
Understanding Collaborative Writing Practices of People with Visual Impairments

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Abstract

Collaborative writing has been a common activity in different professions for many years. Researchers from multiple disciplines, including from HCI and CSCW, have experimented and evaluated a number of collaborative writing tools. However, with the emergence of more modern technologies like cloud-based Google Docs, newer versions of Microsoft Word etc., collaborative writing practices are gaining in popularity and use. Yet, we know little about the accessibility of these systems and how they should be designed to best support the increasingly common collaborative practices that constitute everyday work groups and collaboration. Our research goal is to study how people with visual impairments collaboratively write with other sighted and/or visually impaired peers in practice, whether and how they use computer-mediated collaborative tools, and design new assistive technologies to facilitate collaboration among a group of writers with visual impairments or mixed abilities.

Author Keywords

Vision impairments; collaborative writing; mixed-abilities group

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Introduction

Collaborative writing refers to the joint production of a document, where co-authors contribute to all aspects of writing – from brainstorming, decision making and writing content to reviewing and revising the content to coordinating aspects of shared ownership of the final document [18]. Producing collaboratively written documents is becoming commonplace with the growing popularity of teamwork in many professions. Authoring manuscripts and proposals with other researchers is an encouraged practice in academia [26]. College and university students also write class assignments and project reports in groups [15, 27]. In business organizations, employees jointly write progress reports and meeting minutes with their colleagues. Last but not the least, Wikipedia, the free encyclopedia, is a successful example of wiki-based collaborative writing effort [22]. These examples illustrate the pervasive nature of collaborative writing and how it shapes our daily lives.

With this rising popularity of co-authorship, a number of tools and features have become available to aid the practice of collaborative writing. For example, two commonly used word processors - Microsoft Word and Google Docs - both have features to support collaboration such as annotations, conversations, track changes and revision histories. The emergence of these commercial tools has coincided with a significant body of HCI research examining collaborative writing practices [2, 3, 5, 14, 15, 19, 23, 25, 27]. However, the accessibility aspects of these tools has received much less attention from researchers. Two separate usability studies on Microsoft Word [17] and Google Docs [6] have found that interfaces and collaborative features of these tools such as change tracking and revision histories are not accessible via screen reader. Recently, Microsoft Word and Google Docs have added accessibility features that allow sharing and co-authoring documents using screen readers,

keyboard shortcuts and speech recognition ^{1,2}. However, researchers have not yet explored the adoption and use of these accessible resources in practice, specifically among teams with diverse abilities. Our research goal is to better understand 1) how people with vision impairments co-author shared documents, 2) whether and how they use existing accessibility features, and 3) how we can design assistive technologies to better support collaboration within mixed-abilities group.

Research in Collaborative Writing

Researchers have examined how people use modern collaborative editing tools and collaborative features of word processing applications such as synchronous editing, track changes, commenting, etc. [5, 14], the relationship between user perceptions and editing behaviors [15, 23, 25, 27], work styles [5, 14] and group dynamics [2, 3, 4]. Besides, researchers have also designed systems to create effective visualizations of users' writing and editing behaviors that facilitate self-awareness [21, 24], help determine ownership [25], improve content quality [28] and enhance language learning [28].

A separate thread of research has been conducted on Wikipedia and the Wiki system that supports collaborative writing in large groups. Researchers have built experimental tools to visualize writing practices in Wiki [8, 22] and investigated editor interactions and awareness, group formation and maintenance, and conflict resolution [11].

In parallel, collaborative writing has also been explored in crowd platforms. Researchers have designed algorithms to decompose a complex writing task into microtasks that can

¹<https://support.office.com/en-us/article/accessibility-support-for-word-c014d8b8-4ef3-4a7a-935d-295663f3343c>

²<https://support.google.com/docs/answer/6282736?co=GENIE.Platform%3DDesktop&hl=en>

take as little as a few seconds each to complete and can be completed by crowd workers without prior context and coordination with other workers [1, 9, 10, 13]. In contrast, Teevan et al. explored collaborative writing through microtasks in a small group of collocated collaborators [20].

