

Assistive Technologies for Web Access for Individuals with Aphasia

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Our work focuses on assistive technologies for people with mild-to moderate aphasia and other mild language disorders in the use of Word Wide Web. This medium is particularly challenging for people with language disorders because of the amount information packed into pages, idiosyncratic terminology and interactivity, complexities of page layouts, and demand for language input,.

We interviewed seven consultants with aphasia about their use of the Web. These sessions included questions about their habits of computer and Web use, as well as observation sessions, where the participants performed either routine Web activities or specified new tasks (e.g. “Book a bus tour to Mt. Evans online”). Based on these observations we outlined several broad categories of difficulties that people with aphasia face in their use of the Web. Among them are:

- Procedural difficulties due to UI artifacts and terminology (e.g. entering verification code presented in obscured letters, finding the “Submit” button, knowing what “Sales rep” means).
- Difficulty interpreting web search results, separating relevant from irrelevant results, visual/spatial layout of the results.
- Inefficiencies/discouragement due to Web page crowding, long lists of information or search results, caused by difficulty of skimming in language-impaired users.
- Problems understanding specific low-frequency words and words with multiple meanings (e.g. “media”).
- Difficulties with generating and spelling words in Web searches and emails.

We are working on several prototypes, using AI and other algorithms, to help with these difficulties:

Word generation. Anomia, or inability to generate words, is found in virtually all people with aphasia and may also result in paraphasia (generation of incorrect words). Paraphasic errors can be sound-based (incorrectly saying or typing words with similar sound patterns) and/or semantic (substituting words with related meanings). We are exploring two ways of using the user's guesses as clues for generating word suggestions:

- Semantic-based: user enters “keep”, “food”, “frozen”; system suggests “refrigerator”.
- Spelling or phonetics-based: e.g. user enters “marhonica” (a typical phonemic paraphasia); system suggests “harmonica”. The algorithm gives promising results when tested on a transcription of actual naming errors made by aphasic patients (Boston Corpus of Aphasic Naming Errors).

Keyword extraction. We are experimenting with generating a set of keywords for a given web page, to help the user better decide whether a particular page is relevant, without having to skim. Keywords are selected to cover major semantic themes in the document. For example, the generated keywords for an article entitled “Staying Healthy on the Road: Asia Travel Health”, are “Asia”, “bacteria”, “travel”, “vitamins”, “healthy”, etc). A variation on the algorithm can generate keywords using a subset of English containing only simple words (‘Basic English’).

Word explanation. We are experimenting with several ways to automatically assist a language-impaired user with understanding a word. In particular:

- Presenting dictionary definitions with word senses coordinated with the context in the original passage that a user is reading.
- Harvesting definitions of the word from the Web (e.g. using Google “define:” feature) and selecting ones that are easiest to understand, based on measures of semantic complexity and relevance.
- Presenting use of the target word in another sentence (selected from a large corpus), in such a way that its meaning can be deduced from the other words in that sentence.

Page classification. We are exploring ways producing more relevant search results by allowing the user to specify the context of their work (e.g. “I want to buy a product”). Once that context is known, we use machine learning techniques to filter out the search results that are irrelevant to that context. We call this “pragmatic classification” - classifying a page, regardless of its primary topic, by pragmatically-motivated facets (e.g. “buying products”, “finding information about a person”, etc).

Graphic simplification. Automatically altering the page layout in various ways, such as displaying the components of a page separately.