Taking the Initiative with Extempore: 
Exploring Out-of-Turn Interactions with Websites

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Abstract
We present the first study to explore the use of out-of-turn interaction in websites. Out-of-turn interaction is a technique which empowers the user to supply unsolicited information while browsing. This approach helps flexibly bridge any mental mismatch between the user and the website, in a manner fundamentally different from faceted browsing and site-specific search tools. We built a user interface (Extempore) which accepts out-of-turn input via voice or text; and employed it in a US congressional website, to determine if users utilize out-of-turn interaction for information-finding tasks, and their rationale for doing so. The results indicate that users are adept at discerning when out-of-turn interaction is necessary in a particular task, and actively interleaved it with browsing. However, users found cascading information across information-finding subtasks challenging. Therefore, this work not only improves our understanding of out-of-turn interaction, but also suggests further opportunities to enrich browsing experiences for users.

Categories and Subject Descriptors: H.5.2 [User Interfaces]: Interaction Styles; H.5.4 [Hypertext/Hypermedia]: Navigation.

Keywords: out-of-turn interaction, web interactions, user study, user interfaces, browsing, interactive information retrieval.
1 Introduction

It is now well accepted that flexible and contextual web browsing is imperative for customizing information access. Many solutions have been proposed—faceted browsing [7], personalized search [11], integrating searching and browsing [9], and contextual presentation of results [6]—all of which aim to support the user in achieving his or her information seeking goals. The scope of such research entails the development of new interaction techniques [4,9], designing interfaces to support these techniques [7], and studying [3]/modeling [3] information-seeking strategies employed by users. Many of these projects have had qualified success, and one would be tempted to surmise that all dimensions of research have been thoroughly explored. In this paper, we identify an additional dimension of information access that suggests a novel technique for interacting with websites.

1.1 Setting

Consider a US Congressional website organized in a hierarchical manner, where the site requires the user to progressively make choices of politician attributes—state at the first level, branch at the second level, followed by levels for party, and district/seat—by browsing. Imagine how a user would pursue the following tasks:

1. Find the webpage of the Democratic Representative from District 17 of Florida.
2. Find the webpage of each Democratic Senator.

The first task can be satisfied by typical drill-down browsing because it involves supplying in-turn, or responsive, information at each level (see Fig. 1). By in-turn, we mean that the user need only click on presented hyperlinks (click ‘Florida’ first, ‘House’ next, and so on). Each click communicates partial information about the desired politician. Achieving the second task by communicating only in-turn information would require a painful series of drill-downs and roll-ups, in order to identify the states that have at least one Democratic Senator, and to aggregate the results. While the user has partial information about the desired politicians, s/he is unable to communicate it by in-turn means.

The key observation here is that flexibility of information access will be enriched by increasing the means for supplying partial information. Ideally, the user, having seen that s/he does not have the partial information requested at the top level (i.e., state), would have liked to supply the information that s/he does have, namely that of party and branch of Congress.

1.2 Solution Approach

Out-of-turn interaction is our solution to support flexible communication of partial information not currently requested by the system. Hence such information is unsolicited but presumably relevant to the information-seeking task. Out-of-turn interaction is thus unintrusive, optional, and can be introduced at multiple points in a browsing session, at the user’s discretion. One possible means to support it is to allow the speaking of utterances into the browser.

Figure 2 describes using out-of-turn interaction to achieve Task 2 above. At the top level of the site, the user is unable to make a choice of state, because s/he is looking for states that have Democratic Senators. S/he thus speaks ‘Democrat’ out-of-turn, causing some states to be pruned out (e.g., Alaska). At the second step, the site again solicits state information because this aspect has not yet been communicated by the user. The user speaks ‘Senate’ out-of-turn, causing further pruning (e.g., of American Samoa), and retaining only regions that have Democratic Senators. At this point, the goal has been achieved (the user notices 31 states satisfying the criteria), and s/he proceeds to browse through the remaining hyperlinks. Notice that these are
contextually relevant to the partial information supplied thus far, so that when ‘Georgia’ is clicked, there is only one choice of seat (Senior) implying that the other Senatorial seat is not occupied by a Democrat.

