

# The Invisible Labor of Access in Academic Writing Practices: A Case Analysis with Dyslexic Adults

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Writing is the currency of academia. Although technology-mediated writing has been studied extensively in CSCW, we know little about how writing practices unfold with disabled people, such as dyslexic writers whose neurodivergence shapes how they process language. Our qualitative analysis reveals how dyslexic professionals simultaneously identify how editing tools break down on academic language; develop workarounds that re-appropriate other tools as language sources; cultivate ad-hoc collaborations to compensate for technology's limitations; and navigate culturally ingrained ableist expectations for writing. We discuss how dyslexic writers' experiences with shouldering invisible work to participate in academic writing processes indicates that current tools and services do not support their needs. We then draw on our findings to inform design opportunities to make writing processes more accessible through changes to writing tools, institutional services, and peer review practices.

CCS Concepts: • **Human-centered computing** → **Empirical studies in accessibility**; **Accessibility systems and tools**.

Additional Key Words and Phrases: dyslexia; accessibility; writing tools; academic writing; collaboration

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## 1 INTRODUCTION

Preparing written deliverables is important for success in higher education. Writing and productivity tools mediate the experiences of iterating on submissions for competitive opportunities and career milestones. CSCW and HCI scholars have extensively studied technology-mediated written communication. Outside the contexts of collaborative writing in small teams [6, 103, 112] and online crowds [5, 78, 95], prior work often conceptualizes writing tool usage as an individual's experiences in a text editor. The scope of previous studies does not include the evolving relationships between an author, final readers, and stakeholders who provide interim feedback and support. Many questions remain about the technology-mediated interactions with people who are involved in writing processes, but not ultimately named as authors.

Although many people struggle with writing, the process and norms of academic writing pose additional challenges for dyslexic people. Dyslexia is a neurodivergent condition characterized by difficulties with reading and writing [2, 100]. The experience of dyslexia impacts communication and technology usage throughout life [41]. Studies about dyslexic adults in higher education [18, 30, 98]

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show they have non-normative experiences with processing language, such as misspelling words and not recognizing misspellings. Prior research conceptualizes accessibility for dyslexic writers as spell checkers to fix errors for them [64, 69, 107]. Yet, we know little about how experiences with these tools are situated in the social contexts of academic writing, including the evolution of a field's jargon or high stakes of peer-reviewed publication. This is particularly important given that an estimated 15 to 20% of the American population experiences some symptoms of dyslexia [2]. This estimate is likely a lower bound because access to clinical diagnosis is unequally distributed [48]. In the present paper, we investigate the following research questions (RQs):

**RQ1:** How do dyslexic adults negotiate their writing experiences with technologies, collaborators, and audiences in different social contexts?

**RQ2:** How do current writing tools help or hinder dyslexic adults' experiences in academic work?

**RQ3:** How can the sociotechnical systems of writing better support dyslexic adults?

We interviewed and observed 11 dyslexic adults who attend or completed higher education in the United States, representing a specific subset of the dyslexic population pursuing degrees at research institutions. While this study focuses on the social contexts of preparing academic papers, writing is important for the work of dyslexic adults whether they eventually pursue academic or non-academic careers. Our analysis reveals dyslexic adults engage in the interrelated experiences of identifying the bounds of what editing tools cannot do; developing workarounds to bridge gaps left by tools; instantiating ad-hoc collaborations with close ties on assumed individual writing tasks; and navigating ableist norms and expectations for written language. These findings illustrate the additional time, effort, and use of social and material resources constitute *invisible work* [92] required for dyslexic people to participate in academia. These practices are made invisible when interim editing processes are not regarded, or are briefly regarded in acknowledgments sections without a material benefit, in the submitted documents or summative evaluations. These experiences become more complex and difficult to navigate when additional invisible work is needed for specialized writing (e.g., undergraduate assignment vs. PhD dissertation).

