to our Tag Cloud engine (e.g. curriculum vitae and research statements) to produce a compact visual synopsis of the researcher's academic life—a 'virtual concept badge' for seeing interest patterns at a glance. The resulting artifacts act as conversational props, relying on visual perception and interactive conversation—rather than automation—to unpack the field of shared interest and evaluate collaborative opportunity. Two or more people learn about each other by examining one another's Tag Clouds; they evaluate the collaborative potential by comparing their Clouds, and conversing with reference to them. The following section describes observations and analysis from the first pilot of Wearable Tag Clouds, leading into final design considerations for future iterations.

Pilot User Trial

Wearable Tag Clouds were piloted for the first time at a faculty planning retreat for the new interdisciplinary H-STAR Institute (Human Sciences and Technologies Advanced Research) at Stanford University. This retreat gathered together twenty-five faculty members from a wide diversity of disciplines (Linguistics, Computer Science, Philosophy, Psychology, Mathematics, Education, and others). The participants—most of whom were not previously acquainted with those outside their own department—gathered at the retreat for the purpose of introductions and learning about each other's work, culminating in the identification of emergent, multi-faculty, cross-department research themes, and the initiation of collaborative research white papers to serve as the foundation for an H-STAR strategic research plan.

Personal Tag Clouds were created for each faculty participant using curriculum vitae as the primary input,

supplemented with research statements, where available. Figure 1 shows the first author's own Tag Cloud from the event. Participants first arrived for a welcoming dinner reception, and were given their nametags with Tag Clouds affixed. Explanation of the source texts was given when asked for. Informal observations and testimony at this event revealed the Tag Clouds often played leading roles in the conversations that ensued. One faculty member reported that the Clouds were the basis for or most-common referent in every single conversation she participated in; they were also frequently observed to be the first subject of inquiry following the exchange of names. These observations suggest both the initial utility of Tag Clouds as "ice-breakers" and their continued usefulness as a resource for conversation topics. The tangible affordances of a *wearable* visualization were also evidenced as faculty often pointed to their own Clouds while making self-referential statements and pointed to others' Clouds when making inquiries. Also, being able to read a person's largest words from a distance appeared to enable "semantic probing" to assess the desirability of interaction in advance of an actual encounter.

Future Considerations

Overall, people used the designed affordances far more than expected. Most wore their Cloud nametags again on the second day of the retreat, though reference to them dropped nearly to zero. This highlights the visualization's specific utility during the formative stages of collaboration. Several important critiques came out of the H-STAR user experience. Participants desired editorial control over their own Tag Clouds so as to produce more accurate self-representations, and wished that most-recent publications be the primary source of text data instead of curriculum vitae (to exclude out-of-date research interests). Some desired to see animated visualizations of research interests over the course of their career. This last idea points to future work on Wearable Tag Clouds as computational devices which could, for example, dynamically highlight the interests shared in common by interacting individuals.

Future design-based research on this paper's topic is important because of the identified potential for wearable information visualizations to positively impact collaborative research communities.

Endnotes

(1) Common English words (and, the, they, etc.) are ignored due to their overwhelming frequency and lack of subject relevance. In addition, the Porter Stemming algorithm (Porter, 1980) is used to group words that share a common root.

(2) Other ordering, weighting and layout schemes are possible, and future research will explore these possibilities. Note that color value is also used to show relative word frequencies, in a way that mimics depth-perception cues.

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