

Disabled Users and Mobile Technology:
Are chatbots and social media platforms accessible?

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According to a 2018 blog post by Nathan McDonald, globally “More than 3 billion people around the world now use social media each month, with 9 in 10 of those users accessing their chosen platforms via mobile devices,” and the number of mobile phone users is at 5.135 billion, up 4 percent year-on-year (2018). Mobile-based conversational agent software using AI (artificial intelligence) is often tied to popular social media apps such as Facebook messenger or Twitter, allowing users to directly communicate with one another over the platform. These conversational agents, also known as chatbots, are used by nearly half of Americans as digital voice assistants on smartphones and other devices (Hitlin, 2018).

Considering the popularity of these platforms, one needs to ask, “Are social media and chatbots, both of which are visually and auditory-dependent, accessible for those with disabilities?” After all, the user experience a disabled person has with social media and chatbot technology should not be an afterthought by software developers, as disabled audiences are a powerful buying force in the mobile tech marketplace. A 2011 study by the Institute on Disability stated that “If people with disabilities were a formally recognized minority group, at 19% of the population, they would be the largest minority group in the United States.” (Drum, 2011). Similarly, many businesses are using social media to market to potential customers, communicate within their organizations, and as of 2016, 84% of organizations are using social media as a recruiting tool (Zilar, 2017). If their social media content isn’t accessible, the reach and effectiveness of these initiatives is limited.

Identifying a research gap in the area of chatbot and mobile social media accessibility, and gathering information about mobile social media and chatbot use by disabled users were areas explored for this annotated bibliography.

Three sources cited were surveys and/or evaluations of disabled users and their social media/mobile app behavior, but all three surveys ended by simply noting “more needs to be done” without giving specifics on how to create a more inclusive digital space. Additionally, in six other sources, accessibility concerns for both chatbot and social media platforms were for visually impaired users only, and did not consider cognitive or other disabilities in the research. Since mobile technology bases interactivity through visual cues, it’s possible researchers focused more on visual impairment than other disabilities deliberately. It’s also possible that suggestions for improvement weren’t given because the surveys were done by researchers and not developers.

Four sources were written by developers and designers, and their content included actionable processes for developing either accessible chatbot interactions or making social media images accessible for visually impaired users.

All sources were selected based on relevance to the topic of accessibility for chatbot and social media platforms, and sources older than 2014 were deemed irrelevant due to the rapidly changing nature of mobile technology. Finally, sources were not limited to those written by American authors; international research articles were also considered due to the global nature of social media and conversational agents. Each annotation includes an assessment of whether the research gap is filled or needs further exploration based on the content of the article. APA style was used for this annotated bibliography due to its focus on social sciences and timeliness of research.

Bindi, T. (2017, November 15). *Microsoft using AI to empower people living with disabilities*.

Retrieved from

<https://www.zdnet.com/article/microsoft-using-ai-to-empower-people-living-with-disabilities/>

Tas Bindi is a technology journalist for ZDNet and described how Microsoft utilizes artificial intelligence (AI) for mobile apps, chatbot development, and Windows 10 accessibility features. The applications for AI range from assisting visually disabled people by describing their surroundings to aiding mobility-impaired users by navigating their computers and improving typing ability.

Developers use Microsoft Cognitive Services technology to build chatbots that facilitate help-desk services or assist with facial and object recognition, features also applicable in non-disabled workplaces.

Notably, Microsoft executives pointed out the role disabled users have in helping to create innovative assistive software. In other sources, researchers focused on the role disabled users have as test subjects, but in this article they were included as possible developers of assistive technology themselves. This article improved the research gap and acts as a positive step toward utilizing chatbot technology as an assistant, not a hindrance for disabled users.

Calado, C. (2017, January 30). *We need to talk about accessibility on chatbots*. Retrieved from

<https://uxdesign.cc/we-need-to-talk-about-accessibility-on-chatbots-98cf93c54963>

Calado is a user-interface designer who wrote the article with chatbot developers as the primary audience. Calado presents the question, “What happens when a blind person wants to use your chatbot?” and notes a research gap early in the article by stating “nobody is really talking about accessibility for Chatbots — I couldn’t find anything on Google.” (2017). He performed an informal study of several popular chatbot agents which revealed that VoiceOver assistive technology couldn’t properly read text fields or text messages, ignored template styles, and images were missing alt-text.