This paper makes empirical, conceptual, and practical contributions to CSCW. First, we contribute new empirical evidence of the invisible work of access [10, 21, 85], drawing from Star and Strauss' theorizing of invisible and visible work [92]. Our analysis reveals current tools perpetuate social inequality because it is disproportionately difficult for dyslexic writers to resolve and disambiguate errors found by editing tools. The consequences of tools' limitations unfold in material outcomes when writing is evaluated: reviewers penalize erroneous writing based on assumptions that errors indicate laziness or rushed submissions. In actuality, dyslexic scholars are just as competent as nondyslexic peers but must devote *more* time, effort, and resources when existing tools and services do not support their needs. Second, this paper shifts how we conceptualize dyslexia. Drawing from Disability Studies [44, 82], we problematize how tools and norms were not established with dyslexic writers in mind. The point of view we provide contrasts with prior research that frames dyslexia as a deficit in the individual. Third, we discuss sociotechnical interventions to make writing practices more accessible. Our recommendations improve everyday work practices mediated by writing tools, services, and peer review systems to better support neurodiverse participation by default.

## 2 BACKGROUND: A BRIEF OVERVIEW OF PERSPECTIVES ON DYSLEXIA

Dyslexia is defined as a learning disability that involves difficulty with processing language, affecting experiences with reading, writing, and speaking [2]. Psychology and neuroscience researchers continue to debate the differences between dyslexic and nondyslexic individuals, including word recognition [19, 26], decoding [76, 81], and spelling [94, 99], as well as methods for diagnosis [4, 47, 56, 86, 89]. In contrast, there has been a push from Disability Studies scholarship and neurodiverse

communities to stop pathologizing dyslexic people [20, 58, 75] and improve attitudes towards dyslexic people in the media and everyday life [106].

Dyslexia as a term and diagnosis has a complex history. Sleeter and other Disability Studies scholars note dyslexia research originated in psychologists' efforts to understand why upper-middle class children were not succeeding in school [87]. Like other neurodivergent conditions, which continue to be underdiagnosed and misdiagnosed [3, 17, 39, 48, 49, 111] due to systemic inequities perpetuated in healthcare [11–13, 90, 105, 110], dyslexia is entangled with notions of class and race.

Much dyslexia-related research focuses on diagnosis and treatment during early childhood education [55, 80, 83]. Some prior work examines dyslexic students' negative experiences with exams and essays common to university coursework [25, 53, 98], motivating the need to improve pedagogies and rethink academic assessments. Prior work details how dyslexic students develop substantial coping strategies and competencies to participate in higher education [38, 74]. These students describe themselves as having the strengths of perception, persistence, resilience, and creativity to succeed in academia. Mendelsohn and other dyslexic adults emphasize that *"dyslexia doesn't go away after I'm done with classes for the day. It doesn't go away when I'm working as a student teacher or interning with an employer outside of school. And it won't go away when I graduate. Dyslexia affects me in all parts of my life,"* [41]. This reality motivates research on experiences of dyslexia in different stages of life and social contexts, such as the academic or professional experiences described in the present paper.

### 3 RELATED WORK

Below we describe prior work about understanding dyslexia and technology use, writing tools and collaborative practices, and academic ableism perpetuated in technology design and use.

