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**VotingVoice: An Accessible Voter's Guide for People with Aphasia**

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## Version history

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*This document extends our earlier report, "Design Guidelines for Creating Voting Technology for Adults with Aphasia," AVTI Working Paper #006.*

## Abstract

People with aphasia and other communication disabilities experience a multitude of challenges in everyday life, and experience significant challenges related to interacting with written information. Voting, and learning about political issues, can be especially difficult, as individuals are often required to parse complex phrases. This report documents our research in developing VotingVoice, a tool that enables people with aphasia and their partners to read, annotate, and review complex texts. This research was conducted in collaboration with The Snyder Center for Aphasia Life Enhancement (SCALE), a local aphasia support center in Baltimore, MD. We have worked for over a year with the members and speech-language pathologists at SCALE. In this report, we describe our interactions with a group of SCALE members who take part in a regular class on news and political issues, and present suggestions for designing accessible information resources for adults with aphasia.

## Introduction

The term *aphasia* describes a medical condition that affects an individual's ability to process language, including both producing and recognizing language. Thus, aphasia can affect an individual's ability to read and write, as well as to speak or understand speech. Aphasia is an acquired condition, and is most commonly the result of a stroke, although aphasia may also be caused by traumatic brain injury or other injuries to the brain. Aphasia affects approximately one million Americans, and is more common than Parkinson's Disease, muscular dystrophy, or cerebral palsy (National Aphasia Association).

Aphasia can vary widely in its severity, based on the extent of the individual's brain injury. Some people with aphasia may only have occasional difficulty recalling or recognizing a word, while others may be largely or completely unable to recognize or produce language. A diagnosis of aphasia typically does not imply

reduced intelligence, only a difficulty in processing language. However, as aphasia is typically caused by brain injury, aphasia may be comorbid with cognitive impairments, and is often comorbid with physical weakness (hemiparesis) or paralysis (hemiplegia). Individuals with aphasia may use a variety of technologies to support independent activities, and often use some type of augmented and alternative communication (AAC) technology to support their ability to communicate.

As aphasia can vary greatly in its presentation and severity, the impact of aphasia on an individual's daily life can also vary tremendously. In significant cases, aphasia can negatively impact an individual's functional independence, quality of life, and mental well-being (Hilari, 2008). Aphasia commonly results in increased social exclusion (Parr, 2007). Being unable to read, write, or speak, can prevent an otherwise cognitively able individual from living and working independently. These challenges can also reduce an individual's ability to participate generally in public life, including participating in political and community activities.

Our research at the UMBC Prototyping and Design Lab (<http://umbcpad.com>) focuses on developing novel interactive technologies to support the independence of people with disabilities. Since 2012, we have explored various research projects intended to reduce the challenges experienced by individuals with aphasia in collaboration with the Snyder Center for Aphasia Life Enhancement (SCALE), a community center for adults with aphasia, located in Baltimore, MD, USA.

Over the past year, we have conducted research to explore the difficulties experienced by adults with aphasia when voting, and when attempting to learn about current events, politics, and other news. This report documents our ongoing research partnership with members and staff of SCALE. We provide an overview of the challenges experienced by individuals with aphasia when learning about news and politics, and identify strategies for presenting content to individuals with aphasia in an accessible manner.

### **Related Work**

Prior research has shown that a diagnosis of aphasia can reduce social participation, and has even been shown to reduce ability to vote in informal settings (Dalemans et al., 2010). To our knowledge, no comprehensive study of the impact of aphasia on voting participation has been conducted.

In general, little research has examined how information technology, and in particular accessible user interfaces, can improve the lives of people with aphasia

Most prior research in this area has focused on AAC tools and devices to enable people with aphasia to more easily generate speech (e.g., Beukelman and Mirenda, 2006). Within the human-computer interaction community, researchers have designed technology to support people with aphasia in writing email (Al Mahmoud and Martens, 2010), planning daily activities (Moffatt et al., 2004), and managing recipes (Tee et al., 2005). To our knowledge, our current research is the first to examine accessible user interfaces for improving access to voting information for individuals with aphasia.

## **Background and Formative Research**

In the past year, our research team has participated in on-site research at SCALE. Our research activities have involved a variety of activities, including observations, focus group sessions, interviews, and prototype testing (both paper and electronic) with both staff (speech-language pathologists, personal care assistants) and members.

As of January 2014, SCALE has a set of approximately 50 members with adult onset aphasia. Members age from their 30s to their 90s, and vary greatly in the extent and functional effects of their aphasia. SCALE offers a vocational support for moderately impaired individuals, and a comprehensive program for more severely impaired individuals. We have worked primarily with the latter group, who experience significant communication challenges at a level that makes independent work and living difficult.

