metaViz: Visualizing Computationally Identified Metaphors in Political Blogs

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Abstract

This paper presents metaViz, an online application that uses computational metaphor identification to find conceptual metaphors in political blogs. The application presents those metaphors to users in an interactive, visual fashion, with the goal of fostering critical thinking and creativity. This paper describes the computational techniques and interface design of metaViz, and presents an evaluation of the tool based on a controlled experiment showing that metaViz is more effective at fostering critical thinking than blog reading alone. This research draws attention to the need for tools that facilitate blog reading while encouraging critical engagement with the text, helping to lay the groundwork for enabling new ways of reading and interacting with blogs.

1. Introduction

Political blogs have become an increasingly influential and democratizing force in political discourse, as well as an important research area [1-4]. For example, social networking analysis was applied to examine differences and similarities in linking patterns among political blogs of different ideologies during the 2004 US presidential election [1]. Most such research is similarly empirical or analytic, focusing on sentiment analysis [2], political affiliations [3], or other aspects. While such work is both informative and important, there may also be value in examining how such analyses could be re-represented to those interacting with and through blogs.

To that end, this paper presents a tool that uses computational metaphor identification (CMI) to find linguistic patterns potentially indicative of conceptual metaphor in political blogs. Metaphor here refers not to a literary or poetic device, but rather to a fundamental aspect of human thought: we often conceptualize one set of experiences in terms of another [5,6]. Such conceptualizations are often evidenced by linguistic patterns and are prevalent in political discourse. For example, when describing an election, one might say that “candidates fight during an election,” that they try to “defeat their opponents in an election,” and ultimately that someone will “win the election.” These patterns of language evidence the metaphor ELECTION IS WAR¹, that is, we often conceptually frame an election as if it were a war. The goal here is to draw these linguistic patterns, and the conceptual metaphors they might imply, to readers’ attention in order to encourage critical thinking. Thus, this work represents an inversion on many traditional AI approaches. Rather than using people as a model for how to make computers think, the focus here is on using computers to make people think.

The tool described here, metaViz, presents computationally identified metaphors in an interactive visual fashion to foster critical and creative thinking about metaphors in political blogs. Many existing services track aspects of what is being said in the blogosphere and by whom, but few such technologies are designed to highlight how the various issues involved are being discussed and encourage critical reflection about that framing. Such critical thinking is integral to supporting debate and deliberation about political issues [cf. 3]. This paper summarizes computational metaphor identification (CMI), presents the design and implementation of the metaViz tool, and demonstrates through a controlled experimental evaluation that metaViz can effectively foster critical and creative thinking about conceptual metaphor in political blogs.

2. Related work

The tool presented here draws primarily on Lakoff and Johnson’s work [5,6], which views metaphor not as a literary or poetic device, but rather as a fundamental aspect of human cognition. For example, when discussing money, one might say “he poured money into his savings account” or “they froze my assets.” Lakoff and Johnson [6] claim that such

¹ This paper uses SMALL CAPS for specific conceptual metaphors, italics for concepts in a metaphor, ALL CAPS for domains, and “quotes” for words in example phrases.
linguistic patterns evidence the conceptual metaphor money is a liquid. People often use words from their knowledge of liquids to talk about money because the cognitive structure of the metaphor “sanctions the use of source domain language and inference patterns for the target domain” [5:208]. This is not to say that conceptual metaphor is primarily a linguistic phenomenon. Rather, the linguistic patterns serve as evidence for the cognitive phenomenon.

Conceptual metaphor is prevalent in political discourse. Howe [7] describes common political metaphors, focusing on the domains of war and sports. For example, political parties can be framed as a team, where individuals can join the team, captain the team, be a team player, etc. Sports and war metaphors emphasize conflict but downplay the importance of negotiation and compromise.

The existence of such varied metaphors leads to the notion of metaphorical pluralism, that many different metaphors may be used to frame the same concept. For example, a wide variety of metaphors can be used to frame the concept of love, such as love is a journey; “this relationship is [n’t] going anywhere”; love is madness: “I’m just wild about Harry”; or love is magic: “she is bewitching” [6:44,49]. Each metaphor highlights certain aspects of love, while downplaying others. Lakoff and Johnson argue that “successful functioning in our daily lives seems to require a constant shifting of [many] metaphors ... to comprehend details of our daily existence” [6:221]. Moreover, suggestion of an alternative, novel metaphor can draw out different aspects of the situation, can “cause us to try to understand how [the novel metaphor] could be true, [and] makes possible a new understanding of our lives” [6:175]. The tool described in this paper is designed to promote such critical reflection by identifying and presenting to the user potential conceptual metaphors.