#### 3.1 Understanding Dyslexia and Technology Use

The present paper builds on CSCW and HCI scholarship about dyslexic adults' experiences with technology, which spans web accessibility, social media, search, and spell checkers. Rello et al. used quantitative methods to understand dyslexic users' preferences for fonts [66, 67], text size [72], background colors [70], text layout [71], and text simplification [68] when reading websites. Miniukovich et al. developed and evaluated website readability guidelines with both dyslexic and nondyslexic readers in mind [45, 46]. Vezzoli et al. [101] apply a neurodiversity perspective to appreciate how interactions with images, text, video, sounds, and other modalities in social media enable multimodal literacies and identity work among dyslexic teenagers. Reynolds and Wu [73] investigated dyslexic Facebook users' writing challenges and workarounds (e.g., editing after posting; asking others to proofread; drafting posts in word processors with spell check). Following up on their broad survey of how users re-appropriate "web search as a linguistic tool [28]" (e.g., to check spelling or grammar), Morris et al. [50] and Fournery et al. [29] analyzed interviews, surveys, and readability judgment tests by dyslexic searchers to identify how to improve information retrieval algorithms and comprehensibility of search result pages. Rello's dissertation [65] and Pedler's research [60] characterize the spelling mistakes and evaluate spell checker performance in dyslexic students' writing. We extend this prior work by analyzing how dyslexic people reconfigure a multitude of tools and negotiate participation (RQ1) in academic writing contexts and relationships.

#### 3.2 Writing Tools and Collaborative Practices

CSCW has substantial prior work on how group interaction unfolds with writing tools. Boellstorff et al. [8] and Olson et al. [54, 103, 108] describe writing strategies in small teams, such as alternating between a/synchronous editing and how groups may scaffold their writing process with a divide-and-conquer approach, outlining, or finding templates. Birnholtz et al. [6, 7] and Wang et al. [103]

describe how group members are cautious around editing others' work or exposing their typing behaviors, depending on the document purpose and relationships among authors. Teevan, Iqbal, and collaborators [35, 95] developed "microproductivity writing tools" which decompose writing processes into microtasks (e.g., generating ideas, labeling ideas to organize them, writing paragraphs) that can be easily delegated. More recently, Sarrafzadeh et al. [79] discuss the need for "stage-aware" writing assistance which is conscious of how authors perceive stages of their writing process, how stages relate to different tasks, and whether those stages can be inferred or must be specified by writers. Yet, most of this research is conducted with nondisabled participants. There is still much to understand about how the experience of a language-related disability like dyslexia shapes technology-mediated writing processes.

In contrast to an extensive literature on writing tools and collaboration among nondisabled individuals, the few studies on assistive writing tools for dyslexic people focus on improving spelling and grammar checkers. Rello et al. [69] and Quattrini et al. [64] developed "*spell checkers for dyslexia*" with a text corpus from dyslexic writers; these systems perform better on the real-word (e.g., "seems" vs. "seams") and boundary errors (e.g., "sub marine" vs. "submarine") that dyslexic writers frequently produce. Following their study [73] of dyslexic Facebook users' self-presentation challenges and strategies, Wu et al. [107] developed a character-based neural machine translation model that "*translates 'dyslexia-style' to 'non-dyslexia-style' writing*," which they motivate by noting existing spell checkers are not optimized for social media. They deployed their AI-powered "Additional Writing Help" system for comment threads and evaluated how it impacted participants' confidence and writing activity. Dyslexia and writing processes, however, are about much more than just spelling. The present paper provides a contextualized understanding of how dyslexia is experienced in longer-term writing processes and group interactions focal to CSCW (RQ2).

### 3.3 Academic Ableism Perpetuated in Technology Design and Use

Informed by Disability Studies and Disability Justice, this research starts from the premise that technology is not value-neutral [23, 32, 61, 97, 109]. Abolitionist lawyer and Disability Justice organizer Talila A. Lewis [37] defines ableism as:

"A system that places value on people's bodies and minds based on societally constructed ideas of normalcy, intelligence, excellence and productivity. These constructed ideas are deeply rooted in anti-Blackness, eugenics, colonialism, and capitalism. This form of systemic oppression leads to people and society determining who is valuable and worthy based on a person's appearance and/or their ability to satisfactory [re]produce, excel and 'behave.' You do not have to be disabled to experience ableism."

