UX Research:
Eye Tracking& Accessibility

Zhengchen Zhou & Mary Nichols

Directed by Professor Matthew Peterson

Visual Attention and Cognition Lab

George Mason University

Table of Contents

Resources

Resources for ppl with low vision
https://www.aao.org/eye-health/diseases/low-vision-resources

Self help guide to living with low vision
https://lowvision.preventblindness.org/2020/12/18/a-self-help-guide-to-non-visual-skills/

Blog about good and bad accessibility practices
https://blog.prototypr.io/common-accessibility-problems-good-and-bad-examples-in-modern-websites-a13efb7256ad

Web content accessibility guidelines
https://www.w3.org/TR/WCAG20/

Low vision OT skills
https://www.youtube.com/watch?v=K9MMUZe0DTA

Fighting blindness canada
https://www.fightingblindness.ca/

Well designed website for accessibility
https://www.boia.org/blog/86-percent-of-websites-fail-this-accessibility-basic

Great examples of websites that have accessibility features
https://www.convinceandconvert.com/digital-marketing/accessible-website-examples/

Low vision information global
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5820628/

Research articles

Low vision with eye tracking idying public signs
https://link.springer.com/content/pdf/10.1007%2F978-3-642-14100-3_46.pdf
ASL
http://host.web-print-design.com/asl/

Eye tracking tech low vision
https://par.nsf.gov/servlets/purl/10149405

Low vision website ux
https://www-proquest-com.mutex.gmu.edu/docview/220963020/fulltext/767C3368A6334044PQ/1?accountid=14541

Guide access and usable websites
https://redish.net/wp-content/uploads/Theorfanos_Redish_InteractionsPaperAuthorsVer.pdf

Chief low vision complaints
https://www.aaojournal.org/article/S0161-6420%2814%2900198-5/fulltext

Eval of gaze-controlled vision enhancement system
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5381883/#pone.0174910.ref001

A Heuristic Method to Evaluate Web Accessibility for Users With Low Vision
https://ieeexplore.ieee.org/abstract/document/8822682

Applying Web Usability Criteria for Vision-Impaired Users: Does It Really Improve Task Performance?
https://web-b-ebscohost-com.mutex.gmu.edu/ehost/detail/detail?vid=0&sid=d3e3c99c-5e34-4808-95d2-4f99dba82800%40sessionmgr102&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=33372241&db=pbh

An exploratory study of web adaptation techniques for people with low vision
https://link.springer.com/content/pdf/10.1007/s10209-020-00727-6.pdf

Web magnifiers vs rwd
https://link-springer-com.mutex.gmu.edu/chapter/10.1007%2F978-3-319-20612-7_18

Resources for mobile assistive tech and methods to provide access to them

https://www-proquest-com.mutex.gmu.edu/docview/1968072083?pq-origsite=primo&accountid=14541

Experiment Tools

free Magnifixer 6.3, access to eyetracker in basement, WIX

Hotjar website
https://insights.hotjar.com/sites/2629484/setup?step=installation-method

```
<!-- Hotjar Tracking Code for 10.151.189.20 -->
<script>
    (function(h,o,t,j,a,r){
        h.hj=h.hj||function(){(h.hj.q=h.hj.q||[]).push(arguments)};
        h._hjSettings={hjid:2629484,hjsv:6};
        a=o.getElementsByTagName('head')[0];
        r=o.createElement('script');r.async=1;
        r.src=t+h._hjSettings.hjid+j+h._hjSettings.hjsv;
        a.appendChild(r);
    })(window,document,'https://static.hotjar.com/c/hotjar-','.js?sv=');
</script>
```

Eye Tracker investigation: Eyelink1000 info

https://www.sr-research.com/wp-content/uploads/2021/08/eyelink-1000-plus-brochure-updated.pdf

- **SR Research WebLink** is a powerful software solution that allows EyeLink users to track eye movements while participants view and **interact with dynamic media such as websites,** PDF files, scene camera, online games, and computer software. It is ideal for performing usability testing and also perfect for running simple “slideshow” experiments with image and video stimuli.
- **Powerful screen recording that captures dynamic screen events and changes as an mp4 video file -** *possibility of recording videos of the session*
- WebLink has a number of features that make it particularly suitable for studies in which users browse websites. In combination with our analysis software Data Viewer (see pages 18-19),
    - WebLink allows users to:
        - • Capture websites using Firefox or Chrome browser
        - • Capture the entire webpage content as a single image for offline analysis and creation of interest areas and heat maps
        - • Capture dynamic website content (e.g. video and audio) with .mp4 screen recording
        - • Simultaneously record live video/audio from participant to capture reactions / verbal responses