Calado offers possible solutions which would enable the bots to accurately read fields and identify user interface elements and recommends developers do usability testing with a wide range of disabled persons before launching their bots.

This source was timely, relevant, and most importantly, presents the need for

conversational agents to be inclusive for everyone. Since the study was informal, the results were anecdotal and actual disabled users were not evaluated. A similar study by professional researchers in an academic setting would go further to narrow the research gap and increase the odds that actual regulations to govern accessibility requirements would be implemented in the chatbot marketplace.

Di Prospero, A., Norouzi, N., Fokaefs, M., & Litoiu M. (2017). *Chatbots as assistants: An architectural framework*, Paper presented at CASCON '17: Proceedings of the 27th Annual International Conference on Computer Science and Software Engineering, Markham, Canada: ACM Digital Library.

The authors of this article are Department of Electrical Engineering and Computer Science faculty members at York University who presented their research at the 2017 Annual International Conference on Computer Science and Software Engineering.

They created a chatbot for college students using a software product line perspective and defined a method by which developers can create AI learning that adapts its functionality from the user without asking the user to identify their disability outright. The chatbot instead learns the user's disability based on the type of questions the person asks. The researchers' primary goal was to outline a chatbot-building framework for other developers to follow.

This source was unique in that it touched on both social media and chatbot technology, and mentioned how chatbots cross the boundaries between AI and social media. The team also explored Facebook Messenger, a chatbot which connects social media users through bot technology and its effectiveness with disabled audiences.

This source was helpful in bridging the gap between two mobile technologies, social media and chatbots, while considering disabled audiences.

Griffin-Shirley, N., Banda D., Ajuwon, P., Cheon, J., Lee J., Park, H.R., & Lyngdoh, S. (2017).

A survey on the use of mobile applications for people who are visually impaired. *Journal of Visual Impairment & Blindness*, 111(4), 307-323.

The authors of this article, all of whom are professors of educational psychology or doctoral students, outline a 2017 online survey they conducted of visually impaired people who use mobile applications on their smartphones. The focus for the

exploratory study was to learn how visually impaired users perceive and use mobile apps and identify related challenges.

This source confirmed that visually-impaired individuals frequently use social media apps and smartphones to access social media. Such mobile apps were perceived as user-friendly, and iOS device users considered mobile apps more accessible than those using Android devices.

A primary study limitation was lack of diversity. Out of 259 participants, the majority were white, female, and college educated. The authors recommended the study be replicated using more diverse methods of recruiting participants.

This study confirms that visually-impaired individuals desire to communicate via social media, and businesses who post content to these platforms must be cognizant of making their information accessible to those with vision problems. The research gap remains, however, for chatbot accessibility, as no chatbot technologies were included in this survey of mobile applications.

Morris, J. T., Sweatman, M. W. & Jones, M. L. (2016). Smartphone use and activities by people with disabilities: User survey 2016. *Journal on Technology and Persons with Disabilities*, pp. 50-67.

Researchers at the Rehabilitation Engineering Research Center for Wireless Technologies published in 2016 the results of a multi-year user survey of smartphone use by people with disabilities which revealed disabled individuals use social media at roughly the same rate as the non-disabled population.

The purpose of the survey was to reveal if disabled users are able to capitalize on the rapidly expanding potential of mobile technology by comparing survey data gathered by earlier Pew Research Center surveys. They also examined how demographic variables such as age and income impacted mobile app usage.

Findings showed people with speech-hearing difficulties, higher income users, and younger disabled individuals are groups that use smartphone features and functions more than other groups surveyed. Age, type of disability, and income level had varying degrees of impact on smartphone usage. The findings suggest that barriers to accessibility on smartphone technology have not been overcome.

This source represents another example of a smartphone-usage survey which identified ongoing barriers to accessibility on mobile devices but did not offer specific advice on how to overcome those barriers.