Applied to CSCW, the concept of ableism prompts us to question what has been socially constructed as "normal" in sociotechnical systems, which includes examining the ability assumptions nondisabled people take for granted in interactions between people, information, and technology in the sociomaterial environment. A growing body of CSCW and HCI research about the lived experiences of disabled academics [34, 36, 84, 85, 109] illustrates how status-quo tools and practices continue to be inaccessible and perpetuate ableism. Examples of how ableism manifests in technology-mediated interactions include the usage of data visualization and images unaccompanied by nonvisual representations (thereby excluding blind colleagues) [9, 10, 16] and spoken conversation without thoughtful deployment of sign language or captioning (thereby excluding d/Deaf and hard-of-hearing colleagues) [22, 36, 57, 91]. Disability Studies scholars explain ableism also persists in institutional structures that put responsibility on disabled individuals to request accommodations for every course and social event [23]. This individual accommodation model implies disabled people are anomalies who come with additional burdens, despite good intentions.

Research also shows many accommodations are insufficient for domain-specific work activities in academia, leading to what Shinohara et al. [84] conceptualize as access differential, "the gap between the access that non/disabled students experience," and inequitable access, "the degree of inadequacy of existing accommodations to address inaccessibility."

Building on Disability Studies and HCI scholarship about ableism [23, 32, 34, 85], we focus on writing because it is central to academic work and is a concrete instance of ableism that can be addressed through CSCW research and development. The present paper reports on the lived experiences of dyslexic adults to understand what barriers they face and how they develop individual workarounds to address those barriers. Illuminating these challenges and strategies will inform next steps researchers and institutions can take to make academia more accessible (RQ3).

## 4 METHODS

We conducted semi-structured interviews followed by observations and think-alouds of prompted writing tasks. Data collection occurred before the COVID-19 pandemic.

### 4.1 Participants

Eleven dyslexic adults in the Midwestern United States participated. This sample size is in line with other interview-based CSCW and HCI studies with neurodivergent communities [101, 113]. Participants ranged from 19 to 34 years old, read and speak English, and frequently write for their disciplines. We recruited via the authors' academic network and university's disability services office. Table 1 summarizes participants' career stages, disciplines, and writing experiences mentioned.

It is estimated that 15 to 20% of the American population experiences some symptoms of dyslexia [2], however, we note this is a lower bound because access to clinical diagnosis is unequally distributed [48]. During recruitment, our institution's disability services office noted that dyslexia and other learning disabilities were the most common diagnosis on campus.

Our sample is a specialized subset of the dyslexic population who attend or attended research institutions and may not represent the broader dyslexic community. Participants mentioned experiencing dyslexia throughout the lifespan and vary in whether they were diagnosed as a child or adult. All participants except two mentioned they were the only dyslexic person they knew at their university. Most informants did not feel connected to a broader neurodiverse community.

Some participants are non-native English speakers, including a LatinX immigrant and an Italian international student. They explain how growing up in a different culture than their peers *and* being dyslexic impact their writing processes, such as managing words that look similar in multiple languages. We note more research is needed about dyslexic non-native speakers as well as dyslexic writers who are not English speakers and are working with translators or multilingual co-authors to write for international venues.

### 4.2 Procedure

Participation included a semi-structured interview, writing activity, and think-aloud ("*verbalizing their thoughts as they move through the user interface*" [52]). Sessions were 60-90 minutes and occurred at mutually convenient locations, such as a library. We paid each participant \$30 cash.

**4.2.1 Semi-structured interviews.** Interviews lasted 30-45 minutes and followed a semi-structured format, which allowed additional topics to emerge from participants' stories. The prepared questions focused on experiencing dyslexia as university students; writing strategies; writing in different relationships (classmates, co-authors, instructors, mentors, etc.) and social contexts (classes, research, job applications); challenges and workarounds; writing with both mainstream tools and assistive technology; and improving systems to better support dyslexic writers.