- https://risoms.github.io/mdl/docs/build/manual/EyeLink%201000%20Plus%20User%20Manual%201.0.12.pdfhttps://risoms.github.io/mdl/docs/build/manual/EyeLink%201000%20Plus%20User%20Manual%201.0.12.pdf
    - 2.1 Web UI Interface The Web User Interface (Web UI) is a tool supplied with the EyeLink 1000 Plus eye tracker that allows users to access files from the Host PC, configure eye tracker settings, and perform Host software updates. This tool can be run on both the Host PC and the Display PC. On the Host PC, you can access this interface by simply pressing (Ctrl+Alt+Q) three keys together to exit the current eye tracking session. On the display PC, you can access this interface by pointing your browser to 100.1.1.1 (detailed instructions for running the Web UI on the Display PC are provided in section 2.1.4). The Web UI interface consists of a file manager and a configuration tool.

Articles that used eyelink1000 plus to simulate low vision

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7726591/ - used weblink to simulate low vision and to also simulate Gabor patches (black and white bars) appearing randomly on screen

https://jov.arvojournals.org/article.aspx?articleid=2670439
“ Initially, subjects developed a peripheral locus of fixation under simulation of a 6° scotoma, which was used as a baseline.”
Eye-positional data were collected using a gaze-contingent setup based on MATLAB (MathWorks, Inc., Natick, MA) and the Eyelink 1000 Plus eye tracker (SR Research, Ltd., Ontario, Canada).

The Redesign: Make A Bad Website

- Bad contrast
- Multiple columns of text
- Colors that don't help user distinguish where they are on site
- Sans serif type is easier for low-vision people to read than serif type. - bad font

Findings from a study and recommendations from study
G1. Never rely on color alone to convey functional meaning-that includes not relying on background color alone to define different sections of a Web page.
G2. Outline tabs with a black border so that they look like tabs even when their special colors are taken away.

Types of Websites?

- Air bnb type of site
- Ask prof's advice?

Action Items for 10/5/2021
Zhengchen Zhou:

- **Conduct basic literature review**

Mary:

- **Identify additional literature for literature review**

https://www.nsw.gov.au/
Gain info on covid-19

Both:

- **Identify type of website - include rationale**
    - **Identify types of tasks**

Tasks

1. **Find a place to get swabbed for COVID-19**
2. **Look up regulations about COVID-19 in the area**
3. **Support for people with a disability**

Eyetracking questions
Is there like a sign up list for the eyetracker?

Is there a way to blur the screen?
Filter for the whole screen
Eye tracker won't even know it

Software to make things inaccessible

https://screenblur.en.lo4d.com/windows

Chrome extension
Sheen - customize blurring for whole website

Manual
https://www.sr-support.com/attachment.php?aid=714

Week of 11/15/2021
Chevis
-work on script for experimenters

Experiment Scripts

“you are having a vacation in New South Wales, Australia. And you are trying to look up information on guidelines for COVID-19 and support for people with disabilities.

The first task is: Find a place to get swabbed for COVID-19
The 2 task is: Look up regulations about COVID-19 in the area
The 3 task is: locate information on support for disabled people

Please think aloud through all the tasks. We will also record both the screen and audio.
(At the end of tasks) Please fill out the system usability scale.

Now you need to do the exactly same tasks on another website.

(At the end of tasks) Please fill out the system usability scale.”