Most previous computational linguistic work on metaphor treats it as an obstacle to overcome [cf. 8], employing computational methods of differentiating literal text from figurative, then applying special processing to that figurative text in order to infer its literal meaning. One exception is CorMet [9], which uses domain-specific textual corpora to extract known conceptual metaphors. The technique used here draws largely on CorMet but extends that work in two important ways. First, CorMet was designed to extract known conventional metaphors, whereas the technique used here was designed to identify potential metaphors in relatively arbitrary corpora. Second, little work has explored how such computational techniques could go beyond analytic purposes to be used in interactive tools and systems.

As mentioned above, blogs are becoming an ever-increasingly influential force in politics. While a significant amount of previous research has focused on political bloggers [1,4,2], relatively little has focused on blog readers. An early qualitative study of blog reading found, among other results, that readers “were conscious of why they read blogs, [but] few were reflective of how they read” [10:1119], arguing that an important area of research involves developing tools that encourage critical reflection in blog reading. In a large-scale analysis of quantitative data about blog readers, Farrell, Lawrence, and Sides [3] argue that reading political blogs often leads to greater political participation, but that it also leads to greater polarization, such that readers only read blogs with similar political ideologies.

Importantly, very little research has been done on tools designed specifically for blog readers. Existing sites such as memeorandum.com and etalkinghead.com serve as blog and news aggregators. Others, such as wonkosphere.com and skewz.com, use techniques including textual analysis or user voting to determine different political blogs’ ideologies. BLEWS [2] mines blogs to provide sentiment analysis that compares opinions expressed about news stories in conservative vs. liberal blogs. These and other similar sites keep blog readers informed as to what is being said by whom, but not how those things are being said. While there has been some early work done on identifying conceptual metaphors in political blogs [4], the authors are not aware of any research studying how people use any of these tools, especially not in terms of the critical thinking they can help foster.

3. Implementation

The implementation of metaViz consists of two main components: the computational metaphor identification algorithms that run offline to analyze the data, and the metaViz web application that is used to visualize the results.

While space precludes a full description of the algorithms involved, this section summarizes the techniques employed in computational metaphor identification (CMI), which extends previous work in computational linguistics [9].

Metaphors are conceptual mappings wherein a source concept partially structures the understanding of a target concept. In the above example, election is war, the target concept election is partially framed in terms of the source concept war. CMI begins by gathering corpora for the source and target domains. In this paper, the target corpora are posts from political blogs, either from a single blog or aggregated from several
blogs. For the source corpora, Wikipedia articles from a given category are used, as they provide a readily available, large source of content on a wide variety of topics. All documents in the source and target corpora are parsed [11].

The crux of CMI is selectional preference learning [12]. For example, words for the concept of food are often the direct object of the verb “eat.” Using the parsed documents, CMI calculates selectional preferences of the characteristic nouns in a corpus, where characteristic means that the noun is highly frequent in the corpus relative to its frequency in general English. Selectional preferences are calculated by Resnik’s [12] approach of using relative entropy of the posterior distribution conditioned on a specific noun and case slot with respect to the prior distribution of verbs in general English. These preferences are the divided among the various verbs for which the nouns select to calculate the nouns’ selectional association for specific verbs.

To identify metaphors, CMI looks for correspondences between the source and target corpora. For example, in the Military corpus, words for the concept war would select to be the direct object of “win,” the object of the preposition “during” with the verb “fight,” and so on. In some blog corpora, words for election also select for those same verbs in the same grammatical relationships. The degree of correspondence between the two determines the confidence score of the potential metaphor.

One of the strengths of CMI is that it works in the aggregate. While individual instances of phrases such as “fought during the election” and “defeated in the primary” may not at first glance appear metaphorical, it is the systematicity of these patterns that becomes compelling evidence for the existence of a metaphor.