SCALE follows a classroom model for its activities. The comprehensive program meets two days per week; members sign up for and attend a series of classes during this time. The class structure provides members with an opportunity to socialize with one another and trained instructors. Classes are taught by speech-language pathologists or subject experts. SCALE's classes run for 15 weeks, and include topics such as reading, current events, music, photography, and yoga. Our work involving voting accessibility has primarily involved a class called "What's in the News," in which members read and discuss articles on news web sites. These classes are coupled with informal group discussion sessions and one-on-one training sessions with therapists.

### ***SCALE's Instructional Approach***

Communicating with a person with aphasia can be difficult even in one-on-one settings. Interacting with a group of people with aphasia can present additional challenges. SCALE instructors are trained in interaction with people with aphasia

in a classroom setting, and use a variety of strategies to make content accessible, and to ensure that everyone is included in discussion.

Our previous white paper (AVTI Working Paper #006) described the instructional techniques used at SCALE to present content in a way that is accessible to people with aphasia. These strategies are described here:

- **Present content using multiple formats.** Whenever possible, present content in multiple media, such as printed text, images, and speech.
- **Extract key content.** Large amounts of text can be difficult for adults with aphasia to read. When possible, reduce complex passages to a set of simple key points.
- **Rephrase for verification.** Presenting content using multiple phrasings, for example, presenting several synonyms for a word, or presenting both the positive and negative form of a statement, can reduce the chance of misunderstanding.
- **Provide easy feedback mechanisms.** Some individuals with aphasia find it difficult to express that they need further explanation, or that they do not understand. Classrooms at SCALE also feature signs that can be used to indicate agreement, disagreement, or confusion; pointing at the sign enables the individual to provide feedback even when he or she is unable to articulate this feedback vocally or in writing.

### *Participatory Design Research*

Our research group has conducted on-site, participatory research at SCALE for over one year. In general, our research has followed a participatory design (PD) approach, in which members of the SCALE community provide guidance and direction for the technology that we are collaboratively developing.

Conducting PD with individuals with aphasia presents additional challenges beyond those found when engaging in PD in the general population. We use a variety of techniques to elicit design ideas and design feedback from our user group, including focus groups and design teams, acted-out sketches, play-acting, and low-fidelity prototyping. Our PD approach for individuals with aphasia has been documented in a recent publication (Kane et al., 2012).

## **Understanding Current Voting Behaviors and Challenges**

To understand the challenges faced by adults with aphasia, and their current strategies for overcoming these challenges, we continue to conduct fieldwork at SCALE around the topics of voting and learning about current events. The current document describes research conducted between September 2012 and July 2013. Our research has included focus group discussions, classroom observations, and one-on-one interviews with SCALE members (adults with aphasia) and speech-language pathologists. We have particularly focused our research on a class titled “What’s in the News?”, in which members and staff review and discuss current events. Our research also draws from training materials developed by the SCALE.

This section describes the techniques implemented at SCALE to improve access to news and current events, provides an overview of the challenges experienced by adults at SCALE when voting (and learning about voting issues), and describes their current voting behaviors.

### *What’s in the News?*

SCALE offers a revolving set of classes on a variety of topics, with a 15-week “semester.” While some classes, such as a recent class on exotic animals, are only offered once, some classes are offered each semester. Examples of these current classes are a class on reading comprehension, and a class covering current events, called “What’s in the News?”

The News class typically features about 10 students, and is led by a single instructor, typically a speech-language pathologist from the SCALE staff. Student volunteers sometimes provide additional classroom support. The class meets for 1-2 hours each week. The purpose of this class is to learn about, and discuss, news and current events.

In this class, the instructor typically leads the group in reading about and discussing current news topics. She typically drives the discussion by loading news-related Web pages on a computer, and displaying them on a projection screen. She will ask class members if they are familiar with the subject being discussed, and will often ask them about their opinions on the current subject (either positive or negative). Discussion is guided by the interests and responses of the

The content of the News class is not limited to political or voting information, but often focuses on this topic when elections are near. The instructor also assists members of the class in preparing for voting activities, by viewing news articles on upcoming election issues, and by printing out and reading through practice ballots.

SCALE does not directly assist members in voting at a polling place, although many members receive assistance from family members when voting.

### *Current Voting Participation and Accessibility*

The members of the News class comprise the majority of SCALE members who are actively interested in news and politics. While we have not collected individual data on who has voted and when due to confidentiality reasons, we have identified general trends and issues related to voting and learning about voting.

In general, the act of voting, and especially informed voting, was considered to be quite challenging by many of the individuals with aphasia. Most of the individuals that we spoke to brought a companion to help them vote. Due to the difficulty in voting, some individuals focused only on major elections and issues, or voted by political party only, and did not pay attention to minor issues. Many individuals who had experienced aphasia many years reported that they no longer followed news and politics due to the difficulty of doing so.