-work on finding different ways of accomplishing the three tasks

- **1 Find a place to get swabbed for COVID-19**
  1.1 Search, find results for vaccination, enter “Get your COVID-19 vaccination” page, book now, enters Vaccines Clinic Finder...
  1.2 Follow the yellow banner in the most obvious place...
  1.3 find the 8th block in the main page, enter “Get your COVID-19 vaccination” page...
  1.4 View all media Releases, “You may also be interested in”, click the red banner for COVID clinic…
  1.5 View all media Releases, find the news about COVID appointment after several “next” buttons
  1.6 MyserviceNSW in the upper-right corner in front page, download mobile app for COVID…
  1.7 click the COVID-19(coronavirus) button in the banner in front page, vaccination, …
  1.8 click News in Popular in the bottom of front page, search COVID in the box, find clinic news…
  1.9 click the ‘What’s happening’ button in the banner in front page, click COVID-19 block
  1.10 click the ‘Living in NSW’ button in the banner in front page, find ‘Featured’, find ‘COVID-19’
  1.11 click the ‘Working and businesses’ button in the banner in front page, find ‘Trending Topics’ or downward links...
- **Look up regulations about COVID-19 in the area**
  2.1 search in the search box in front page...
  2.2 click News in Popular in the bottom of front page, search COVID-19 in the box, find news about the regulations
  2.3 find NSW Government news in the front page, View all media releases, find the regulations…
  2.4 Click the first block of COVID-19 rules and restrictions in the front page

2.5 click the COVID-19(coronavirus) button in the banner in the upper-right corner in front page, click regulations
2.6 click the 'What's happening' button in the banner in front page, click COVID-19 block
2.7 click the 'Living in NSW' button in the banner in front page, find 'Featured', find 'COVID-19'
2.8 click the 'Working and businesses' button in the banner in front page, find 'Trending Topics' or downward links...

- **Info on support for disabled people**
  3.1 search 'Support for people with a disability' in the box

Both:
Read through Experiment Builder manual

Mary: finish "bad" website
Figure out how to incorporate website tasks into experiment builder

Website:
https://maryrnichols94.wixsite.com/nswtest

https://screenblur.en.lo4d.com/windows

Experiment Recording: What do participants do?
Participant 1

A

- **Find a place to get swabbed for COVID-19**
    a. **Clicks covid-19 tab**
    b. **Find a testing clinic**
    c. **Pretty**
    d.
- **Look up regulations about COVID-19 in the area**
    a. **Current restrictions**
    b. **Rules for fully vaccinated people in NSW**
    c. **Clicks masks with covid checkins**
    d. **Saying and how to prove your vaccinated**
    e. **Has scotoma out to the side**
    f. **Does not appear to be using screen reader**
    g. **Community sport**
    h. **Schools has own tab for rules**
    i. **Completed task**
- **Support for people with disabilities**
  Living in NSW
  Disabilitiy services

B

- **Find a place to get swabbed for COVID-19**
    a. **A lot harder to read on this one**
    b. **I'm going to click on COVID-19**
    c. **Book your vaccination**
    d. **Booster vaccination - not sure if that's regular or if booster specifically**
    e. **Book your vaccination**
    f. **Going to try and click on this**
        i. **Expected it to be a button**
        ii. **Because it says BOOK NOW and that's an action word**
    g. **Booster how to find out**
    h. **Where to get your vaccinations**
    i. **Maybe I can look at a different tab?**
    j. **I wish there were a search function**
    k. **Clicks on Business**
    l. **Maybe just Living in the area**
        i. **Doesn't look like there's much**
    m. **What's happening**
    n. **Guess I'll**
    o. **OH THERE'S A DROPDOWN MENU**
    p. **Maybe safety plans is wher eyou can do it**

    i. No place to book in
    ii. Oh I just clicked on it
    iii. Okay current restrictions?
    iv. Booster
    v. Trending topics -
    vi. OOp find a testing clinic there it is!
    vii. And i
    viii. Did not use mag reader
- Look up regulations
    a. Look at dropdown menu
    b. Current restrictions I think
    c. Is this from I'm assuming that's what it currently is
    d. I expected it to be a list of regulations
    e. Rules for fully vaccinated people
    f. Probably try to use control F

- Support for people with disabilities
    a. Go bac up to this menu thing up here
    b. Guess I would go to Living in NSW
    c. Ist that a dropdown as well?
    d. Doesn't look like it
    e. This is talking about financial support
    f. Don't know if that's exactly what I'm looking for
    g. Business I guess?
    h. Maybe have your say? Oops already checked here
    i. Going to see if the dropdown menu has anything on thi
    j. Going to click on support down here
    k. Still not
    l. If you're stressed or anxious you can get help
    m. Not sure where else it could beo
    n. Oh there's the search feature!
    o. Looks like it might be covid-related
    p. It does seem like that
    q. Accessible font is even smaller than the normal font
    r. Going to go back and check
    s. Staying safe going to click on that
        i. More related to covid-19
        ii. Not seeing anything specifically
        iii. Not seeing any other things
        iv. Oh here's something here with chronic conditions
        v. This is it
    t. Task completion i think so
    u. Dropdown under cover - dropdown was same color as background
    v. Harder to navigate
        i. Tabs were confusing
        ii. Took a long time to find search

