Information Foraging in E-Voting

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Abstract
In this paper, we present a case study of human-information interaction in the online realm of politics. The case study consists of a participant observed while searching and browsing the internet for campaign information in a mock-voting situation while taking notes that were to be shared with others. Interaction analysis of the case study data consisted of applying Information Foraging Theory to understand participant specific behaviors in searching and browsing. Case study results show skewed time allocation to activities, a tradeoff between enrichment vs. exploitation of search results, and issues with lack of scent, low value perception, and value depletion of information. Potential implications for voter-centered design of e-voting portals are discussed and future work is outlined.

Keywords
Voter-centered design, www.votesby.us, participatory design, e-voting, e-democracy, e-participation, information foraging theory, information patch, information scent, comparative informatics.

ACM Classification Keywords
H.5.3 Group and Organization Interfaces: *Theory and models, Asynchronous interaction Collaborative computing, Evaluation/methodology;* H.1.2 User/Machine Systems: *Human information processing*.

Introduction

The internet continues to grow as an important political information, communication, and participation tool [10]. Smith & Raine [9] report that 46% of Americans have used the internet, cell phones, text messaging or e-mail to get information about the 2008 U.S. presidential campaign. They report increasing use of social networking sites and multimedia content such as online video, and use of these tools for multiple purposes such as scheduling political events and donating money. In terms of political news, 40% of all adults report using the internet in contrast to 31% at the same point in the 2004 election [4].

Robertson and colleagues [5, 7, 8] have been engaged in the iterative development and empirical evaluation of a web portal that encourages potential voters to examine information about candidates and issues more carefully than they would using a traditional search tool. The environment, called VotesBy.US (www.votesby.us), is an interface to Google in which queries can be constructed using drop-down menus. This research has shown that the interface encourages more thorough and extensive, issue-based searching [4]. We recently studied the impact of an integrated annotation tool on search behavior, contrasting no-annotation with private- and shared-annotation conditions [6]. We found that note taking significantly influenced the manner in which participants browsed for information about candidates. Note taking, especially public notes, competed for time and cognitive resources and resulted in less thorough browsing.

Information foraging theory

Intrigued by these findings, we set about to conduct another empirical investigation of political information searching and browsing with note taking. We replicated the experimental design of [6] in a new mock-voting scenario. The case study presented here is selected from the Shared Notes condition in which participants were instructed that their annotations would be available for others. In prior analysis, we focused on content analysis of empirical data. In this work-in-progress paper, we focus on the behavior of a single participant and discuss that participant's activities in the context of information foraging theory [3]. We extend our analytical approach to conduct an interaction analysis [2] of the case study data consisting of audio-video and screen recording of the session, transcription of the talk-aloud comments, and tagged markers for various tasks and actions. Interaction analysis [2] "investigates human activities such as talk, nonverbal interaction, and the use of artifacts and technologies, identifying routine practices and problems and the resources for their solutions" (p.39). We conceptualize interactions with the drop-down interface of VotesBy.US and socially shared notes taken on Google Notebooks at the individual level of human information interaction [1]. Information Foraging Theory was applied to the online behavioral data to understand the phenomena at this *local* interactional level. According to Pirolli and Card [3], "Information Foraging Theory is an approach to understanding how strategies and technologies for information seeking, gathering, and consumption are adapted to the flux of information in the environment. The theory assumes that people, when possible, will modify their strategies or the structure of the environment to maximize their rate of gaining valuable information" (p.643). Our objectives are (1) to present findings from the interaction analysis of the case study described above at the *local* information foraging level,

(2) identify tentative implications for design of political informatics systems, and (3) outline future work.

Case Study Participant and Situation

We selected one participant who we refer to as S3 out of a total of 15 participants for case study analysis. Participant S3 is a 26 year old male of Korean ethnicity. S3 has a 2-year college degree and is currently enrolled as an undergraduate student at the University of Hawai'i at Mānoa with an annual income of USD 10,000-20,000. S3 rated his political ideology as being somewhat liberal. S3 reported having moderate interest in politics and discussing politics with family and friends about once a week. Further, S3 reported being affiliated with the Democratic Party. S3 reported voting in only major elections and having voted in the US general election of 2004 but not in the midterm election of 2006. S3 reported Internet usage of several times a day from home and work but less than once every few weeks for looking up political information on the Internet.