2 Out-of-turn Interaction

What does it mean to interact out-of-turn? One interpretation is that, when the user speaks ‘Democrat’, s/he is desiring to experience an interaction sequence through the site containing ‘Democrat.’ The implicit assumption in the current implementation is that what is spoken is a link label (or variation thereof) nested deeper in the site, and hence an in-vocabulary utterance\(^1\). Therefore, out-of-turn interaction is merely a mechanism to address alternate aspects of the given activity, while postponing the specification of currently solicited aspects.

Why would users interact out-of-turn? There are several reasons. First, what the site is requesting from the user may actually be what the user is seeking in the first place! For example, in Figure 2, the site is soliciting state but the user is looking for states with a certain property. Second, being able to speak out-of-turn in an otherwise hardwired site permits the realization of interaction sequences not describable by browsing. This means that we can support all permutations of specifying politician attributes, without explicitly enumerating in-turn choices. The above example would require \(4! = 24\) faceted browsing classifications to support all tasks (i.e., browse by party-state-branch-district, by state-party-branch-district, and so on). Third, the incorporation of out-of-turn information does not curb the interaction (i.e., the levelwise organization is preserved), but rather situates future interactions in the context of past ones. More fundamentally, out-of-turn interaction is a novel way to flexibly bridge any mental mismatch between the user and the website, without anticipating when the mismatch might happen.

2.1 Related Research

To better understand the merits of out-of-turn interaction, we showcase related research in a three-dimensional space (see Figure 3) involving: (i) the nature of information exploited, (ii) the level of context supported,\(^1\)In other implementations, we might conduct a more elaborate modeling of the vocabulary.
Figure 2: A web session illustrating the use of out-of-turn interaction in a US congressional site. This progression of interactions shows how the (Democrat, Senate, Georgia, Senior) interaction sequence, which is indescribable by browsing, may be realized. In steps 1 and 2, ‘Democrat’ and ‘Senate’ are spoken out-of-turn (resp.) when the systems solicits for state. In step 3, the user clicks ‘Georgia’ as the state (an in-turn input). The screen at Step 4 shows that only the Senior Senator from Georgia is a Democrat, and leads the user to his homepage.
and (iii) the interaction technique.

The first axis distinguishes between the specification of partial vs. complete information. Supporting only the specification of complete information means that interaction is viewed as a one-shot activity; supporting specification of partial information implies that information-seeking is to be conducted over multiple steps. Since the complete information approach is more restrictive than the partial information approach, it is situated toward the origin. The second axis makes a distinction of whether input or results (or both) are contextually qualified in some manner. Our contribution to this space is the third dimension of whether interaction occurs by in-turn or out-of-turn means.

Search engines (e.g., Google) are characterized by specification of complete information (in this case, the query), because the interaction is terminated by returning a flat list of results. Such a low-context, complete information approach is denoted by the origin in Fig. 3. Browsing, on the other hand, involves the incremental specification of partial information (right of origin in Fig. 3).

When we take context into account, two further clusters of projects emerge in the in-turn plane spanning the (information × context) axes. When only complete information is supported, results presentation provide the major opportunity for exhibiting context (front left corner of Figure 3). This is seen in site-specific search tools (e.g., at Amazon.com), in the contextual search of Dumais et al. [6], and the personalized search strategies of Pitkow et al. [11]. The more dense cluster (front right of Figure 3) forms in the partial information region. These are projects that support contextual information access by providing either greater input flexibility or adaptable display of results over the course of an interaction, or both. Faceted (flat or hierarchical) organizations [7, 13], Dynamic Taxonomies [14], Strategy Hubs [4], adaptive hypermedia [5], and ScentTrails [9] are examples. We discuss these further.