Accessibility in Collaborative Writing

Although a large body of research has been conducted on collaborative writing tools and practices, accessibility issues have been significantly under-explored. Given the widespread use of collaborative writing tools in today's world, accessibility issues are important to address in order to eliminate barriers and potential inequities in access to work and learning contexts for people with various impairments. One example of this can be seen in existing commercial collaborative writing tools that become inaccessible for people with visual impairments due to their heavy reliance on visual features and dynamic user interfaces [12]. Collaborative writing tools do not offer interaction via alternative input/output modalities (e.g., audio or tactile). As such, the most direct way for people with visual impairments to interact with collaborative writing tools is through a screen reader. Yet, usability studies that explored visually impaired users' experience with these tools found that collaborative features (e.g., revision histories, tracking changes, information about presence of other users etc.) on both Google Docs and Microsoft Word are very difficult to access via screen reader [6, 17]. Specifically, visually impaired users have trouble understanding the context of the revisions and comments in a document and they struggle to work through track changes to accept or reject suggested edits [17]. Schoeberlein et al. [17] provided an example of this problem: in the 'track changes' interface of Word a modified sentence excerpt may be presented as "A well-regulated well-regulated militia" to sighted users, while the same

sentence excerpt is read as "A deleted text well regulated inserted text well dash regulated militia." by JAWS screen reader. The later representation makes the context of the writing very tough to understand.

Even the basic features such as creating, accessing and formatting documents, understanding table contents, searching text, navigation through different menu options etc. are also challenging to use for a visually-impaired individual [6]. Mori et al. implemented a modified version of Google Docs, in which some basic features can be accessed via screen reader [7, 12]. However, the researchers did not focus on the collaborative features – neither synchronous editing or asynchronous commenting – and they did not study users' experience with the modified interface. On the other hand, Schoeberlein et al. [17, 16] developed an Add-In prototype for Microsoft Word, which presented the context of a revision and prompted the user to accept or reject the revision through dialogue box that could be read aloud by a screen reader. However, the researchers did not explore how visually impaired users can add comments on the text themselves, or collaborate with others in practice.

Research Plan

We plan to take a multi-stage approach to understand accessibility in mixed-abilities collaboration

Firstly, we plan to conduct ethnographic observations and interviews where dyads and groups of writers with mixed-abilities (sighted and visually impaired) will co-author shared documents using common tools like Microsoft Word and a screen reader. Their experiences in working with existing tools will help us better understand the accessibility of new collaborative features in practice.

Secondly, informed by our interviews and observations, we

will design systems that can assist people with visual impairments to explore new ways of collaborative writing.

Finally, we will conduct user studies to evaluate our systems and propose design guidelines to support mixed-abilities collaboration.

Personal Statement

I started my PhD in the Technology and Social Behavior program at Northwestern University in Fall 2017 as the first Bangladeshi student in the program. Prior to that, I received a BS in Computer Science and Engineering from Bangladesh University of Engineering and Technology. At Northwestern, I am studying and designing systems to support well-being and creative expression for people with disabilities. I expect to complete my PhD by 2022.