iii. **Tried to use magnification lens**
    1. **Scotoma blocked use of it**

Participant 2

Website A

- **Find a place to get swabbed for COVID-19**
    - **look s around website on screen page**
    - **It's hard to see the things so I just clicked the first thing that says covid**
    - **Restrictions um**
    - **Looking for something that says testing**
    - **COVID-19 TESTING - show different options for testing and descriptions and locations**
        - **Button? - usually there's a list under a header it usually is a clicablke link especially since it's a on e liner**
        - **Is there an actual place**
    - **There's a book vaccination - that may be another area**
    - **I would assume it maybe the same link**
    - **Help stop the spread**
        - **Check-in rules**
            - **Doesn't seem like it's disccusiing specific vaccination process**
            - **Other one seems like**
            - **All aligned if they're talking about getting the vaccine**
            - **General spread**
            - **Phys distancing - checkin rules**
            - **I would hope that one of the varying things I clicked on**
            - **There is a get your**
            - **Laughing - it's very challenging to see**
            - **Vaccination**
            - **What makes it hard to see - it's veery bright, letters**
            - **Skipped over small text - hope it something isn't important**
            - **Hopefully that's a link**
            - **Now i'm just reading the vaccination appointment that's available**
            - **Find next avail - good opp to go to somewhere in the portal**
            - **Not using mag lens at all**
            - **Last header**
            - **Is that spanish exclamation point**
            - **Maybe another place to get swabbed**
            - **Not sure what this is - would**
                - **Mag lens doesn't help because it's still very small**
                - **Block -**
                - **Little no contrast -**
                - **Using dark ring**
                - **Find nearest - hopefully that would be another map**

- **Task completion? I would find a location- did not find location to get a test**

- **Look up regulations about COVID-19 in the area**
  - **Immediately i just looked at the side things I don't know why?**
  - **I don't think that's really helpfu**
  - **Omg there's a dropdown**
    - **I just clicked on the COVID-19 post - I didn't hover**
    - **It's hard to see where you reached the bottom of the dropdown**
    - **I don't like this dropdown**
      - **I keep scrolling off of it**
      - **I don't think it's really clear what the dropdown messages mean - how is that different**
      - **What I'm traveling to**
      - **Staying safe**

    - **Current restrictions??**
    - **Maybe this??**
      - **Rules and restrictions - I don't know if this supposed to be a link**
      - **Same size approximately as the other headers**
      - **What are the restrictions for fully vaccinated people**
        - **List underneath this header**
        - **I don't know**
      - **Yes - partially**
      - **Felt like there could be more regulations**
      -

- **Support for people with a disability for COVID-19**
  - **I'm going to assume that's what the Support**
    - **Very challenging to find the bottom of the dropdowne**
      - **Support for anyone affected**
      - **Mental health that's some disabilities**
      - **And this is info**
        - **And it's a link**
        - **Resources for people with disabilities**
        - **Combine with mental disabilities**
          - **Break down**
          - **This would be the support**
          - **Services that is too small to read**
          - **Can read - don't think that a lot of people could**
          - **Cause so bright**
      - **Yes**

Website B

- **Find a place to get swabbed for COVID-19**
  - **Clicks on covid-19**
    - **Testing clinic**
    - **I assume it will show me a place**

- **Look up regulations about COVID-19 in the area**
  - **Starts at home page**
  - **Thing that says rules and restrictions on the home page**
  - **Same list with fully vaccinated vs people who are t**
  - **Legislation and penalties**
  - **Disability simulatro kept turning off**
  - **Now here's the specific rules with facemasks and regulations**
  - **Accomplished task**

- **Support for people with a disability during COVID-19**
  - **Support**
    - **See mental health**
    - **So i'll click on support for people with a disability**
    - **And support for people with disabilities**
    - **Yes -**
    - **Easier - clearer- structure of words is consistent**
      - **Change the white spacing - more consistent and clean**
      - **Dropdwon wasn't flying everywhere**
        - **Structure of drodpwon more clean**
    - **Information is the same**
    - **Other website more redundancy -= didn't know where i was going**
    - **Easier to see on the home page**
      - **Similar things - clearer**
        - **Spacing of words and structure and left aligned**
        - **Headers were different colors and larger**
        - **Links are underlined can click on it**