Sites and systems exposing faceted browsing (e.g., epicurious.com) support multiple classifications by providing enumerated in-turn choices. This often leads to cumbersome site designs and a mushrooming of possible choices at each step. The Dynamic Taxonomies project provides in-turn operators for pruning information hierarchies, while Strategy Hubs enumerates templates for prolonged and detailed information-seeking tasks, again in-turn. The adaptive hypermedia projects employ user models (e.g., of past browsing behavior) to tailor the presentation of hyperlinks. ScentTrails argues that browsing may not be focused
Figure 4: The Extempore out-of-turn interaction toolbar. This interface is embedded into a traditional web browser to augment hyperlink interaction. User has supplied Democrat presumably out-of-turn.

enough and that searching loses context, and aims to combine them in a single framework. However, its use of searching always precedes browsing and therefore limits the richness of supportable interactions. Out-of-turn interaction aims to provide precisely this combination of focused input and exploratory browsing in a single, flexible, framework.

Our work can be viewed as complementary to these efforts in that it lifts the nature of interaction from in-turn to out-of-turn means (top of Figure 3). For instance, the example session shown in Figure 2 can be viewed as a lifted version of traditional browsing, yielding a (high context, out-of-turn) technique that exploits partial information. While out-of-turn interaction can be studied in many settings, this paper only discusses its use in conjunction with browsing of levelwise, hierarchically organized sites.

Out-of-turn interaction, especially of the unsolicited reporting nature, has been recognized as a simple form of mixed-initiative interaction [2]. Interleaving out-of-turn responses with in-turn clicks can be viewed as conversational shifts of initiative between the user and the website.

2.2 Extempore

We have built a user interface, called Extempore, that accepts out-of-turn input either via voice or text. The voice version was implemented using SALT 1.1 (1; a standard that augments HTML with tags for speech input/output) and SRGS (Speech Recognition Grammar Specification), for use with Internet Explorer 6.0. The text version is a toolbar embedded into the Mozilla/Netscape web browser (v1.4) and was implemented using XUL (see Figure 4). It is important to note that Extempore is embedded in the web browser, and not the site’s webpages. It is also not a site-specific search tool that returns a flat list of results (akin to the Google toolbar). Further, while search engines index webpages, Extempore rather relies on an internal representation of the website and, when out-of-turn input is supplied, uses transformation techniques to stage the interaction, pruning the website accordingly. The details of the underlying software transformations are beyond the scope of this work; see, for example, Ricca and Tonella [12], and Perugini and Ramakrishnan [10] for ideas on transformation techniques. Extempore can be used for out-of-turn interaction in many web sites, given a representation of the site’s structure, e.g., in XML.

3 Exploratory Study

Extempore is fundamentally different from existing approaches to customize browsing experiences; therefore we conducted a study that exposes users to out-of-turn interaction, to determine if they utilize it in information-finding tasks, and their rationale for doing so. The main component of the study entailed asking participants to perform eight specific information-finding tasks in the Project Vote Smart (PVS) website [http://www.vote-smart.org]. Rationale was gathered through think-aloud and retrospective protocols.

\(^2\)Currently there is no SALT plugin for Mozilla (and likewise with XUL and IE). Due to these technological constraints, we do not support both interfaces of Extempore in the same implementation.

\(^3\)At the time this study was conducted, PVS employed a hardwired organization akin to Figure 1; the site has been recently restructured into a flat faceted classification.
3.1 Goals

The goal of the experiment was to study usage patterns for out-of-turn interaction, not to evaluate the interfaces used to realize it, or to compare out-of-turn interaction with other interaction techniques.

3.2 Participants

We collected data from 24 participants in the analysis; all were students with an average age of 21, and a majority were undergraduates in computer science. Some of the participants were recruited from a HCI course, and were compensated with extra-credit from the instructor. Since a component of this experiment involved voice recognition software, we primarily recruited native speakers of English. Average participant computer and web familiarity and use was 4.75 or greater on a 5-point Likert scale. Average participant familiarity with voice recognition software was 1.46, and mean familiarity with the structure of the US Congress was 2.83; no user had visited the PVS website prior to the experiment.

3.3 Tasks

The eight tasks were carefully formulated to generate a diverse set of interaction choices:

A. Find the webpage of the Junior Senator from New York.
B. Find the webpage of the Democratic Representative from District 17 of Florida.
C. Find the webpage of the Republican Junior Senator from Oregon.
D. Find the webpage of the Democratic member of the House in Rhode Island serving district 2.
E. Find the states which have at least one Democratic Senator.
F. Find the states which have twenty or more congressional districts.
G. Find the states which have at least one Republican member of the House.
H. Find the political party of the Senior Senator representing the only state which has congresspeople from the Independent party.