SCALE staff and members reported a variety of accessibility challenges when voting:

- **Lack of accessible and unbiased voting information.** When researching voting issues, SCALE members often experienced challenges finding accessible and unbiased information. Large media outlets such as CNN and Fox News often provide the most accessible online information, and are more likely to feature multimedia content. However, some individuals expressed concern about the biases of such large media outlets. Furthermore, these large organizations typically focus on national issues; consequently, it is often more difficult to find accessible information about local issues.
- **Lack of physical access.** Many individuals who have had a stroke experience weakness or paralysis in parts of their body, and may use a cane, walker, or wheelchair. Physical accessibility of the polling place and voting technology was frequently reported as a barrier to participating in voting. Some individuals reported specific challenges regarding getting to the polling place, and waiting to vote, especially if they were required to stand.
- **Difficulty understanding instructions.** Our participants with aphasia often experienced difficulty understanding, following, and remembering instructions, both those provided by staff at the polling place as well as those on the ballot

itself. This problem was exacerbated by electronic voting systems, which may require learning to use a new computer interface.

- **Concerns about making incorrect choices.** Many of the adults at SCALE who had voted were concerned about accidentally making an incorrect choice, and voting against their own interests. When faced with an unclear question, individuals sometimes preferred to leave their response blank rather than risk making an incorrect choice.
- **Complex ballot initiatives.** People with aphasia often do well with simplified statements and content. However, many issues that individuals are called to vote upon are inherently complex, and cannot be reduced to a simple statement. This is especially true for ballot initiatives, which often have complex structures. For example, Maryland's 2012 state ballot featured an initiative involving whether the state should allow undocumented immigrants to pay in-state tuition rates. The text of the ballot question was 125 words long; as measured by Microsoft Word 2011, the initiative text presents a Flesch Reading Ease Score of 13.3 ("best understood by university graduates"), and a Flesch-Kincaid Reading Level of 12<sup>th</sup> grade (Kincaid et al., 1975).
- **Difficulty processing numbers.** Many of the adults at SCALE have difficulty understanding numbers and accurately gauging the relationships between them, whether represented as numerals or text. Thus, ballot initiatives involving complex numbers could be quite difficult to understand. Some SCALE members understand numerical content better when presented with charts or graphs, though this content is typically not available on actual ballots.
- **Effect of phrasing on comprehension.** While adults with aphasia typically understand their own opinion on an issue, the phrasing of questions about that issue may distort their response. If the individual is expecting a question or topic to be phrased in a certain way, encountering that issue in a different context may cause them to misunderstand the content, or even to adopt an opinion opposite their own beliefs.
- **Differences between sample and real ballots.** SCALE members often prepared to vote by reading and practicing with a sample ballots. However, they sometimes found that the actual ballot differed in presentation from the practice ballot, and experienced difficulty connecting the two.



- **Misunderstandings when working with an aide.** When voting, SCALE members typically brought along a companion, such as a family member, to provide assistance. However, the aide did not always fully understand the individual with aphasia's plan or preferences. Accurately learning these preferences requires time and patience from both the individual and his or her aide, and often one party or the other was resistant to doing so. Furthermore, if the individual with aphasia encountered a problem while voting, he or she would not always choose to seek help.

### *Making Voting Accessible to People with Aphasia*

Through our observations during the News class, and through interviews with the instructor and students, we identified a number of strategies used at SCALE to increase the accessibility of news and voting topics during the class.

- **Highlight and isolate key points.** The instructor used a variety of techniques to simplify existing material, such as web pages and sample ballots. The instructor carefully reads through material with the group, highlighting important phrases by circling them, underlining them, or writing them down on a whiteboard. The instructor often copies a small section of text from a document and pastes it into a separate document to isolate it, reducing information overload. The instructor also frequently relies upon repetition to emphasize points and increase comprehensibility.
- **Combine speech, text, and images.** When covering news articles in class, the instructor presents the text alongside representative images. She also reads along with the text, or uses web sites that can read their own content automatically, such as The New York Times and The Wall Street Journal.
- **Rephrase content.** The instructor will often read text from an original source, and then rephrase it to increase comprehensibility. Many of the adults with aphasia at SCALE have difficulty understanding speech, but benefit from hearing the same content phrased multiple ways.
- **Poll frequently.** The instructor ensures that class members are following along through frequent verbal polling. She will typically ask a question about the current content, and ask class members to indicate whether they agree or disagree. She will often ask about the same topic from multiple perspectives, to test whether the class members' responses are consistent, or whether they may be experiencing difficulty in understanding the topic.