Pseudonym	Career stage	Discipline(s)	Writing contexts mentioned
Alex	PhD Candidate	Linguistic Anthropology	Research publications, Course essays, Grading student papers
Carina	Undergraduate	Neuroscience, Spanish	Course essays, STEM problem sets
Dawn	Undergraduate	Psychology, Film	Course essays, Film scripts
Derek	Undergraduate	History, Business	History papers, Business reports
Drew	PhD Candidate	Math, Biology	Research publications, Professional emails & resumés
Edwin	Manager (Non-academic)	Sociology, Social Work, Psychology	Course essays
Kyle	PhD Candidate	Learning Sciences	Research publications
Lisa	PhD Student	Biology	Research publications
Mason	Undergraduate	Math, Economics, Business	Business & tech journalism, Course essays
Riva	Undergraduate	Industrial Engineering, Environmental Science	Environmental Science reports
Tori	Undergraduate	Undecided (considering Psychology)	Course essays

Table 1. Table of participants' academic backgrounds and writing contexts mentioned during interviews.

**4.2.2 Prompted writing observations and think-aloud.** We asked participants to complete a short essay-writing activity (25-30 minutes) and editing think-aloud (20-30 minutes). We temporarily turned off automatic spell checking so participants could narrate their editing experiences in think-alouds. We provided a laptop<sup>1</sup> for participants to write in Google Docs or Microsoft Word. These observations and think-alouds enabled us to collect data about moment-to-moment interactions with technology that can be difficult to recall in detail during interviews. We structured the activity to generate discussion about tools and practices rather than be evaluative of participants' writing, domain knowledge, or argumentation. To keep the session relatively short, we used prompts that would presumably not require additional reading before composing. The prompts were adapted from a writing center's existing resources for short persuasive essays and topics included driver licenses, animal testing, or social media (see Appendix). Although the format, timeframe, and topic choices were not naturalistic or representative of informants' writing for coursework or publications, they were highly generative for discussion within the interview context.

After participants composed, we used their document as a point for further inquiry. We re-enabled spell checkers and asked participants to think aloud as they edited their draft in the word processor. We asked additional questions during think-alouds which elaborated on topics mentioned during interviews or brought up additional considerations when the interfaces were readily available to discuss (e.g., display of suggestions in spell checker dialogs).

<sup>1</sup>We acknowledge that asking participants to use provided laptops may affect their writing experience with differences in keyboards, operating systems, etc. We chose to prepare laptops so participants would not have to install screenrecording software or change settings on personal machines. We realize the tradeoff here is that using unfamiliar laptops means informants' routine practices may be less evident in standalone video recordings. As such, during the thinkaloud conversations, we asked informants how writing on the provided laptop differed from their personal setups to gain more context.



### 4.3 Data Analysis

We analyzed data in an iterative process informed by constructivist grounded theory method [14, 15], video analysis for qualitative research [33], and Disability Studies [44, 82]. Our qualitative analysis involved iterations of coding, memoing, and constant comparisons of data to developed concepts. Initial open coding and memoing was about participants' descriptions of dyslexia in their own words; challenges and workarounds; practices for individual versus co-authored writing; technology usage; context-dependent aspects of disability experiences (e.g., power dynamics); and nondyslexic people's reactions to their writing in different relationships (e.g., co-author, student, instructor). As recommended in constructivist grounded theory method [14, 15], we updated the interview guide to better understand emerging ideas and probe open areas of questioning, such as dyslexic writers asking nondyslexic people for support and the relationships those experiences are situated in. Later analysis focused on surfacing the invisible work of dyslexic writers and how dyslexic writers navigate the social contexts of written deliverables.

We analyzed interview data alongside observation data, including screen captures, audio-video recordings, and documents. Acknowledging that each person experiences dyslexia differently, we intentionally did not quantify features of observations across participants. The observational excerpts presented in our Findings are examples of issues and workarounds mentioned in interviews. The purpose of these excerpts is to show how these tools break down in domain-specific written communication and be contextualized in the writing process for a particular participant, rather than be representative of all dyslexic users' experiences with these tools.