S3 was given a scenario about a mock-voting situation and instructed on how to use the drop-down search interface (left side of Figure 1) to search the internet for campaign information. The scenario asked the participant to imagine that he had just moved to Arizona where a U.S. Congressional election was coming up. The participant was informed that there were ten candidates from various parties running in the contest. These were actual candidates in an upcoming election at the time the study was conducted. Participant S3 was told that he was going to "vote for one candidate" and that he should use the search interface to find out what he needed to know in order to make a choice. Materials that participant S3 discovered and browsed on the internet were real and current campaign materials. Further, S3 was instructed

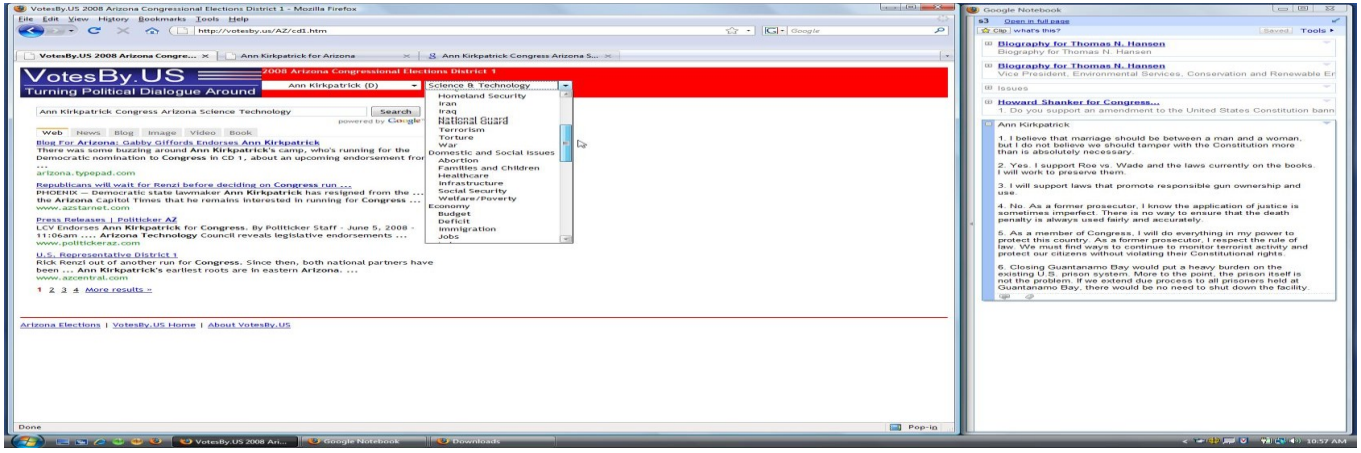

Figure 1: The VotesBy.US interface allows users to select candidates from one list and issues from a second list. Menu selections result in automatic Google searches. Results are returned in results list with tabbed categories (Web, News, Blog, Image, Video, Book). Google Notebooks allowed users to make notes. In this example, S3 is taking notes on Ann Kirkpatrick.

about taking notes with Google Notebook. (right-most side of Figure 1). As mentioned earlier, S3 participated in the *Shared Notes* condition and was told that his notes would be available for other users to see when those users were browsing the same materials.

In order to search the internet, S3 used an interface with two drop-down selection menus, one listing the candidates' names and another listing a set of issues (see Figure 1). Robertson et al. [7] described the initial design of this "drop-down" search interface and showed that it results in more thorough and complete searching and browsing than a free-form query box. Selections from the drop-down lists generated queries which were visible in a query box and which were automatically sent to Google. Selection of a candidate resulted in a search query consisting of that candidate's name and the office (e.g. "Jeffrey Brown Congress Arizona"). Selection of an issue resulted in a search query consisting of the issue keyword (e.g. "Civil Rights"). When menu items were selected from both lists the result was a combined query (e.g. "Jeffrey Brown Congress Arizona Civil Rights"). An AJAX API to Google was utilized to display search results on pages with the following content categorization tabs: *Web, News, Blog, Video,* and *Book*. Participant S3 could page through results lists, or look at the results lists under each tab, or open web pages from the results lists. While carrying out the tasks described in the scenario participant S3 was encouraged to think aloud. Software was used to capture and integrate the search behavior and verbalizations of the each participant. An experimenter remotely tagged the capture file while the participant was searching for information. Participant S3 was given as long as he wished to search and instructed that he should tell the experimenter when they were ready to vote. After voting, participant S3 was given a recall survey and an exit questionnaire.