An important aspect of CMI is that it identifies only linguistic patterns potentially indicative of conceptual metaphors, not the metaphors themselves. Lakoff [5] emphasizes that metaphor is primarily a cognitive phenomenon, and that metaphorical language serves as evidence for the cognitive phenomenon. CMI leverages computational power to search through large bodies of text to identify patterns of potential interest.

The metaViz web application then presents those computationally identified metaphors in a readily accessible, interactive fashion. metaViz begins by loading a list of analyzed corpora (Figure 1, left side). Each corpus consists either of posts from a single blog, of posts aggregated from a collection of blogs (e.g., all Republican blogs), or of the campaign speeches from the candidate for one of the major US political parties. Users are directed to select one or more corpora and to choose a domain for each corpus for which to display potential metaphors.

Once a domain is selected, potential metaphors from the chosen domain for that corpus are displayed in a column (Figure 1, colored columns). Metaphors are shown as data clouds, grouped by the concept in the target corpus they frame, where the size of a potential metaphor in the cloud is a logarithmic function of the confidence score for that mapping. Targets are listed in order of their strongest metaphor. For example, in the green (middle-left) column in Figure 1, the metaphor an election is like a battle is the single strongest metaphor from the Military domain in the blog Power Line, so metaphors for election are listed first. The metaphor cloud design aligns with the notion of metaphorical pluralism [6]: many different, sometimes conflicting, metaphors are often used for the same concept, and this design encourages users to consider how these different metaphors might or might not fit the concept they frame.

The cloud of potential metaphors can suggest, for example, that a candidate is like a theory. To see why a candidate might be like a theory, the user can click on the source term. The bottom pane (in Figure 1) lists example phrases from the target and source corpora, paired up based on the verb-case slot involved in the correspondence. For example, the aggregated Republican blogs talk about how “Obama is tested” similar to how, in science, a “theory is tested.” Each example phrase links back to the source text in which it was found, allowing the user to see the metaphor in context.

Informed by previous findings about use of online collaborative visualizations [13], the original design of metaViz simply contained a Link button (Figure 1, upper right), which generated a URL linking directly to the current state of the visualization. However, preliminary user studies made it clear that using metaViz in relative social isolation was not incredibly effective at fostering critical thinking. As one participant put it, “Sure, I see this metaphor here and it kind of makes sense. Now what?”

To address this, a discussion feature was added, allowing users to comment on metaphors and reply to
TABLE I. CRITICAL THINKING CODES, DESCRIPTION OF CODES, AND QUOTES FOR CODES

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Violence</td>
<td>Elections are generally non-violent</td>
<td>“The opponents rarely resort to overt, physical violence.”</td>
</tr>
<tr>
<td>Death</td>
<td>People do not die in elections</td>
<td>“Elections don't cost lives...”</td>
</tr>
<tr>
<td>Destruction</td>
<td>Most elections do not involve destruction of property</td>
<td>“...there is no real collateral damage.”</td>
</tr>
<tr>
<td>Routine</td>
<td>Elections happen on a routine, scheduled basis</td>
<td>“Elections occur regularly...”</td>
</tr>
<tr>
<td>Trivialize</td>
<td>The comparison trivializes the trauma of a war</td>
<td>“To really believe [an election and a war] were the same would be to trivialize war and its magnitude.”</td>
</tr>
<tr>
<td>Individual</td>
<td>Elections involve individual candidates, not large armies</td>
<td>“A war would involve more than two people at the front lines.”</td>
</tr>
<tr>
<td>Shared Cause</td>
<td>All parties in an election aim to improve a country</td>
<td>“...both sides want to be a part of the same system.”</td>
</tr>
<tr>
<td>Weapons</td>
<td>Elections do not involve weapons</td>
<td>“There are no firing of weapons...”</td>
</tr>
<tr>
<td>Clear Winner</td>
<td>War does not always have a clear, single winner</td>
<td>“...elections have clear winners, while oftentimes a war will not.”</td>
</tr>
<tr>
<td>Democratic</td>
<td>War is antithetical to democracy</td>
<td>“...describing [an election] as a war is connotative to the idea that people have to fight [in] the process of democracy.”</td>
</tr>
<tr>
<td>Territory</td>
<td>Candidates do not literally control and occupy territory.</td>
<td>“No land is occupied.”</td>
</tr>
<tr>
<td>None</td>
<td>Subject gave no dissimilarities</td>
<td>“It makes complete sense to me.”</td>
</tr>
</tbody>
</table>

each others’ comments (Figure 1, right column). Comments are organized in threads, with one initial comment and an expandable list of replies. Numerical indicators next to each analyzed blog and in the source domain drop down display the total number of comments (Figure 1, left column).