Simple eye test - to see what participants are coming in with
Probably have actual health medical
Have a simple eye test to see how well they can see
Influence their use of the top mag lens

Participant 3

A

Find a place to get swabbed

- **Looking at the labels**
- **Don't know what NSW**
- **I think i clicked on the right button**
    - **Looking at sub menus**
    - **Find a testing clinic**
    - **Search for a location**
    - **Yes - if this the end points**
    - **I felt like it was easy because covid -19 was at the top and one of the options was to find a testing clinic**
    - **And i think it was nice - the button is so bbigf - don't have to click on words**

Look up Regulations about COvid-19 in the area

- **COVID-19 rules so i know it's local**
- **Updates**
- **I thought that there was going to be a list of rules here**
- **Rules and regulations for nov 8th**
- **I would go**
- **As recent as november 9th**
- **All the rules about masks**
- **Visiting family and friends**
- **I feel like i found it**
- **Did not use mag lens**

Find support for people with a disability in the area

- **Maybe Living in NSW**
- **Can i search for things**
- **I found support**
    - **I see disaiblity services**
    - **Now I have to find support**
    - **I think i completed my task**
- **I feel like that was medium - i was guess**
- **None of the labels were clear about knowing where to get help**

B

- **Find a place to get swabbed**
    - **This is a lot more difficult**
    - **I can not even read what the lower line says**
    - **Find info something something**
    - **I assume there are options**
    - **Ooh something popped up!**
    - **CORONA 19okay if i go over to far it disappears**
    - **I'm trying to to**
    - **A lot harder - first off the website with the blur effect - cursive made it harder**
    - **It was lighter**
    - **hover ing the submenu i was usin the magnification the entire time**
    - **And the submen**
    - **I guess**
    - **I figured there wou,ld be find a test site**
    - **I would have to slowly read the whole thing as I moved out of the way - my reading space is only 1 ½ inches wide**
    - **Has the same info - still don't get a lot of information**
- **Look up Regulations about COvid-19 in the area**
    - **Go back to the covid menu**
    - **Looking at the magnification lens - using mag lens because it's bigger font**
    - **Oh wait - i'm looking at the submenu**
        - **Oh it disappeared**
    - **Current restrictions**
    - **I can see clearly see rules and restrictions adn i guess that's good enough**
    - **This one says stay up tod ate involving rules and restriction**
    - **Expected - it seems like it would underline**
    - **Rules and restriction swas a link - font is so tiny**
    - **Not a lot of content**
    - **Can't click on anything**
    - **Completed tasks (thinks)**
    -
- **Find support for people with a disability in the area during COvid-19**
    - **Going to go through the list**
    - **Going to attempt to click on support**
    - **It was right in the center of the scotoma**
    - **COVID-19 support and assistance is big enough**
    - **Can't click on anything**
    - **Resources for people with disdaiblities**
        - **Can't even read it with the magnification**
        - **Can't read that**
        - **Completed task**
- **Comments: hard time what i meant the system - was easy to read everything**
- **Eye opening**

Look at dropdowns for eye tracking for both websites A and B
3 participants
A versus B
Within groups

General researcher comments:

- Participants had trouble finding the dropdown in website b
- Website B dropdown
    - Difficult to know which subsection they were clicking
    - “Hope this works” attitude
    - Dropdown would disappear when participants would get to the bottom of it

- Participants used the shadow of the scotoma to read low contrast areas in website b
    - Insight: Needed additional support in reading low contrast
- Participants had an easier time using the dropdown in website A
    - COnfingured more effectively for individuals with low vision
    - Insights:
        - High contrast
        - “Boxed” area where you can click into subsection
        - Section highlighted
        - Not in one column but rather in three columns
- Participants in general did not use the magnification lens

Research Proposal:
Does following accessibility guidelines for low vision eliminate the need for magnification devices?

Mary Nichols & Zhengchen Zhou

Visual Attention and Cognition Lab

George Mason University

Introduction

One in eight American workers will be disabled for 5 or more years during their working careers (Council for Disability Awareness, 2021). 4.3 million people according to the CDC are blind and have low vision, accounting for being in the top ten of disabilities in the United States (CDC, 2020). Moreover, according to the International Agency for the Prevention of Blindness, 217 million people globally have moderate to severe vision loss or low vision even with corrective eyewear (Ackland et. al, 2017).