- **Verify answers.** Adults with aphasia may sometimes respond to multiple questions about the same topic inconsistently, if they have difficulty understanding a question or articulating the response. The instructor of the News class stated that she is always careful to restate and verify class members' opinions to be sure that the instructor was not speaking for the member.
- **Practice sample ballot.** Before elections, the instructor prints out sample ballots and leads the class through the ballot. She highlights and underlines important terms in the ballot. As the class goes through the sample ballot, she polls the class for their opinions on each of the issues, and writes down their opinions so that they can be revisited and double-checked later.

In addition to the aforementioned strategies, the News class instructor relies upon a set of reliable and accessible online sources for course content. The instructor typically begins with mainstream information sources, and modifies them to be more accessible class members. Large, mainstream news sites such as CNN, The New York Times, and The Wall Street Journal are often most useful, as they were likely to feature supplemental audio or video content. SCALE members also favor sites that feature charts, graphs, timelines, and other information visualizations, such as the US Debt Clock, which shows a real-time count of debt in the United States; iCasualties, which charts casualties in war over time; Politifact's Truth-or-Meter, which visualizes promises made by politicians, and their actions to keep or break these promises; and the Voice of America, which features videos on news topics presented in simple English, along with text captions.

### **VotingVoice: A Guided Reading Aid for People with Aphasia**

Based on our formative work, we identified an opportunity for supporting individuals with aphasia in the voting process through technology. In particular, our design partners identified numerous difficulties in learning about voting issues and preparing to vote. Since voters are often discouraged or disallowed from bringing their own technology into the voting place, and since many other research projects have explored developing new voting booth technology, we chose to focus on developing technology that can be used to improve the voting experience, but which remains in the control of the end user.

Our prototype, VotingVoice, is designed to support reading complex content such as news stories and voting guides, taking notes on this content, and reviewing this content later. The design was guided by the needs identified by our formative research with individuals with aphasia and the educators and speech-language therapists at SCALE. The end result is a web-based application that allows users to

take notes and review notes on any web document, and which presents a user interface that is adapted to the needs of individuals who may experience difficulty when reading complex text. This tool may be used by a single user, but may be best used by a combination of a user and a facilitator, such as a teacher or a speech-language therapist. The following sections describe the design and development of VotingVoice, as well as a preliminary evaluation of VotingVoice with aphasia subject experts.

### *Project Requirements*

The core concept of VotingVoice, that of a tool to support voter education and preparation, was decided at the start of this project, and was based on our prior experiences in designing technology for adults with aphasia. Our goals for the project, which became requirements for VotingVoice, were based on our formative research described previously in the report. Our requirements were as follows:

- Provide the ability to take notes on arbitrary content on the Internet;
- Provide the ability to record snippets of key content;
- Provide the ability to review notes later;
- Provide the ability to annotate notes with non-text information (e.g., images, sounds);
- Provide the ability to indicate agreement and disagreement in easy ways (e.g., star ratings);
- Provide the ability to print out notes to bring to a polling place;
- Support viewing on multiple technology platforms (e.g., tablet, phone, web).

### *Design*

Our initial design concepts focused on the development of tools to support easy creation and review of end-user notes. While some previous projects have supported annotating content on the web, such as Annotator (Open Knowledge Foundation) and Diigo (Diigo Inc.), these tools were not designed to be accessible to users with disabilities. Our previous research in understanding technology use for adults with aphasia revealed that many adults with aphasia are hesitant to take initiative in exploring a user interface. Thus, one priority for the design was to make any annotations clearly visible, so that they could be used without navigating through a complex user interface.

A second priority was to enable users to remove much of the “background noise” in current web sites and to focus on easily digestible content. Our formative research revealed that many existing sources of information on the web contain many distracting elements, and that instructors at SCALE often copied information

from their original source into a separate window in order to focus on the content. Thus, we explored designs that allowed users to focus solely on a small subset of information, and to navigate through these “snippets” step by step.

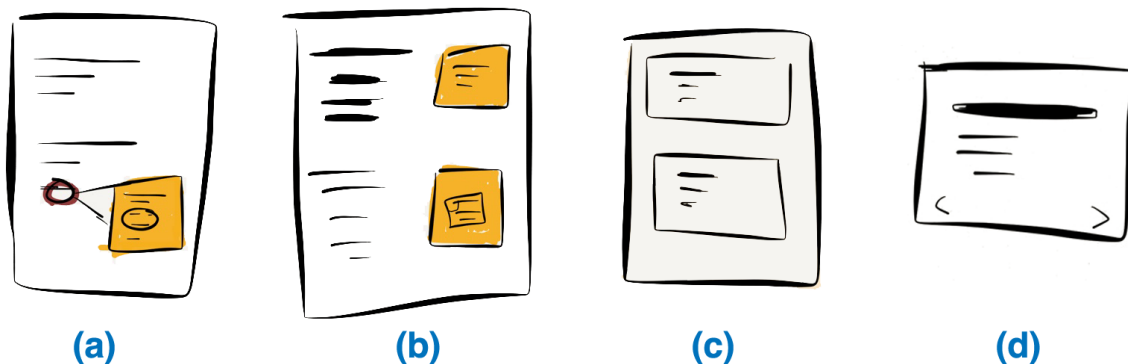


Figure 1. Initial sketches of the VotingVoice user interface. (a) Pop-up notes; (b) Margin notes; (c) Printable note summary; (d) Note review slideshow.