4. Evaluation

A study was conducted to assess metaViz’s efficacy at fostering critical thinking, its core goal. The evaluation presented here compares the amount and kinds of critical thinking in which participants engaged when using metaViz as compared to reading political blogs without metaViz.

4.1. Methods

An experimental study was conducted with 54 subjects from Amazon’s Mechanical Turk service [14]. In the control condition (N=30), subjects were asked to read and summarize three posts from different political blogs. Subjects were then given a brief prompt explaining the notion of conceptual metaphor using the example MONEY IS LIKE A LIQUID, e.g., “he poured all his savings into bonds.” This description was followed with the political metaphor AN ELECTION IS LIKE A WAR, about which subjects were asked three questions:

- “Does this metaphor make sense to you? How is an Election like a War?”
- “Are there ways that this metaphor does not make sense? How is an Election not like a war?”
- “Can you suggest an alternative metaphor for an Election that might highlight different aspects?”

Subjects in the experimental condition (N=24) started with the prompt explaining conceptual metaphor, followed by an overview of metaViz. Subjects were then given three separate links to metaphors identified by the metaViz system: A SENATOR IS LIKE AN ARMY from the Military domain, A VOTE IS LIKE A GAME from the Sports domain, and A CANDIDATE IS LIKE A THEORY from the Science domain. The corpora for these metaphors corresponded one each to the posts the control group read. Subjects were asked to read some of the posts linked to from the example fragments, and then to make two comments for each metaphor, one either agreeing or disagreeing with the metaphor, and one replying to another comment either in agreement or disagreement. Finally, subjects were presented with the same political metaphor, AN ELECTION IS LIKE A WAR, and asked the same questions as the control group.

Since the goal of metaViz is fostering critical thinking, this analysis focuses on subjects’ answers to the question: “How is an election not like a war?” Responses to this question were coded based on 12 categories (Table 1), which were derived from subjects’ responses. Responses with multiple dissimilarities received multiple codes.

These codes were counted and scored in a variety of ways to assess various aspects of critical thinking. Critical thinking and creativity go hand-in-hand [15]; an important component of critical thinking is generating novel critiques, and creativity requires the ability to critically assess the current situation and determine what alternatives might be considered. Thus, the analysis of critical thinking presented here includes not only a measure of how critical but also how creative participants’ responses were. For each response, we calculate the total number of codes to assess ideational fluency, an originality score based on the uniqueness of

2 The five subjects who received the None code were not included in subsequent analyses of fluency, originality, or creativity.
the subject’s responses, and a creativity score incorporating both the total number of responses and their uniqueness. Originality for a given response is defined as the average likelihood that the codes applied to a response were unique to that response. Originality serves as a measure of a response’s insight, in that a more original response critiques the metaphor in a way fewer others did. A response’s creativity is defined as the combined odds of all a response’s codes being applied to another response. For example, if a response was given two codes, and each of those codes was only applied to 10% of all responses, the total creativity would be 1/0.1 + 1/0.1 = 10+10 = 20. Thus, the creativity score combines ideational fluency exhibited and the originality of the justifications given.

This evaluation tests the following hypotheses:

H1 – Use of metaViz will lead to higher ideational fluency, i.e., more critical thinking as evidenced by more distinct critiques of the metaphor.

H2 – Use of metaViz will lead to more original critiques of the metaphor.

H3 – Use of metaViz will lead to more creativity, i.e., responses will exhibit both more critical thinking and more original critiques.

4.2. Results

The results presented here demonstrate that metaViz is more effective at fostering critical thinking than simply reading blogs. Subjects who used metaViz provided more original critiques of the metaphor—an election is like a war. Furthermore, those who only read blog posts without metaViz were more likely to cite an election’s lack of violence, the least original justification that an election is not like a war.