The CDC states that low vision is primarily caused by macular degeneration, cataracts, diabetic retinopathy, glaucoma and other chronic conditions and is expected to increase; in 2014 the number of people with cataracts was 25.7 million and in 2050 it's expected to rise to 45.6 million (2015).

Severe vision loss presents problems with reading, navigating, using assistive technology, and using the internet (Brown et. al, 2014). In 2021, WebAIM, a web accessibility research institute, conducted an analysis on the top-used 1,000,000 websites' home pages and reported that 97.4% of homepages contained features that did not conform to web accessibility guidelines such as low contrast text (86.4%), missing alternative text for images (60.6%), and empty buttons (26.9%) (https://webaim.org/projects/million/). Consequently, 15% of U.S. adults with a disability, including those with low vision in 2021, compared to 5% of abled adults, do not use the internet at all (https://www.pewresearch.org/fact-tank/2021/09/10/americans-with-disabilities-less-likely-than-those-without-to-own-some-digital-devices/ft_2021-09-10_disabilitydigitaldivide_02/)

Literature Review

Leporni and Paternó (2008) demonstrate that web accessibility design criteria improve the usability for individuals with low vision and blindness who use assistive technologies and Theofanos and Redish (2015) developed specific guidelines for low vision users based on their feedback, elucidating that “one site may be feasible for all.” People with a central scotoma from macular degeneration rely on their peripheral vision for engaging in vision-based tasks, producing unique methods and needs for gathering information such as magnification software (Barraza-Bernal et. al, 2018)

Although many people with low vision rely heavily on visual assistive technology, it can cost upwards of thousands of dollars, barring low-income individuals with disabilities from interacting on social media, browsing the web, or accessing employment opportunities (McDonnall & Sui, 2019, Moreno, 2020). In addition, assistive technologies may come with their own usability issues. Screen magnifiers are the most popular assistive technology tool for users with low vision, yet they occlude screens globally, disrupt spatial orientation, and burden users with excessive scrolling (Fraser et. al; 2000, Hallett et. al; 2015)

Hypothesis:

In the present study, we will assess the necessity of magnification software for low-vision users accessing and interacting with websites when a website is built in accordance with accessibility guidelines.

Methods and Equipment

Participants

8 adults (5 males and 3 females) between the ages of 22 and XX (M = XX) with normal or corrected-to-normal vision were recruited to participate in the study.

Equipment

We will use an Eyelink 1000 eye tracker to simulate a scotoma in the central vision of the participants, as well as to track eye movements. The usability tests will be conducted on a desktop computer.

For the usability tasks, we selected an accessibility-compliant website NSW Government that adheres to WCAG, the website accessibility guidelines that list usability standards which make the web barrier-free for individuals with disabilities.

For the non-usable website, we have created a website using Wix with the same content as the NSW Government site that does not comply with accessibility standards. The Wix-created website will have poor contrast, columns of text that are not user friendly for magnification software (horizontal scrolling can make it difficult for reading text), inaccessible font type and size (Marzo -letters are all caps and close together), lack of borders for sections, and colors that do not distinguish location on website. We chose these inaccessible features because they were chief complaints from users with low vision (Maus et al.; 2020, Theofanos et. al 2005). Although including keyboard shortcuts is a key component for an accessible site for people with impaired vision, our participants will be non-disabled and will therefore not have developed low vision website viewing strategies (WCAG 2.0, 2021). We are, consequently, not including measures to integrate keyboard shortcuts. For the magnification condition, we will use the magnification software Zoom.

Experimental Design

Participants will be grouped into two groups of four. The first group will use the magnification software and the second group will not. Both groups will complete tasks in the accessible and non-accessible websites. We will use a within-subjects experimental design as there can be large differences in eye movements between people performing the same task using the same interface. We will record the task completion time, eye movements including saccades and fixations, and task completion rates.