Figure 1 shows some initial design ideas for the VotingVoice user interface. We considered four potential formats for note content: a *pop-up notes mode*, similar to Annotator, which allows users to view notes by tapping or moving their mouse over the highlighted text; a *margin notes mode*, which presented notes on screen within the page margin; a *printable note summary*, which showed only the user’s notes; and a *note review slideshow*, which would enable users to page through large amounts of content one small amount of information at a time, similar to a slideshow.

We also considered including note content from several sources. Our primary intended usage has been to support collaborative reading, such that a person with aphasia could read through a complex text with a partner, annotate the content to provide helpful context, and to review the annotated content later. However, this means that the user and partner need to generate the annotation content themselves. We considered additional options for creating annotation data, such as allowing Internet users to add content, or even automatically fetching content based on key words. For example, our system could identify the name of a political figure in the text and automatically fetch photographs or a biography of that individual using Internet sources such as Wikipedia. We decided to focus only on the user’s own notes for the initial version, as this would avoid problems related to incorrect or biased information in notes from the Internet. However, we believe there is potential in drawing from other Internet sources to make content more accessible, and discuss potential uses of such a feature in our future work section.

### *Development and Implementation*

We developed a working prototype of VotingVoice using HTML and JavaScript. The source code for our prototype is provided via an open source license, and is included in the “Additional Resources” section at the end of this document.

This project draws on several existing open source software libraries, most notably the Annotator project (Open Knowledge Foundation), which is an open source library that enables web users to annotate arbitrary web pages in the browser. We also used the meSpeak text-to-speech library (Landsteiner, 2013) and the Readability library (Arc90 Labs, 2009) for extracting the main content from web pages.

The current prototype relies heavily on the Annotator library for creating, storing, and retrieving annotated content. However, we extended Annotator to support additional features required by our user group. These features are briefly outlined here. Features of the VotingVoice prototype are documented in detail in the following section.

- Enabled images to be added and viewed in annotations;
- Enabled annotations to have different colors;
- Enabled annotations to have image tags (e.g., check mark, star rating);
- Enabled annotations to be read out loud using text-to-speech;
- Enabled annotations to be viewed in the margin, as a printable review list, and as a slideshow.

These features were added as a plugin module to the main Annotator library, and can thus be used without altering the original Annotator code. We intend to share information about these new features with Annotator’s development team and determine whether they may be added to the main Annotator project.

### *Feature Overview*

A complete overview of VotingVoice, including an interactive demonstration, may be found at the demonstration site included in the “Additional Resources” section below. This section briefly describes and illustrates the major features of VotingVoice.

**Text simplification:** Instructors at SCALE noted that many web pages contained large amounts of extraneous information, such as advertisements, social media links, and page sidebars. Instructors often addressed this problem by copying portions of the document into a separate window, so that they could be reviewed

without the distracting elements. VotingVoice simplifies this process by including a content identification and extraction feature, based on Readability (Arc90 Labs). This feature allows users to enter a web address and receive a simplified version of that page that contains only the main body text and images. Figure 2 shows an example of text simplification.



Figure 2. VotingVoice’s text simplification feature removes extraneous content from a web page. Left: original page. Right: simplified page.

**Text-to-speech:** Synthesized speech can help adults with aphasia read difficult text passages. While some computing platforms, such as Apple’s iOS, provide built-in text-to-speech for arbitrary text, many platforms do not provide this feature. VotingVoice includes an integrated text-to-speech engine via the meSpeak library (Landsteiner, 2013). Users can select any text in the document and convert it into speech via a pop-up menu. Users’ annotations also present a button that can be used to speak the content of the annotation.