We refer to tasks A, B, C, and D as non-oriented tasks, in that they can be performed as easily by employing solely in-turn interaction (i.e., in this case, hyperlinks), solely out-of-turn interaction (Extempore),
or using a mixture of both. Out-of-turn interaction does not appear to be worthwhile with respect to these tasks because the effort required to perform them with out-of-turn interaction is commensurate with that of in-turn interaction. Tasks E, F, G, and H are out-of-turn-oriented, because they are difficult to perform with only in-turn interaction. Formally, we say an information-seeking task is out-of-turn-oriented if the minimum number of browsing interactions required to successfully complete it exceeds the maximum depth of the targeted website; otherwise it is non-oriented.

The maximum depth of the PVS site is four and Figure 5 illustrates the minimum number of interactions required per task. In calculating this minimum number, we assumed that the user can supply at most one aspect at each step (in-turn or out-of-turn), and discounted back button clicks (happens when employing only in-turn interaction for an out-of-turn-oriented task). Notice also that some tasks, namely the non-oriented ones, cannot be performed by purely a sequence of out-of-turn interactions; a terminal in-turn input is often necessary and these are discounted as well. For instance, try solving task A using purely out-of-turn inputs.

3.4 Design

The study was designed as a within-subject experiment. Task was the independent variable and the interaction observed (in-turn vs. out-of-turn) was the dependent variable. Participants were given both the toolbar and voice interface of Extempore; and performed four tasks with each (two non-oriented and two out-of-turn-oriented). We designed the experiment with the provision for interfaces in two different modalities, to more naturally assess the use of out-of-turn interaction independent of a particular interface for it. Each participant performed the eight tasks in an order pre-determined by a latin square to control for unmeasured factors. In addition, the specific interface to be used (toolbar or voice) for a (task, participant) pair was determined a priori by complete counterbalancing within each task category. Thus, for each task, half of the twenty-four participants were given the toolbar interface and half the voice interface. The participants were free to utilize any strategy to complete the information-finding tasks, given Extempore and the available hyperlinks; they were given unlimited time to complete each task.

3.5 Configuring Extempore

A vocabulary for the PVS site was created by collecting all link labels, synonyms (e.g., ‘Representatives’ for ‘House’), and alternate forms of common utterances (e.g., ‘Senate’, ‘Senator’, ‘Senators’). Both the toolbar and voice version of Extempore supported this vocabulary, with the toolbar supporting abbreviations (e.g., CA for California), in addition. To keep users abreast of partial information supplied thus far (either by browsing or via Extempore), we continually updated an ‘Input so far:’ label in the browser status bar (see Figure 2). We also included a provision for the user to inquire about what partial information is left unspecified at any step. Access to this feature is provided through a ‘What May I Say?’ button (labeled with a ‘?’ in Figure 3) or utterance.

The semantics of out-of-turn interaction in information hierarchies required some practical implementation decisions. For instance, when the user speaks ‘Junior seat,’ the specification of ‘Senate’ can be automatically inferred by functional dependency. Another form of such ‘utterance expansion’ occurs in response to single-valued options. For instance, in Figure 2 one can argue that the choice of seat at the last step is really unnecessary, as there is only one option left (Senior). When only one path remains among the available options, we vertically collapse them and directly present the leaf page. This feature was not illustrated in Figure 2 for ease of presentation, but we implemented it in our study. Notice, however, that no information is lost during such collapsing, since terminal pages in PVS identify all pertinent attributes of politicians.
3.6 Equipment, Training, and Procedures

3.6.1 Equipment

Participants performed the tasks on an Extempore-enabled Pentium III workstation, connected to a 17” monitor set at 2560×1024 resolution in 34-bit true color, running Windows 2000. We recorded a video of each participant performing the information-finding tasks using the Camtasia screen and audio capture software. The resulting capture was used to aid participant recollection during the retrospective verbal protocol as well as in subsequent analysis (e.g., think-aloud). The Audacity audio recording application was used during the retrospective portion of the experiment to capture participant explanations. Data from the pre-questionnaire (demographics, computer familiarity) and post-questionnaires (rationale) was recorded on paper. Finally at the end of the entire experiment we transcribed and collated the data gathered from all sources to construct a complete record of each participant session, including interaction sequences followed per task. Each participant session lasted approximately 90 minutes.

