Investigating Mobile Accessibility Guidance for People with Aphasia

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ABSTRACT
The World Wide Web Consortium's (W3C) Web Content Accessibility Guidelines (WCAG 2.0) have become widely accepted as the standard for web accessibility evaluation. This poster investigates how the mobile version of these guidelines caters for people with aphasia (PWA) by comparing the results from user testing against that of an audit using the guidelines. We outline the efficacy of the guidelines in the broader context of how they cater for various impairments and offer some recommendations for designing for people with aphasia.

INTRODUCTION
The W3C's WCAG guidelines are a standard for conformance for websites [4]. WCAG 2.0 guidelines are widely applied in website appraisals and are pan-disability, meaning they cater to users with different disabilities. Given that mobile devices are now the most common method by which people access the internet [3], mobile accessibility is of growing importance and the W3C are extending their work with specific guidance for mobile accessibility [5].

This poster explores the effectiveness of this mobile guidance in the context of PWA. Aphasia is a communication disorder which occurs when language regions of the brain are damaged. It affects approximately 2,000,000 people in the US [6], and this number is set to rise due to an aging population and the increasing likelihood of surviving a stroke. Aphasia results in newly acquired difficulties in reading, writing, speaking and comprehension for people who have previously been competent in these skills. These difficulties, along with accompanying mobility issues arising from stroke or associated brain injuries, hinder this population from using mobile applications effectively. This poster advances the research in the accessibility evaluation of mobile applications by conducting an audit using the current accessibility guidance as a framework, and by investigating the effectiveness of the audit through comparison with the results of user testing. We discuss the results in order to understand the efficacy of the guidelines, concluding with reflections on other studies that have compared audit and usability tests for user groups with impairments.

ASSETS'18, October 22–24, 2018, Galway, Ireland.

ACM ISBN 978-1-4503-5650-3/18/10.
https://doi.org/10.1145/3234695.3241011

METHOD

Accessibility Audit
The accessibility audit was developed by taking the W3C Mobile Accessibility document [5] and creating a checklist of the testable recommendations. Recommendations which were related to non-mobile applications, operating system level accessibility, and compatibility with external keyboards were removed from the checklist. We also split a recommendation into separate guidelines if it contained more than a single, testable criterion. This reduced the original set of 28 guidelines to a checklist of 17 items (see Appendix A). An audit was then conducted of four common social media apps (Facebook; Twitter; Pinterest; Tumblr). Five sections, including two pages and three journeys, were audited for each app. These were the home feed and profile page, plus the key user journeys of adding a friend, creating a content post, and updating a profile picture. Each section was audited separately in a binary pass/fail audit against each of the checklist items by an experienced user researcher.

Usability Testing and Mapping to Audit
Task-based usability testing was conducted with four PWA on the same four apps from the accessibility audit (Tasks shown in Appendix B). Eight usability sessions were undertaken across four days. These were moderated by a speech and language therapist (SLT) and a user researcher. The study was approved by the relevant research ethics committee. The participants', of which there were four, ages ranged from 30s to 60s and all had mild/moderate aphasia. Usability issues were extracted from the session transcripts and were coded as either major (task was not completed) or minor (delay in task completion). Source error analysis was conducted on each usability issue to identify the root cause of what the participant experienced. Each usability issue was then mapped to a guideline from the accessibility checklist. Where a usability issue could not be mapped to an existing guideline, a new category was created.

RESULTS
Participants in the usability tests encountered a total of 73 usability issues, 57 of which were major (i.e. prevented the user from completing a task), and 16 were minor (i.e. delayed the user in completing a task). The mean number of

usability issues experienced per participant per social media app (i.e., the 73 issues over the two apps for each of the four participants), was 9.1. Table 1 shows all the issues which were mapped to the audit guidelines. Table 2 shows the 5 most frequent usability issues which were not mapped to the guidelines in the audit.

Category Description	Minor	Major
The action required to achieve the task requires a gesture other than a simple tap or swipe.	1	3
The touch target is smaller than the W3C recommended size of 9mm by 9mm.	1	0
The same icon is used in different contexts to execute different actions within the same application.	1	1
There is insufficient styling of an element to indicate that the element is actionable.	0	2
The navigation changes or includes additional menu items in different contexts, which go unnoticed.	0	1
Total (10)	**3**	**7**

Table 1: Usability issues arising from testing – mapped to accessibility audit guidelines

Only 13.7% of the total usability issues encountered by participants could be mapped to the accessibility guidelines. They were mapped to 5 different guidelines from the accessibility audit. The remaining 63 (86.3%) usability issues could not be mapped to any guideline from the accessibility audit. These 63 issues were grouped according to the cause of the issue, leading to 13 categories of issues.

Category Description	Minor Issue	Major Issue
a) Unfamiliar icon – The icon used to represent a function is novel, and the meaning of it is unfamiliar or misunderstood.	3	17
b) Hidden feature or indirect action – The button or action required to proceed or complete a task is hidden and can only be revealed by interacting with another element first.	2	12
c) Feedback Prominence – The feedback which follows after an action is either too small to notice or disappears before the user is able to read it.	4	4
d) Unclear copy/text – Text-based instructions are unclear and do not provide sufficient information.	0	4
e) Complex gesture – The action required to achieve the task requires a gesture other than a simple tap or swipe.	1	3
Total (63)	**13**	**50**

Table 2: Five of the most frequent usability issues which were not mapped to the guidelines. Less frequent issues removed for brevity. See poster for table (available at: blogs.city.ac.uk/inca/outputs).