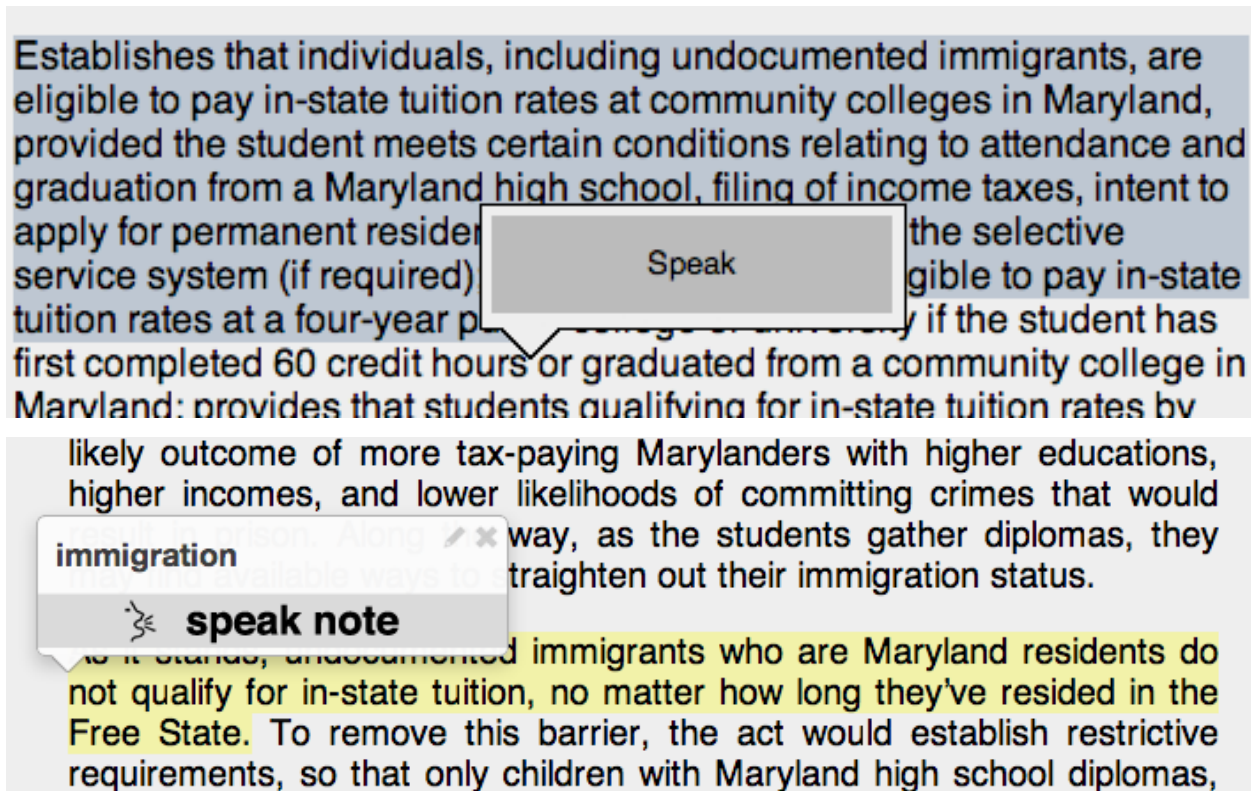


Figure 3. Examples of VotingVoice's text-to-speech feature. Top: Users can select arbitrary text and speak it. Bottom: Users can speak the content of any notes that they have recorded.

**Annotation:** A core feature of VotingVoice is the ability to add notes to existing Web content. VotingVoice uses the Annotator library (Open Knowledge Foundation) to capture and store user notes. Annotator provides a default user interface for recording notes, and provides a backing store called AnnotateIt that can be used to store notes on any page. Multiple users may make notes on a single page, and any user can see the notes placed on that page. Users may make an annotation by highlighting a section of the text, choosing *Annotate* from a pop-up menu, and entering an annotation (see Figure 4).

VotingVoice uses a modified form of Annotator's default user interface. Typically, Annotator only allows users to store annotations as plain text. VotingVoice allows users to include links to images in their notes, and displays these images in the annotation pop-up. VotingVoice also provides a tagging feature that uses a series of image-based tags that may be used to indicate agreement (via a smiley face or check mark), disagreement (via a frowning face or X), or confusion (via a question mark). These image tags may also be used to indicate the topic of a note, such as health, education, or economics. These tags are based on the heavy use of images



to identify topics during discussion at SCALE, and provide a quick reminder of the content of a text note. VotingVoice also provides a *Speak Note* button for all annotations. Figure 4 shows the note editor and pop-up note review user interfaces.