3.6.2 Training

Prior to revealing the information-seeking tasks, we gave users specific training on (i) the PVS website, including levels of classification, and interacting with it via hyperlinks; (ii) interacting with PVS using Extempore (both toolbar and voice interfaces); and (iii) interleaving hyperlink clicks with commissions via Extempore. Users were provided a card summarizing the vocabulary that Extempore can understand, as well as explanations of political terms and their functional dependencies. This card was available for their use during the entire session, not just training. We did not use terms such as ‘in-turn’ or ‘out-of-turn’ during training or elsewhere in the study. This is to prevent biasing of participants toward any intended benefits of Extempore, and also to help them conceptualize its functionality on their own. In other words, we simply trained users on how to employ the available interfaces (hyperlink and Extempore) for information seeking. After some self-directed exploration, users were given a short test consisting of four practice tasks (two with toolbar and two with voice).

3.6.3 Procedures

After the users completed the training tasks, we administered the actual test involving tasks A–H above, and employed both concurrent (think-aloud) and retrospective protocols to elucidate rationale. A structured interview, including a post-questionnaire, was conducted to gather additional feedback. The entire experiment generated (24×8 =) 192 (participant, task) interaction sequences.

These sequences were then analyzed for frequencies of usage of in-turn vs. out-of-turn interaction. For purposes of this study, we defined an in-turn interaction as a hyperlink click or the communication of in-turn partial information to the website via Extempore. Notice that just saying ‘Connecticut’ will not qualify as an out-of-turn interaction, if the same choice was currently available as a hyperlink. Similarly, we defined an out-of-turn interaction to be the submission of one aspect of unsolicited partial information to the site. Supplying more than one aspect of partial information to the site out-of-turn (e.g., saying ‘Democratic Senators’) corresponds to multiple out-of-turn interactions.

Notice that a user may supply in-turn and out-of-turn information to the website simultaneously via Extempore. For instance, in the top-level page in Figure [2] the user might say ‘House, Florida, District 17, Democrat,’ all at the outset. Observe that a permutation of this utterance exists—‘Florida, House, Democrat, District 17’—that, if conducted incrementally, could imply a purely in-turn interaction. Such an interaction is thus viewed as having four in-turn inputs. On the other hand, consider a user who says ‘New York, Democrat’ at the outset. There is no permutation with respect to the PVS site that permits viewing this utterance as comprising of purely in-turn input, and hence, it is classified as one in-turn input (‘New
York’), followed by an out-of-turn input (‘Democrat’). This policy of counting does not favor (and actually deprecates) out-of-turn interaction.

Some users, after completing a given task via out-of-turn interaction, verified part of their results via in-turn interactions. This was confirmed through their retrospective feedback, and such in-turn interactions were discounted in the analysis.

4 Results

Of the 192 recorded interaction sequences, 177 of them involved the successful completion of the task by the participant. We analyze these 177 sequences first, followed by the remaining 15 sequences (which were all generated in response to out-of-turn-oriented tasks).

4.1 General Usage Patterns

Results indicate a high frequency of usage for out-of-turn interaction. 94.4% of the 177 sequences contained at least one out-of-turn interaction. In addition, every participant used out-of-turn interaction for at least 70% of the tasks, with 16 people using it in all tasks. Conversely, every task was performed with out-of-turn interaction by at least 80% of the participants, with 4 tasks enjoying out-of-turn interaction by all participants. These results are encouraging because Extempore usage is optional and not prompted by any indicator on a webpage. Participants successfully completed the given tasks irrespective of the presented interface (voice or toolbar).