Findings

S3 took about 1 hour and 9 minutes to complete the task. S3 reported as being "very confident" on his final voting decision. S3's stated information foraging strategy at the start of the activity was to look for general information about the candidates and the congressional district ("I am going to look for general information about the candidates", "I am going to look for information on the congressional district"). This makes S3 a candidate searcher as opposed to an attribute searcher [10].

We categorized the total session into time spent by the participant on various candidates. Results show unequal time allocation to candidates with two candidates allocated 70% of the total time.

S3 made a total of 11 search queries using the drop-down interface of Votesby.US and entered one custom query. As mentioned earlier, executing a search query results in the return of results organized under the various categories of Web, News, Blog, Image, Video, and Book. In terms of information foraging theory, this categorical organization of search query results can be understood as "information patches". Information patches models "deal with time allocation and information filtering and enrichment activities in environments in which information is encountered in clusters" [3]. Pirolli and Card [3] identify two problems with information patch models: (1) time allocation to activities, and (2) enrichment vs. exploitation. We discuss each briefly below.

Enrichment activities are mainly to minimize "between-patch" movements and maximize the informational resources "within-patch". In our context, participants can employ enrichment activities by: (a) customizing the search query by entering a user-defined string in the search box, (b) conducting multiple searches in one drop-down menu (e.g. issues) while fixing the other menu (e.g. candidates), and (c) clicking on the "more results" link to display usually higher number search results in a new browser tab. With regard to (a), S3 entered only one user defined search string. With regard to (b), S3 enriched the information patch for Jeffrey Brown by selecting "Civil Rights", "Gender", "Defense and Military" and "Economy" items from the issues drop-down menu of Votesby.US. S3 employs a similar enrichment activity for another candidate, Ann Kirkpatrick. With regard to (c), S3 enriched the display of search results by opening them in a new browser tab on several occasions. "Between-patch" movements in our case are when S3 used the tabs used for categorical organization of the search results. There were just four between information patch movements (Web-News, Web-Blog, Web-Blog, Blog-News).

In our study context, exploitation of within-patch resources consists of selecting a search query result for further exploration. S3 visited 17 websites in total. These websites consisted of official campaign websites and third-party election portals. Within-patch information foraging in the candidate websites consisted mostly of searching and browsing for information on candidates positions on various issues.

Pirolli and Card [3] characterize information scent as "the (imperfect) perception of the value, cost, or access path of information sources obtained from proximal cues, such as bibliographic citations, WWW links, or icons representing the sources." S3 returned to the search query results 14 times. An analysis of the talk-aloud comments indicates that some of these returns were due to S3's perception of the decreasing information scent ("there's not much information so I'm going to the next person"; "there's nothing here", "same websites that are coming up"; "nothing useful over here"; "the blogs thing might be biased").

We transcribed a total of 89 talk-aloud comments made by S3 using the coding scheme discussed in [6]. About 48% of the comments made by S3 while searching and browsing for political information were evaluation-oriented (general, issue, positive ballot, and negative ballot). Analysis of comments indicated *a lack of information scent* ("there's nothing here"), *perception of a low informational value for some sources* ("the blogs... there's so much unrelated information"), *decreasing informational value to recurring resources* ("same websites that are coming up"), and *information overload* ("there's way too much info to sort through on this website").

Discussion

The case study shows several strategic decisions predicted by information foraging theory such as lack of scent, low value perception, and value depletion of information. The drop-down lists of Votesby.US offer different information environments which the forager may select or switch between. In this case, S3 did not feel that the issue list alone offered a rich enough foraging environment to achieve his information seeking goals. Rather, he used it to increase the scent derived from the environment created by candidate searches. Further research is required to determine

how scent may vary with different political information seeking styles (e.g. issue-oriented voters might find the "issue patch" more useful than the "candidate patch"). Despite the diversity of informational sources, there was little between-patch movement in our case study. One reason might be the interface design, but a more fundamental reason might be the cost of between-patch movement.

Political information seeking is a highly goal-directed activity with a discrete outcome, i.e. a vote. Theories of political information seeking and decision making are primarily from social science and political psychology. They tend to follow rational decision-making models based on weighing evidence, or to stress schema building and schema update models. Political decision making has not been investigated in terms of information foraging theory, a new direction in which we will take this work. We are currently applying the analytical framework of the case study presented here to the remaining experimental sessions and our substantial data corpus. Close case-study analyses of behavior in carefully crafted search and browsing environments will help us understand political information foraging.

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