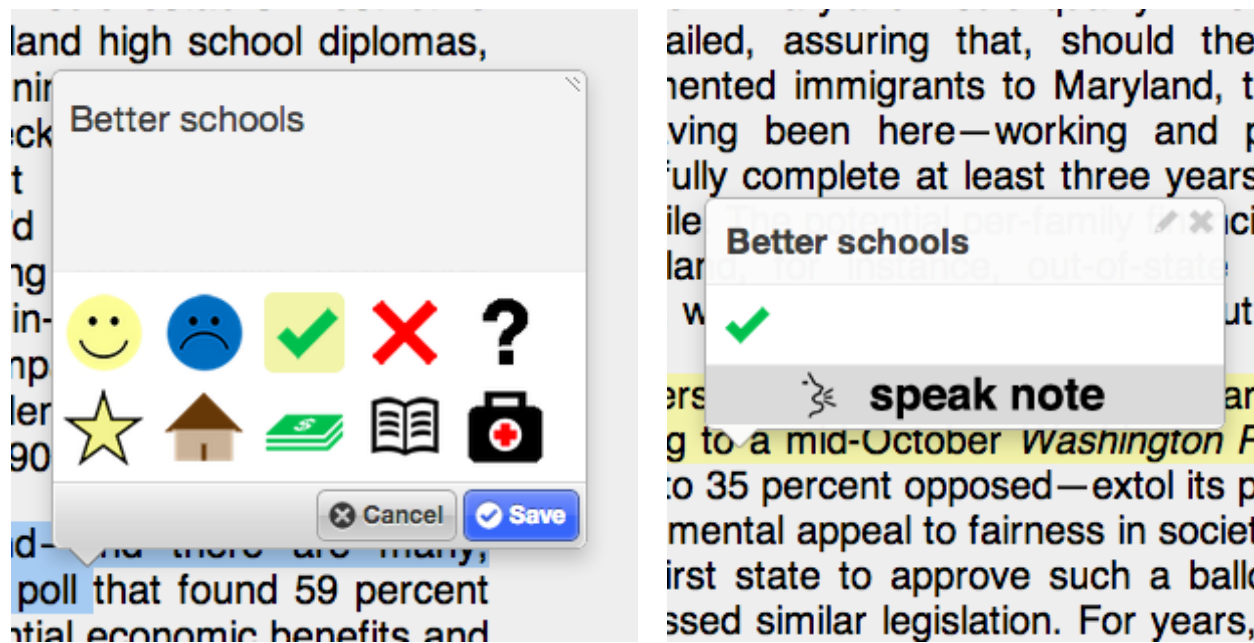


Figure 4. Annotation features in VotingVoice. Left: Note editor view, featuring image tags. Right: Note review pop-up, featuring an image tag and the *Speak Note* button.

**Note review:** In Annotator, notes may reviewed by tapping or mousing over the highlighted annotation text. However, this view may not be ideal for all reviewing situations, as the user must manually reveal each note, and because the entire page is presented at once, which may be distracting to some users. To address these issues, we developed three additional modes for reviewing annotations. Each mode uses the existing Annotator storage, and may be used without changing Annotator’s source code or database.

The *note review list* provides a comprehensive, printable list of annotations for a single page (Figure 5). The *margin notes view* provides annotations as margin notes in the original page (Figure 6). The *note review slideshow* provides an interactive slideshow that allows notes to be reviewed one at a time (Figure 7).



## Review list: 2012 General Election Ballot Question Language

1. *"Requires judges of the Orphans' Court for Prince George's County to be admitted to practice law in this State and to be a member in good standing of the Maryland Bar."*

**Yes on Question 1**



Added Sun Jan 05 2014 at 6:59:07 PM

2. *"Question 2 Constitutional Amendment (Ch. 146 of the 2012 Legislative Session) Qualifications for Baltimore County Orphans' Court Judges"*

**Don't know about question 2**



Added Sun Jan 05 2014 at 6:59:32 PM

3. *"Do you favor the expansion of commercial gaming in the State of Maryland for the primary purpose of raising revenue for education to authorize video lottery operation licensees to operate "table games" as defined by law; to increase from 15,000 to 16,500 the maximum number of video lottery terminals that may be operated in the State; and to increase from 5 to 6 the maximum number of video lottery operation licenses that may be awarded in the State and allow a video lottery facility to operate in Prince Georae's County?"*

Figure 5. Note review list. All notes from a web page are presented in a list. Each list item shows the annotated text, the user's note, and any image tags or pictures added to the note. The note review list may be printed out for review offline, such as when preparing to vote.

# 2012 General Election Ballot Question Language

[View original page](#)

Statewide ballot question language was certified by the Secretary of State on the 20th of August. Local ballot questions may also appear on the ballot in certain counties. [Follow this link for audio recordings of the ballot questions.](#)

## Statewide Questions

### Question 1

#### Constitutional Amendment (Ch. 394 of the 2011 Legislative Session) Qualifications for Prince George's County Orphans' Court Judges

(Amending Article IV, Section 40 of the Maryland Constitution)

Requires judges of the Orphans' Court for Prince George's County to be admitted to practice law in this State and to be a member in good standing of the Maryland Bar.

**For the Constitutional Amendment**  
**Against the Constitutional Amendment**

*"Requires judges of the Orphans' Court fo..."*

Yes on Question 1



### Question 2

#### Constitutional Amendment (Ch. 146 of the 2012 Legislative Session) Qualifications for Baltimore County Orphans' Court Judges

(Amending Article IV, Section 40 of the Maryland Constitution)

Requires judges of the Orphans' Court for Baltimore County to be

*"Question 2 Constitutional Amendment (C..."*

Don't know about question 2



Figure 6. Margin notes view. Annotations are presented as notes in the page margin, alongside the simplified version of the original text. Notes and highlights are color coded to make it easier to match notes to the highlighted text.