Mullen, R. (2018, April 12). *Making chatbots accessible*. [Powerpoint slides]. Retrieved from <https://www.slideshare.net/RossMullen2/making-chatbots-accessible>

Ross Mullen is a web accessibility and inclusive designer and founder of Canaxess, a web accessibility consultation and evaluation firm. Mullen outlines five distinct elements of accessibility to follow when creating a chatbot:

1. Choose a customizable platform
2. Ensure conversation history can be navigated
3. Make the conversation history identifiable
4. Ensure messages are announced
5. All rich media must be accessible

He closes the presentation by urging businesses and developers to test their bots on multiple devices and platforms with a range of assistive technology.

The information in this presentation is a critical step to furthering the conversation about accessibility and chatbot development. Chatbots are still considered “emerging technology” for most businesses and getting the accessibility “foot in the door” early on will prevent inaccessible web and mobile apps from having to be reconfigured or rebuilt down the road. Most importantly, disabled users won’t be shut out of a chatbot conversation if accessibility design principles are followed from the outset.

Newman, L., Browne-Yung, K., Raghavendra, P., Wood, D., & Grace, E. (2016). Applying a critical approach to investigate barriers to digital inclusion and online social networking among young people with disabilities. *Information Systems Journal*, 27, 559-588.

Retrieved from <https://doi.org/10.1111/isj.12106>

Researchers from the Southgate Institute of Health in Australia conducted a resource-intensive case study of eighteen children with physical disabilities. The goals were twofold. First, they explored the digital divide between disabled and non-disabled young people to understand how assistive technology, social media, and internet access can increase their economic, social, and cultural capital in a digital space while reducing the unequal distribution of resources shaping their ability to interact with online peers. Second, they noted a lack of nuanced research into the internet use of physically disabled youth and wanted to add to that literature.

Researchers supplied devices mobile devices such as iPads and laptops along with in-home training to families on how to navigate online media using assistive technology, none of which the parents had been exposed to prior to the study.

Interviews revealed that parents of disabled children spend significant time caring for their children's basic needs and therefore could devote less time to learning to use assistive technology or social media. These parents were unaware of the social benefits for their children being online (578) and some felt their children, even with training, would have limited effective of use social media (582). After training, children reacted positively to accessing social media and communicating with their peers as well as watching videos and playing games, all with minimal assistance.

The researchers concluded there is no single solution to inaccessible online content, but disabled children, if given resources and training, can utilize internet technology to level the playing field with their non-disabled peers. The research gap was narrowed by this study due to the nature of the disabilities considered by the researchers.

Preece, J., Rogers, Y., & Sharp, H. (2015). *Interaction design: beyond human-computer interaction fourth edition*. West Sussex, United Kingdom: John Wiley & Sons Lt.

This textbook was written by three professors who teach in the field of information science and web usability. Their target audience was students in human computer interaction, web design, software engineering and related fields. The source covers how cognitive, social, and affective issues influence how people interact with digital technology.

The authors created usability tests and evaluated applications for mobile devices and other digital platforms. They examined the interactivity of chatbots such as Siri for their one-sided conversational nature, and social media apps such as Facebook, Twitter, and SnapChat were mentioned for the frequency of breakdowns in communication by social media users. In neither case were disabled audiences mentioned as a consideration.

Out of 521 pages, accessibility guidelines and usability testing for disabled

audiences were mentioned on only four, and on those pages, the information was merely a reminder to follow Section 508 guidelines rather than a full discourse on how a disabled individual may interact with technology differently than a non-disabled user.

In this otherwise meticulous textbook, the omission of content concerning disabled users was a missed opportunity for educating new developers on creating inclusive digital media.

Shpigelman, C.N., & Gill, C. J. (2014). Facebook use by persons with disabilities. *Journal of Computer-Mediated Communication, 19*, 610-624. Retrieved from <https://doi.org/10.1111/jcc4.12059>

The authors of this 2014 research study, both of whom are disability and mental health professionals, sought to answer the question: How do adults with disabilities use Facebook? The researchers surveyed Facebook use of 172 disabled individuals who answered nineteen questions about frequency and how the users interacted through the platform.