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REFERENCES

1. Michael S. Bernstein, Greg Little, Robert C. Miller, Björn Hartmann, Mark S. Ackerman, David R. Karger, David Crowell, and Katrina Panovich. 2010. SoyLent: A Word Processor with a Crowd Inside. In *Proceedings of the 23Nd Annual ACM Symposium on User Interface Software and Technology (UIST '10)*. ACM, 313–322. DOI:<http://dx.doi.org/10.1145/1866029.1866078>
2. Jeremy Birnholtz and Steven Ibara. 2012. Tracking Changes in Collaborative Writing: Edits, Visibility and Group Maintenance. In *Proceedings of the ACM 2012 Conference on Computer Supported Cooperative Work (CSCW '12)*. ACM, 809–818. <http://dx.doi.org/10.1145/2145204.2145325>
3. Jeremy Birnholtz, Stephanie Steinhardt, and Antonella Pavese. 2013. Write Here, Write Now!: An Experimental Study of Group Maintenance in Collaborative Writing. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '13)*. ACM, 961–970. <http://dx.doi.org/10.1145/2470654.2466123>
4. Ina Blau and Avner Caspi. 2009. What type of collaboration helps? Psychological ownership, perceived learning and outcome quality of collaboration using Google Docs. In *Proceedings of the Chais conference on instructional technologies research 2009: Learning in the technological era*. 48–55.
5. Tom Boellstorff, Bonnie Nardi, Celia Pearce, and T. L. Taylor. 2013. Words with friends: Writing collaboratively online. *Interactions* 5 (2013), 58–61. <http://dx.doi.org/10.1145/2501987>
6. Maria Claudia Buzzi, Marina Buzzi, Barbara Leporini, Giulio Mori, and Victor M. R. Penichet. 2010. Accessing Google Docs via Screen Reader. In *Proceedings of the 12th International Conference on Computers Helping People with Special Needs: Part I (ICCHP '10)*. Springer-Verlag, 92–99.
7. Maria Claudia Buzzi, Marina Buzzi, Barbara Leporini, Giulio Mori, and Victor M. R. Penichet. 2014. Collaborative Editing: Collaboration, Awareness and Accessibility Issues for the Blind. In *On the Move to Meaningful Internet Systems: OTM 2014 Workshops*. Springer Berlin Heidelberg, 567–573. https://doi.org/10.1007/978-3-662-45550-0_58

8. Fabian Flöck and Maribel Acosta. 2015. whoVIS: Visualizing Editor Interactions and Dynamics in Collaborative Writing Over Time. In *Proceedings of the 24th International Conference on World Wide Web (WWW '15 Companion)*. ACM, 191–194. DOI : <http://dx.doi.org/10.1145/2740908.2742846>
9. Joy Kim, Justin Cheng, and Michael S. Bernstein. 2014. Ensemble: Exploring Complementary Strengths of Leaders and Crowds in Creative Collaboration. In *Proceedings of the 17th ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW '14)*. ACM, 745–755. DOI : <http://dx.doi.org/10.1145/2531602.2531638>
10. Joy Kim, Sarah Sterman, Allegra Argent Beal Cohen, and Michael S. Bernstein. 2017. Mechanical Novel: Crowdsourcing Complex Work Through Reflection and Revision. In *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW '17)*. ACM, 233–245. DOI : <http://dx.doi.org/10.1145/2998181.2998196>
11. Aniket Kittur, Bongwon Suh, Bryan A. Pendleton, and Ed H. Chi. 2007. He Says, She Says: Conflict and Coordination in Wikipedia. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '07)*. ACM, 453–462. DOI : <http://dx.doi.org/10.1145/1240624.1240698>
12. Giulio Mori, Maria Claudia Buzzi, Marina Buzzi, Barbara Leporini, and Victor M. R. Penichet. 2011. Collaborative Editing for All: The Google Docs Example. In *Universal Access in Human-Computer Interaction. Applications and Services (UAHCI '11)*. Springer Berlin Heidelberg, 165–174. https://doi.org/10.1007/978-3-642-21657-2_18
13. Michael Nebeling, Alexandra To, Anhong Guo, Adrian A. de Freitas, Jaime Teevan, Steven P. Dow, and Jeffrey P. Bigham. 2016. WearWrite: Crowd-Assisted Writing from Smartwatches. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16)*. ACM, 3834–3846. DOI : <http://dx.doi.org/10.1145/2858036.2858169>
14. Ricardo Olenewa, Gary M. Olson, Judith S. Olson, and Daniel M. Russell. 2017. Now That We Can Write Simultaneously, How Do We Use That to Our Advantage? *Commun. ACM* 60, 8 (2017), 36–43. <http://dx.doi.org/10.1145/2983527>
15. Judith S. Olson, Dakuo Wang, Gary M. Olson, and Jingwen Zhang. 2017. How People Write Together Now: Beginning the Investigation with Advanced Undergraduates in a Project Course. *ACM Transactions on Computer-Human Interaction* 24, 1, Article 4 (2017), 4:1–4:40 pages. <http://dx.doi.org/10.1145/3038919>
16. John G. Schoeberlein and Yuanqiong Wang. 2013. Providing an Accessible Track Changes Feature for Persons Who Are Blind. In *Universal Access in Human-Computer Interaction. Applications and Services (UAHCI/HCI '13)*. Springer Berlin Heidelberg, 389–398.
17. John G. Schoeberlein and Yuanqiong Wang. 2014. Usability Evaluation of an Accessible Collaborative Writing Prototype for Blind Users. *Journal of Usability Studies* 10, 1 (November 2014), 26–45.
18. Neomy Storch. 2005. Collaborative writing: Product, process, and students' reflections. *Journal of Second Language Writing* 14, 3 (2005), 153 – 173. <https://doi.org/10.1016/j.jslw.2005.05.002>