Our analysis intentionally centers dyslexic people's perspectives and draws from Disability Studies. Challenging how many fields regard disability as merely encompassing diagnosis and treatment, Disability Studies *"involves scrutinizing not bodily or mental impairments but the social norms that define particular attributes as impairments,"* [44]. As such, this paper is less about symptoms unique to dyslexic people and more about de-familiarizing widely used writing tools that do not support dyslexic ways of working. We also draw from Schalk's conceptualization of disability *"as a system of social norms which categorizes, ranks, and values bodyminds<sup>2</sup> and disability as a historically and culturally variable category"* [82]. Our analysis questions how writing tools reinforce a particular social hierarchy, and how nondisabled people's broad acceptance and usage establish the tools and associated practices as "normal." With regards to surfacing implicit ableism perpetuated in academic writing and advocating for change, we resonate with Dolmage's approach: *"The goal here is not to deconstruct the concept of disability as it attaches to certain bodies by saying that this person or that group is not disabled. Instead, the goal is to affirm disability as a shared and positive identity, while challenging the use of disability as something that can be used to disqualify or stigmatize,"* [23]. This is reflected in how the current paper problematizes the lack of supports and awareness about accessibility rather than dyslexic writers' neurodivergence.

### 4.4 Researcher Positionality

At least one author is neurodivergent; none of the authors experience dyslexia. The author's experiences with a different kind of neurodivergence sensitizes them to the circumstances of having invisible disabilities and shouldering invisible labor to meet society's expectations for neurotypicality. This is applicable to this study's focus on lived experiences in academia where it is not safe to openly discuss disabled identity and disabled people must make judgment calls on how describe accessibility needs in different social contexts. These circumstances can cause

<sup>2</sup>In Disability Studies, usage of the term "bodymind" pushes back against the notion that bodies and minds are separate entities. Margaret Price and others explain *"mental and physical processes not only affect each other but also give rise to each other—that is, because they tend to act as one, even though they are conventionally understood as two,"* [62].

a lot of stress and are due to the culturally ingrained ableism in work environments, rather than the fault of any individual. These aspects come through in several Findings about how different stakeholders are unintentionally antagonistic towards dyslexic people and what informants do to prevent negative outcomes. This also shaped the Discussion's recommendations for intervening with nondyslexic people's actions in addition to improving dyslexic adults' writing experiences.

The first author's awareness of dyslexic scholars' experiences came through long-term relationships with dyslexic graduate student peers, co-authors, and colleagues in reading groups before research began. These experiences with dyslexic colleagues are situated in relationships as friends with shared interests outside of this paper's topics. Throughout these relationships, the first author became aware of how experiences of dyslexia crop up in written communication with everyone a dyslexic person meets. Co-authoring with dyslexic colleagues prompted the first author to notice how tools (e.g., ubiquitous spell check) helped or hindered in ways they previously took for granted. These lived experiences with dyslexic colleagues shaped how they conducted interviews to emphasize participants' voices about how they experience dyslexia in academic work, rather than starting from the symptomatic language of clinical research. These aspects also informed their analysis of the social contexts of written deliverables and dyslexic people as colleagues who are both producing and evaluating academic writing, as shown in several Findings.

The authors' training in design, software development, and HCI prompts them to consider the limits of technology and how other interventions are necessary to enable equitable participation. This informed our design recommendations in the Discussion beyond individual user interfaces, including opportunities for service design and rethinking mainstream peer review practices.

## 5 FINDINGS

Our findings are organized into four sections situating experiences of dyslexia in the social contexts of academic writing and communication. Jointly, they reveal many technological, social, and cultural factors that dyslexic people navigate throughout education. Below we show how informants simultaneously (i) identify how tools break down in academic contexts; (ii) develop workarounds that re-appropriate other tools as language sources; (iii) cultivate ad-hoc collaborations to bridge gaps left by tools; and (iv) navigate norms for written language in different academic roles.