Study respondents used Facebook daily to communicate with both disabled and non-disabled friends, and perceived Facebook as a positive online environment yet also expressed concerns about the security, privacy, and accessibility of the platform.

One notable finding was that disabled persons use Facebook for the same reasons and for similar amounts of time as non-disabled users, but the study was limited by the uneven nature of the types of disabilities reported by participants. Research is needed to enhance the security, privacy, and accessibility of Facebook and other SNSs for persons with disabilities.

The study was conducted to fill a gap on the issue of accessibility and social media and answered the question that while disabled users do enjoy utilizing the social networking strengths of Facebook, progress is needed to make the platform inclusive.

Torres, C., Franklin, W., & Martins, L. (2019). Accessibility in chatbots: The state of the art in favor of users with visual impairment. *Advances in Intelligent Systems and Computing*,

vol 794. (pp. 623-635). Springer.

The authors of this book chapter investigated the research gap of iOS and Android mobile chatbot accessibility for blind users by conducting a rapid systematic review of literature on chatbots and other conversational interfaces. Researchers considered both heuristics of usability and the key principles that ensure a given project is user-centered with regards to how blind users interact with chatbot interfaces. Search terms in both English and Portuguese were entered into search engines and included terms (and word combinations) such as “accessibility chatbot” and “accessibility conversational interface” with a date limit of 2007-2017 in order to find relevant sources.

Twenty-five publications were chosen for the final review. No publications about chatbot accessibility were found. It was concluded that academic studies on chatbot accessibility are non-existent (632). The results reinforced the authors’ assertion that more research should be done on accessibility in conversational agent interfaces as well as in-lab usability studies of chatbots with a diverse population of disabled users.

Wilkinson, J. (2018). Accessible, dynamic web content using instagram. *Information Technology and Libraries Journal*, 19, 19-26. doi: 10.6017/ital.v37i1.10230

This article was written in 2018 by University of Montana Web Services librarian Jaci Wilkinson whose development team integrated their popular Instagram content to their website to expose more audiences to their social media feed.

There was a caveat: If the content is displayed on a university website, that content, by law, has to be accessible. Instagram’s format is both mobile-only (no desktop interactivity is available) and inaccessible to visually impaired users.

Wilkinson identified a gap in library literature on accessibility and social media while emphasizing a need for library employees at other institutions to pay closer attention to the ways users access resources and information through social media, especially if that content appears on the institutions’ website.

Solutions included adding #alttext descriptions to the library images. The process outlined in this article demonstrated how dynamic social media content can be successfully integrated while still being accessible. No chatbot or AI agents are associated with Instagram, but it was a positive study as Instagram is one of the least-accessible social media platforms in the marketplace, yet was successfully integrated into the website as accessible content.

Wu, S., Wieland, J., Farivar, O. & Schiller, J. (2017). *Automatic Alt-text: Computer-generated Image Descriptions for Blind Users on a Social Network Service*, Paper presented at CSCW '17: Proceedings of The 20th ACM Conference on Computer-Supported Cooperative Work and Social Computing, Portland, Oregon: ACM Digital Library. Retrieved from <http://dx.doi.org/10.1145/2998181.2998364>

In 2017, four Facebook developers designed, tested, and deployed a system for automatically generating image descriptions (alt-text) for photos shared to the site. The authors identified the accessibility problem of Facebook's inherent visual nature. They sought to solve that problem by using AI (artificial intelligence) technology to "read" the contents of a photo out loud to visually-impaired test participants. The team argued that their system reduces costs, is scalable to a larger number of users, and can process over 2 billion images per day at the speed of less than one second per photo.

They conducted in-lab usability studies augmented by interviews with participants as well as a field study of over nine-thousand participants to evaluate the user experience in a naturalistic setting which was successful with 82% of respondents reporting positive reactions during the test.

This article was unique in that it integrated both AI and social media technology. The authors are both developers and researchers, and therefore went beyond identifying the problems with inaccessibility and sought to find a technical solution. Disabilities that were not vision-based were not considered by the study.

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