19. Yunting Sun, Diane Lambert, Makoto Uchida, and Nicolas Remy. 2014. Collaboration in the Cloud at Google. In *Proceedings of the 2014 ACM Conference on Web Science (WebSci '14)*. ACM, 239–240. <http://dx.doi.org/10.1145/2615569.2615637>
20. Jaime Teevan, Shamsi T. Iqbal, and Curtis von Veh. 2016. Supporting Collaborative Writing with Microtasks. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16)*. ACM, 2657–2668. DOI : <http://dx.doi.org/10.1145/2858036.2858108>
21. Selen Türkay, Daniel Seaton, and Andrew M. Ang. 2018. Itero: A Revision History Analytics Tool for Exploring Writing Behavior and Reflection. In *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems (CHI EA '18)*. ACM, LBW052:1–LBW052:6. DOI : <http://dx.doi.org/10.1145/3170427.3188474>
22. Fernanda B. Viégas, Martin Wattenberg, and Kushal Dave. 2004. Studying Cooperation and Conflict Between Authors with History Flow Visualizations. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '04)*. ACM, 575–582. DOI : <http://dx.doi.org/10.1145/985692.985765>
23. Dakuo Wang. 2016. How People Write Together Now: Exploring and Supporting Today's Computer-Supported Collaborative Writing. In *Proceedings of the 19th ACM Conference on Computer Supported Cooperative Work and Social Computing Companion (CSCW '16 Companion)*. ACM, 175–179. <http://dx.doi.org/10.1145/2818052.2874352>
24. Dakuo Wang, Judith S. Olson, Jingwen Zhang, Trung Nguyen, and Gary M. Olson. 2015. DocuViz: Visualizing Collaborative Writing. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (CHI '15)*. ACM, 1865–1874. DOI : <http://dx.doi.org/10.1145/2702123.2702517>
25. Dakuo Wang, Haodan Tan, and Tun Lu. 2017. Why Users Do Not Want to Write Together When They Are Writing Together: Users' Rationales for Today's Collaborative Writing Practices. *Proceedings ACM Human-Computer Interaction* 1, CSCW, Article 107 (2017), 107:1–107:18 pages. <http://dx.doi.org/10.1145/3134742>
26. Stefan Wuchty, Benjamin F. Jones, and Brian Uzzi. 2007. The Increasing Dominance of Teams in Production of Knowledge. *Science* 316, 5827 (May 2007), 1036 – 1039. DOI : <http://dx.doi.org/10.1126/science.1136099>
27. Soobin Yim, Dakuo Wang, Judith Olson, Viet Vu, and Mark Warschauer. 2017. Synchronous Collaborative Writing in the Classroom: Undergraduates' Collaboration Practices and Their Impact on Writing Style, Quality, and Quantity. In *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW '17)*. ACM, 468–479. DOI : <http://dx.doi.org/10.1145/2998181.2998356>
28. Yeshuang Zhu, Shichao Yue, Chun Yu, and Yuanchun Shi. 2017. CEPT: Collaborative Editing Tool for Non-Native Authors. In *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW '17)*. ACM, 273–285. <http://dx.doi.org/10.1145/2998181.2998306>