### 5.1 Identifying how tools break down when writing for academic audiences

Dyslexic adults are simultaneously learning how dyslexia affects how they write, how existing tools can or cannot provide support, and how to write for their target audiences in ways that demonstrate academic proficiency and knowledge. Informants critique the underperformance of editing tools on domain-specific language, reflecting on how the tools were designed for nondyslexic users writing standardized English. While improving spell checkers for dyslexic people remains an active area of research in natural language processing, accessibility, and HCI [64, 69, 107], our analysis attunes to the social contexts these tools are incorporated into and how they shape practices and outcomes for written deliverables. Below we describe how editing tools complicate—rather than help achieve—the effort of preparing documents to submittable quality.

Informants notice spell checkers repeatedly provide counterproductive help for jargon. Lisa says editing tools underperform *“for biology—there’s just so many words that aren’t English and Grammatically [31] is for English.”* Spell check and autocorrect mishandle Latin names for microorganisms she writes about. For example, *“planaria”* was autocorrected to *“planning,”* and Lisa did not notice until much later. Since a common experience of dyslexia is not noticing misspellings, the work of identifying false positives and false negatives after running spell check is more labor-intensive for dyslexic writers than nondyslexic writers.



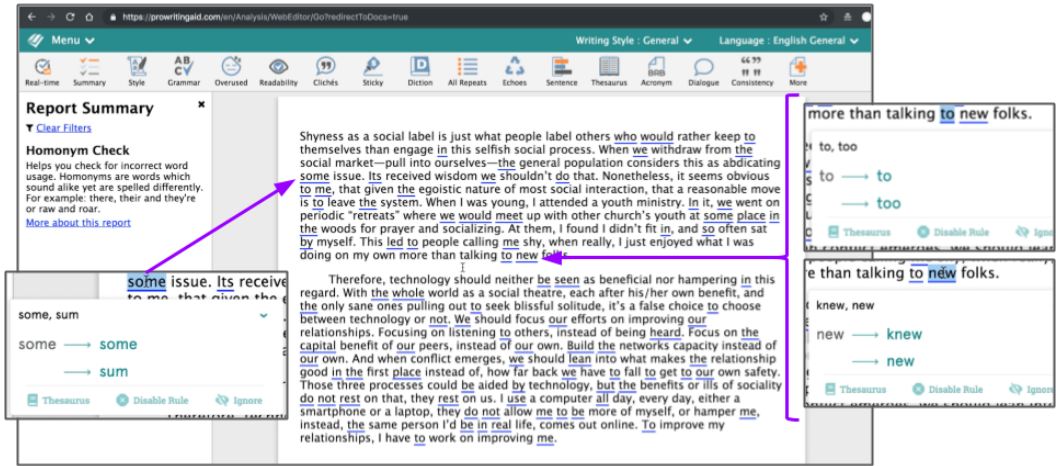


Fig. 1. Screenshot of Kyle using “Homonym Check” in ProWritingAid [63]. The tool overdetects to the extent that it is not helpful for addressing his tendency to make homonym errors.

The tools did not substantially improve when informants tried personalizing. After using ‘Add to dictionary’ features, spell checkers still improperly flag conjugations and venue-specific usages of words in personal dictionaries. To complicate this further, informants are prone to add misspellings to their dictionary due to experiences of dyslexia. Alex is careful with customizing, “*I have to double check the spell check and figure out what it’s doing and why. If I’m spelling it right and spell check doesn’t know, I’ll add it to the dictionary. But I’m not sure how to un-add words.*” If he accidentally adds a misspelled word, the tool is now “*forever blind to that misspelling.*” This motivates future work to design customization workflows that prevent erroneous additions.

Editing tool limitations are compounded for informants with multiple marginalized identities that shape experiences with language. Mason says “*I’m also international. So of course I’m more prone than the classical American dyslexic guy to make mistakes.*” Mason’s bilingual upbringing with Italian and English connects to his additional difficulties with words that resemble each other in both languages, such as “*technology*” and “*tecnologia*” or “*legal*” and “*legale*.” Consequently, spell checkers are less effective for him than native speakers whose writing more closely resembles what the tools were built to process.