4.2 Classifying Interaction Sequences

The 177 interaction sequences were classified into five categories denoted by: (i) I, (ii) O, (iii) IO, (iv) OI, and (v) M. The I and O categories denote sequences comprised of purely in-turn, or out-of-turn inputs, respectively. In IO sequences all in-turn inputs precede out-of-turn inputs (analogously, for OI). M sequences (‘mixed’) are those which do not fall in the above categories. For instance, the interaction shown in Fig. 1 would be classified under I, and that in Fig. 2 is in OI. We posit that this classification provides insight into users’ information-seeking strategies, and can be related to the nature of the information-finding task.

Figure 6 shows the distribution of the 177 sequences into the five classes, and Table 1 depicts a breakdown by both task orientation and classes. Notice that O, OI, IO, and mixed classes have been grouped in Table 1 to distinguish them from pure browsing interactions (I).

As Figure 6 shows, 10 of the 177 sequences fall in the I class, i.e., these are browsing sequences. As Table 1 (lower left) shows, all of the 10 browsing sequences were generated in response to non-oriented tasks, revealing that a 100% (81/81) of the sequences for out-of-turn-oriented tasks involved out-of-turn interaction. Therefore,

- users never attempted to achieve an out-of-turn oriented task via browsing; or in other words,
- users always employed out-of-turn interaction when presented with an out-of-turn-oriented task.

This is notable because it confirms that users are adept at discerning when out-of-turn interaction is necessary.

4.3 Detailed Analysis of Interaction Classes

Let us now study the interactions in classes O, OI, IO, and M. The 69 pure out-of-turn sequences (O) were observed only in out-of-turn-oriented tasks E, F, and G, and was used by all the 24 participants. This
Figure 6: Classification of 177 (participant, task) interaction sequences.

|               | I   | \{O,IO,OL,M\} | total |
|---------------|-----|----------------|-------|
| non-oriented  | 10  | 86             | 96    |
| out-of-turn-oriented | 0   | 81             | 81    |
| total         | 10  | 167            | 177   |

Table 1: Breakdown of 177 interaction sequences in various categories. The total number of interaction sequences for out-of-turn oriented tasks is 15 less than that for non-oriented tasks; these were the sequences where the participant did not complete the task successfully.

clustering of the O sequences around three tasks shows that, whenever participants completed these tasks, they did so in the shortest manner possible. Refer again to Figure 5 for the sharp contrast in the length of the minimum out-of-turn sequence from the minimum in-turn sequence, for these tasks.

Classes IO, OI, and M contain the sequences exhibiting rich interaction strategies. Classes IO and OI were observed in near-equal numbers, and primarily in the non-oriented tasks (A, B, C, and D) with the exception of OI, which was also seen in task H. No particular clustering was observed with respect to participants. The 17 class M interactions exhibited only two types of patterns—14 with an OIO form, and 3 with an IOI form. Furthermore, like OI, these 17 mixed interactions also involved only the non-oriented tasks (A, B, C, D) and task H. It is interesting that we are observing OIO and IOI sequences, even in a site with only four levels. Once again, no specific clustering was observed around participants.

To see if these classes correspond to specific information-seeking strategies, we plotted curves depicting the progressive narrowing down to a desired congressional official, as a function of interaction steps. All curves begin at the (0, 540) point because the PVS site indexes all 540 congressional officials. With each interaction, this number is gradually reduced until the user arrives at the desired set of officials. However, we were unable to observe major correlations between curve slopes and strategies; this is because in the PVS site, the slope is primarily dependent on the nature of the task, not the strategy. For instance if a task involved a state like ‘Rhode Island,’ even an in-turn input of this state information will cause greater pruning than most out-of-turn inputs. To qualify interaction classes better, we must study out-of-turn interaction in more sites.

### 4.4 Cascading Information across Subtasks

Recall that 15 interaction sequences led to incorrect answers; interestingly 12 of these 15 were generated in response to Task H. Notice that Task H is challenging, because it involves two subtasks and cascading information found in one into the other. The user is expected to first find the only state having Indepen-
ent congressional officials (Vermont), and then find the political party of the Senior Senator from that state (Democrat). In other words, this task requires procedural, not just declarative, knowledge (a distinction motivated in the Strategy Hubs project [4]).