All participants will have a simulated scotoma. Participants will be told that they are on vacation in New South Wales and are trying to look up information on guidelines for COVID-19 and support for people with disabilities. Participants will also be asked to think aloud as they move through the tasks. Participants in the first task will try to find a place to get swabbed for COVID-19. Secondly, they will look up regulations about COVID-19 in the area. Lastly, participants will be instructed to locate information on support for people with a disability in New South Wales. Although the tasks for both websites are the same, the location of task objects will not have the same visual features (color/contrast/font/size) and will not be in the exact location, controlling for learning effects. Because the names of the task objects are the same for both websites, however, participants may know where to look for the second website. Consequently, we will alternate the order of website type use to control for order effects in both groups.

Software

We will incorporate the software Weblink to conduct the experiment to track eye movements and fixations on the webpages to track usability issues. We will also record the screen and audio from the participants.

Statistical Analyses

In the present study we will use t-tests to evaluate significant differences for time on task, task completion rates, average fixation times, and SUS scores between the magnification and non-magnification conditions as well as between the accessible and inaccessible websites.

References

Ackland, P., Resnikoff, S., & Bourne, R. (2017). World blindness and visual impairment: despite many successes, the problem is growing. *Community eye health*, *30*(100), 71–73.

Aguilar, C., & Castet, E. (2017). Evaluation of a gaze-controlled vision enhancement system for reading in visually impaired people. *PloS one*, *12*(4), e0174910. https://doi.org/10.1371/journal.pone.0174910

Brown, Jamie C. et al. (2012) Characterizing Functional Complaints in Patients Seeking Outpatient Low-Vision Services in the United States. Ophthalmology, *Volume 121, Issue 8,* 1655 - 1662.e1.

Bureau of Internet Accessibility. (2021, December 1). [web log]. Retrieved December 2, 2021, from https://www.boia.org/blog/new-colorado-law-requires-all-government-websites-to-meet-accessibility-standards.

Bureau of Internet Accessibility. (2021, November 29). [web log]. Retrieved December 2, 2021, from https://www.boia.org/blog/new-york-state-agrees-to-fix-accessibility-barriers-on-covid-19-vaccination-website.

Centers for Disease Control and Prevention. (2020, June 12). *Burden of vision loss*. Centers for DiseaseControl and Prevention. Retrieved October 27, 2021, from https://www.cdc.gov/visionhealth/risk/burden.htm.

Caldwell, B., Cooper, M., Reid, L., & Vanderheiden, G. (Eds.). (2008, December). Web Content Accessibility Guidelines (WCAG) 2.0. Retrieved December 03, 2021, from

https://www.w3.org/TR/2008/REC-WCAG20-20081211/

Disability statistics; chance of becoming disabled. Council for Disability Awareness: Prevention, Financial Planning, Resources and Information. (2021, September 30). Retrieved October 28, 2021, from https://disabilitycanhappen.org/disability-statistic/.

Leporini, Barbara, Fabio Paternò, Fabio (2008) Applying Web Usability Criteria for Vision-Impaired Users: Does It Really Improve Task Performance?, *International Journal of Human–Computer Interaction*, 24:1, 17-47, DOI: 10.1080/10447310701771472

Maus, N., Rutledge, D., Al-khazraji, S., Bailey, R.J., Alm, C.O., & Shinohara, K. (2020). Gaze-guided Magnification for Individuals with Vision Impairments. *Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems*.

Moreno, L., Valencia, X., Pérez, J.E. *et al.* An exploratory study of web adaptation techniques for people with low vision. *Univ Access Inf Soc* **20,** 223–237 (2021). https://doi.org/10.1007/s10209-020-00727-6

Pew Research Center. (2021, September 9). *Americans with a disability are more likely than those without disabilities to say they never go online*. Pew Research Center. Retrieved December 3, 2021, from https://www.pewresearch.org/fact-tank/2021/09/10/americans-with-disabilities-less-likely-than-those-without-to-own-some-digital-devices/ft_2021-09-10_disabilitydigitaldivide_02/.

Theofanos, M. F., & Janice (Ginny) Redish. (2005). Helping Low-vision and Other Users with Web Sites

That Meet Their Needs: Is One Site for All Feasible? *Technical Communication*, *52*(1), 9-20. http://mutex.gmu.edu/login?url=https://www.proquest.com/scholarly-journals/helping-low-vision-other-users-with-web-sites/docview/220963020/se-2?accountid=14541

WebAIM. (2021, April 30). *The WEBAIM millionan annual accessibility analysis of the top 1,000,000 home pages*. WebAIM. Retrieved December 3, 2021, from https://webaim.org/projects/million/.