Figure 2 shows the percentages of responses in the control and experimental groups that received each code. The control group was more likely to cite the lack of violence as a justification that an election is not like a war. The control and experimental groups that received each justification that an election is not like a war (Violence and Death codes), while the control group was more likely to cite the lack-of-violence codes were the most common, with 74.1% of all responses receiving at least one. The less common overall, such as Trivialize, Territory, and Democratic.

The results presented above indicate not only that users of metaViz engaged in more original and insightful critiques of this metaphor, but they also carry interesting implications about the kinds of critical thinking fostered.

The difference in the lack-of-violence codes—Death, Violence, and Destruction—gives some potential insight into that critical thinking. These three lack-of-violence codes were the most common, with 74.1% of all responses receiving at least one. The less common and more varied critiques from the metaViz group suggests that those subjects’ thinking went beyond the common conflict metaphors [7].

This variety may have a number of potential causes. First, metaViz may have primed subjects, giving them practice with metaphorical thinking. While this reasoning may make the results seem obvious, it also reinforces the conclusion that reading blogs without tools such as metaViz is not as effective at fostering critical thinking about metaphors. Second, in the same corpus and domain where metaViz users saw the first metaphor, there were three other Military metaphors for an election: an election is like a battle, an election is like an officer, and an election is like a rank (Figure 1, green middle-left column). Even though their attention was not directed to these metaphors, participants may have noticed and been influenced by them. Third, experimental subjects’ attention was drawn to the metaphors a vote is like a game from the Sports domain and a candidate is like a theory from the Science domain, metaphors which may have

T-tests between the two groups were used to check the three hypotheses listed above. The null was rejected for H2; subjects who used metaViz generated significantly more original critiques of the metaphor (0.649>0.763, p=0.003**). The null was almost rejected for H3; the overall creativity of metaViz users’ critiques was slightly higher (7.740>4.532, p=0.080). However, the test failed to reject the null for H1; users of metaViz provided on average more total justifications for their critique, but this difference was not highly significant (1.857>1.571, p=0.267).

There was also a significant difference in the use of lack of violence (Violence, Death, and Destruction) as a justification that the metaphor—an election is like a war does not fit. While the differences for each of these codes individually were not significant, the total number of lack-of-violence codes was significantly lower in the experimental group (0.750<1.667, p=0.042). No other codes had significant differences between the two groups.

5. Discussion

The results presented above indicate not only that users of metaViz engaged in more original and insightful critiques of this metaphor, but they also carry interesting implications about the kinds of critical thinking fostered.
influenced participants into thinking about less violent aspects of an election. Fourth, making and responding to at least one comment exposed experimental subjects to others’ critical thinking, potentially increasing their ability to make more original, insightful critiques. Again, users of metaViz were not citing similar critiques as each other, but rather had a greater variety of critiques, which is likely supported partly by the data displayed in metaViz and partly by the commenting and discussion that metaViz facilitates.

6. Conclusion

This paper describes metaViz, a tool that presents computationally identified metaphors from political blogs in a visual, interactive fashion to foster critical thinking and creativity about conceptual metaphors. This tool represents two novel, important research directions. First, metaViz was designed for readers of political blogs. While some tools for blog reading exist, little research has been done on how such tools impact blog reading, or how novel tools might engender new ways of reading blogs. Second, the primary goal of metaViz is to encourage critical thinking and creativity. While many interactive tools and information visualizations may be conducive to critical thinking, metaViz was designed for the express purpose of fostering critical thinking. The evaluation presented here demonstrates that, in a controlled study, using metaViz can foster critical thinking about metaphors more effectively than simply reading blogs, not so much the in amount but rather in the kinds of critical thinking in which subjects engage.

The authors are also performing a longer-term, qualitative study to help understand how metaViz impacts blog reading habits and how reading blogs might change and evolve around the use of such tools. Importantly, metaViz was not designed to replace but rather to augment regular blog reading. Indeed, early results indicate that seemingly incomprehensible metaphors identified by the system are not only intelligible to users but also quite meaningful, because the users are regular readers of the blogs being analyzed. This qualitative study is intended to explore how use of metaViz integrates with regular, established blog reading practices. Furthermore, by critically examining trends across blogs, systems such as metaViz can help facilitate new kinds of reading and, potentially, new kinds of thinking.

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8. References