Most people were adept at finding that Vermont was the desired state (e.g., by saying ‘Independent’ at the outset), but did not realize that the task cannot be completed by continuing that interaction. As Figure 7 shows, clicking on the only available state link (‘Vermont’) now presents a choice of House vs. Senate. Clicking on Senate takes the user to the webpage of Jim Jeffords, who is the Junior Senator from Vermont, not the Senior Senator!

Some users immediately realized the problem, as identified in their retrospective interviews, e.g.:

“This question was tricky. Cause it was, I was like wait, if he’s Independent then his party is Independent . . . at first [I thought] it was the Senior Senator who was Independent . . . and I got this guy’s webpage, and then I saw that he was the Junior . . . So then I eventually went back to Vermont and got the [Senior] guy.”

Only 12 (50%) of the participants successfully completed this task. This result demonstrates that cascading information across subtasks is challenging. It was clear that all users wanted to continue the interaction, but some failed to realize that out-of-turn interaction as presented here is merely a pruning operator, and not constructive. Investigating the incorporation of constructive operators such as rollup/expansion is thus a worthwhile direction of future research.

4.5 Rationale and Qualitative Observations

Studying users’ rationale revealed their reasons for interacting out-of-turn:

“I can jump through all the levels . . . .”

“Initially I thought I would prefer the hyperlinks . . . after reading the questions, it became apparent that the toolbar and voice interface would simplify the task.”

“. . . when you wanted to know all the states for the Republicans, then you would have to click on every single link. It would just get annoying after a while. You’d just give up I think. There’d be no way.”

“I guess I would have had to . . . wow, check every state.”

demonstrated understanding of how Extempore works (e.g., input expansion):
“It’s the easiest way cause there is only one Representative from District 17 in Florida and it takes you straight to the page.”

“If you click on the state then you get choices of House and whatever, but if you type in district 2 and it just goes right there.”

Presented advantages and judgments:

“. . . allowed multiple pieces of information to be input at one time.”

“As much surfing as I do, it sort of makes me wish I had those options sometimes ya know instead of going to search engines and fooling around . . . having to come up with different search criteria . . . .”

And also brought out frustrations:

“The voice interface feels a little awkward since I am not used to talking to myself . . . .”

“I don’t always trust the results, [so I went back] confirming that they are all republican.”

Many users learned that out-of-turn interaction is best suited when they have a specific goal in mind, and not meant for exploratory information-seeking (as is browsing). For instance,

“if I wanted to go the whole way down to a specific person, I would use [Extempore], but if I was just looking around, I would use the links.”

“[Extempore] is good when you know the site and know you have to go several layers deep. Links [are good] when you don’t know the layout or don’t know exactly what you want.”

5 Discussion

Extempore enables a novel approach to interact with websites. Users with out-of-turn partial input can employ Extempore to enhance their browsing experiences. Thus, out-of-turn interaction is intended to complement browsing, and not replace it. For designers, Extempore augments their sites with capabilities for personalized interaction, without hardwiring in-turn mechanisms (as is commonly done). In addition, since usage of Extempore is optional, it preserves any existing modes of information-seeking.

There are significant lessons brought out by our study, which we only briefly mention here. This work validates our view of web interaction as a flexible dialog and shows that users actively interleaved out-of-turn interaction with browsing. Importantly, users were proficient at determining when out-of-turn interaction is called for. Studying the rationale and usage patterns has generated a body of knowledge that can be used, among other purposes, for introducing out-of-turn interaction in new settings and to new participants. Furthermore, we have seen that it is easy to target out-of-turn interaction in domains where tasks involve combinations of focused and exploratory behavior. Recall also that dialogs with purely declarative specifications are readily supported; others such as Task H will require further study.

Out-of-turn interaction is most effective when users have a basic understanding of the application domain and know what aspects are addressable. When users do not know what to say [15], our facility to enquire about legal utterances may induce information overload in large sites. While we have not encountered this problem in our PVS study, we suspect that applying out-of-turn interaction in large web directories (e.g., ODP) will involve new research directions.
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