DISCUSSION, LIMITATIONS AND CONCLUSIONS

This study found a very low number of issues would have been covered by the accessibility audit guidelines. Surprisingly, even in cases where usability issues were covered by the audit guidelines, the apps still passed the audit. For example, all four apps passed the audit on G4 (gestures should be as easy as possible to carry out), yet the usability study revealed four issues in this category. This was possibly because the coverage of the audit was limited to a smaller set of user journeys than the whole usability study. The lower than expected coverage suggests two areas of concern. First, that the accessibility audit did not have good coverage of the actual end-user level accessibility usability issues and, second, the accessibility audit is not suitable for testing with PWA and likely other similar speech and language impairments. Comparing our figures to others, Power et al. [1] found that, when compared to a user study, 50.4% of the problems encountered by blind participants while using screen readers were covered by the Success Criteria in WCAG 2.0.

More similar to our results, Rømen and Svanæs [2], when contrasting the WAI guidelines to results from usability testing with dyslexic users, found that 27% of website accessibility problems found in their testing would have been uncovered using the guidelines alone. We suggest that the low number of usability issues captured in the audit, and that of Rømen and Svanæs [2], are likely indicative of the focus of the WCAG guidelines. Often, accessibility guidelines apply quite generally to people with disabilities, with a predominant focus on blind users. Given the specific usability issues people with speech and language impairments, such as the dyslexic participants in Rømen and Svanæs' paper [2] and our participants with aphasia, such guidelines likely do not sufficiently cover many more nuanced issues people with speech and language impairments face.

In terms of informing design from our most common usability errors found, we can recommend the following with regards to designing for PWA: accompany icons with text (from a)); limit the number of steps for interactions and user journeys (from b) and e)); ensure feedback is prominent and persistent (from c)); keep text short and simple (from d)).

In this poster, we aim to surface where the current guidance of accessibility matches with the reality of PWA, as derived from usability testing. We also make evident some of the key usability issues which this population are likely to face when engaging with social media applications. We found that, while some of the guidelines are appropriate, there is some mismatch between the issues that PWA face and the current guidance provided. We argue that further research is required to more deeply understand the barriers faced by people with speech and language impairments to design more appropriately.

ACKNOWLEDGEMENTS

We would like to thank the four individuals who participated in this study and the Engineering and Physical Sciences Research Council (EPSRC) for funding the research project under grant code EP/P025587/1.

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APPENDIX A: FULL LIST OF GUIDELINES

Guideline (G)		Facebook	Twitter	Pinterest	Tumblr
G.1	Text and actions/buttons have a contrast of at least 4.5:1				
G.2	Touch targets are at least 9mm high by 9mm wide			✓	
G.3	Touch targets close to the minimum size are surrounded by a small amount of inactive space		✓		✓
G.4	Gestures should be as easy as possible to carry out (i.e. simple tap or swipe)	✓	✓	✓	✓
G.5	Users tapping on actionable elements should have the opportunity to move outside the element to prevent triggering the event	✓	✓		✓
G.6	Support portrait and landscape screen orientations	✓	✓	✓	✓
G.7	Navigational elements that are repeated have the same relative order each time they are repeated	✓	✓	✓	✓
G.8	Components that have the same functionality are identified consistently	✓	✓	✓	
G.9	Components that are repeated across multiple pages should be presented in a consistent layout		✓	✓	✓
G.10	Position important information so it is visible without scrolling	✓	✓		✓
G.11	Group operable elements that provide the same action	✓	✓		✓
G.12	Elements which trigger changes should be distinguishable from non-actionable elements (style, positioning, text labels for an action, conventional iconography)				
G.13	Provide instructions (e.g. overlays, tooltips, tutorials, etc.) for custom touchscreen and device manipulation gestures	✓			
G.14	Provide instructions for custom touchscreen and device manipulation gestures in a help section				
G.15	Set the on-screen keyboard to the type of data entry required	✓	✓	✓	✓
G.16	Users can enter information on mobile devices in multiple ways such as on-screen keyboard, external keyboard, touch, and speech	✓	✓	✓	
G.17	Support device level accessibility features: larger fonts	✓	✓		
Total passed (out of 17)		11 (64.7%)	12 (70.6%)	8 (47.1%)	9 (53.0%)

APPENDIX B: TASKS

1. Open the application
2. Explore the home feed
3. Express interest in a post (like/favourite)
4. Express interest in a post (comment)
5. Undo or delete task 4
6. Find a friend
7. Add or follow a friend
8. Share content from the friend's account
9. Unfollow the friend's account
10. Create content (post)
11. Delete content
12. Find information about aphasia
13. Find out who you are following
14. Change your profile picture
15. Add a description in your bio
16. Send a private message