**Instructions:** Use the arrow buttons to navigate the slide show.

*"Requires judges of the Orphans' Court for Prince George's County to be admitted to practice law in this State and to be a member in good standing of the Maryland Bar."*

**Yes on Question 1**

✓

Added Sun Jan 05 2014 at 6:59:07 PM

◀ ▶

Figure 7. Note review slideshow. Each note is presented as an individual slide in a slideshow. Users can review each note in sequence.

### *Expert Evaluation of VotingVoice*

We conducted a usability evaluation of VotingVoice with two aphasia experts: a speech-language pathologist and an assistive technology director at SCALE. Our users tested the VotingVoice prototype using several documents, including a voter's guide and a sample ballot, and tested the various modes of VotingVoice. They also presented VotingVoice to some of SCALE's members and gathered preliminary feedback.

Overall, feedback was positive, and the test users saw the potential of the system to improve accessibility of written material. However, more testing is needed to determine the benefits of using a system like VotingVoice for education. In particular, the large amount of text remains a problem for users, even with annotation added. Members of the News class at SCALE currently favor even simpler or more visual web pages. Thus, the prototype might benefit from tools that provide a simpler or more visual view. For example, rather than simply extracting the main body text from a document, VotingVoice could generate a pictorial view of the document, or could automatically include images from other

sites based on keywords in the document. Another possibility is that users should perhaps be introduced to VotingVoice using simpler documents—while the purpose of VotingVoice is to make complex documents easier to read, the documents that we tested (voter guides and ballot measures) are challenging to read in any format, and may make the user interface seem imposing. The test users also provided suggestions for improving the user interface; these are discussed in more detail in the following section.

## **Limitations and Future Work**

We have made progress on a number of milestones over the course of this project, including documenting the accessibility challenges experienced by adults with aphasia when participating in the voting process and developing a functional prototype of our VotingVoice system. However, there are multiple opportunities to extend this work in the future. Most notably, the VotingVoice prototype could be tested further by individuals with aphasia, and tested in realistic voting scenarios. In its current form, VotingVoice might be most useful if incorporated into a classroom setting, such as the “What’s in the News?” class at SCALE. We are also interested in identifying additional user groups who might benefit from this type of assisted reading tool, such as individuals with cognitive or learning impairments or non-native language speakers.

Our aphasia experts suggested several improvements to the interface to improve its accessibility for people with aphasia. First, while the current VotingVoice interface supports adding images to documents, the resulting documents are often still somewhat sparse. A future version of VotingVoice could automatically add images from the Web based on keywords in the document, such as individuals’ names or place names. Second, while the experts appreciated VotingVoice’s integrated text-to-speech, the embedded text-to-speech had a lesser voice quality than the voices typically used by SCALE members. In the future, VotingVoice could use the system’s text-to-speech engine where available, and fall back on the embedded engine only when necessary. The experts also requested additional features for the text-to-speech engine, such as adjustable speed parameter and word-by-word highlighting. The experts also requested the ability to record audio clips as an alternative to text-to-speech.

Finally, while VotingVoice presents a general solution to increasing the accessibility of complicated text documents, throughout this project we observed many instances in which individuals with aphasia experienced difficulties understanding specific types of data, especially numerical data. It may be possible to create alternative representations of numerical data. Instructors at SCALE often

represent numerical data as pictures and charts when discussing it in class, and it may be possible to create more accessible representations of these data, and to automatically insert these accessible representations into documents.

## **Conclusion**

Individuals with aphasia still experience significant accessibility challenges surrounding voting, including the act of voting itself, but also in learning the appropriate background knowledge required to vote in an informed manner. The adults with aphasia who have participated in our research currently rely upon a significant amount of external assistance to learn about voting issues, prepare to vote, and to vote. Many of these challenges extend beyond text complexity, and cannot be resolved through simplifying language alone.

In this paper, we present an overview of accessibility challenges experienced by adults with aphasia, gathered from over a year of formative research at an aphasia center. We present a new technology prototype, VotingVoice, which provides tools for enabling adults with aphasia and their partners to turn complicated web documents into simpler, more approach documents through text and image annotation and text-to-speech. We believe that this notion of accessible annotation may be useful for other types of documents and for other user groups, and we will continue to explore the applications of this approach.

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## **Additional Resources**

VotingVoice demonstration:

<http://voting.touchpadlab.com/guide>

VotingVoice source code:

<https://github.com/umbc-pad-kane/VotingVoice>

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