We present an excerpt from Kyle’s think-aloud to demonstrate the lack of personalization in existing tools. Kyle knows he makes errors with homonyms, possessives, and similar-looking words. He knows errors are in his draft but will not find them easily on his own, so he uses multiple editing platforms to find errors for him. ProWritingAid offers features for different elements of writing, such as “Overused,” “Cliches,” and “Homonym Check.” He pastes his draft into ProWritingAid, clicks “Homonym Check,” and the tool flags several words in every sentence as a potential homonym (Fig. 1). After hovering over several suggestions, Kyle says “*this is overdetecting. Most of these mean nothing...theoretically the answer to all my homonym problems is here but the time and effort [for] going into it is too great.*” As such, these tools do not support Kyle’s desired use case.

Writers cannot debate with the tools’ encoded elements of writing style. Kyle’s overall critique is these tools are “*not very holistic in their approach. They kind of just address each issue one at a time.*” As he iterates, Kyle says tools “*oftentimes insert many errors because they offer these new ideas on how to do it, and then you change it, and then it changes the whole tone and you have to go back and*

*rewrite the thing.*” When he edits later, he must rely on the tool or his memory of the syntax edits to be consistent. If he disagrees with the system’s suggestions, there is no option to indicate if this is venue-specific. Or, as Lisa says, *“a lot of the time there’s words that sound similar but are jargon-y for each [venue].”* These findings show limitations in how editing tools treat each word or phrase independently without accounting for venue-specific practices. Writers must do venue-specific edits on their own, which is disproportionately more time-consuming for dyslexic people.

The findings above portray how editing tools break down when dyslexic writers prepare written deliverables in academic contexts. Part of the problem is how algorithms have limited capability compared to human editors, the larger sociotechnical issue is that spell checkers’ ubiquitous existence upholds values that disfavor dyslexic authors. Alex reflects on how *“society expects perfect spelling”* and the nondyslexic people who eventually read his manuscripts will judge negatively if there are errors. However, this is a socially constructed bias as *“there are other settings where spelling errors are tolerated,”* such as chat speak. To compensate for the lack of support from editing tools, dyslexic writers find workarounds to finish preparing submissions.

## 5.2 Developing time-intensive workarounds to bridge gaps left by tools

Informants revealed the ways in which they incorporate resources outside of the scope of editing tools to circumvent the false positives and false negatives of spell checkers. They also identified opportunities for these domain-specific resources to be integrated with the base features or customization workflows of writing tools mentioned previously. This offers new ways to think about technology-mediated communication.

**5.2.1 Re-appropriating existing tools as language sources.** Informants’ workarounds include going back-and-forth between word processors, search engines, and references to confirm and copy-paste words. This finding relates to prior research about the use of web search as a linguistic tool [50]. Alex says, *“as I’m typing and getting together ideas, I spend a lot more time copying and pasting from other papers I think than other people.”* He *“always [has] every paper I’m working with open on my computer and then copying specific words or phrases from those to make sure that I’ve got the orthography right.”* Writers new to a field also look up terms to check words. However, Alex uses this workflow as a coping strategy for spelling difficulties, regardless of his prior experience with the language. He frequently copy-pastes instead of types because he cannot rely on spell checkers. This invisible labor compensates for how editing tools provide limited help for jargon.

We present a demonstration from Alex’s think-aloud. He writes an example Linguistic Anthropology sentence: *“Recontextualization is a semiotic process where two texts are brought into an envelope of co-eval ness meaning that they are meta-semiotically marked to emphasize their interconnection.”* The spell checker marks “eval” as an error, suggesting “evil, veal, oval, vela, evat” as corrections (left side of Fig. 2). Alex acknowledges he may have errors but cannot rely on spell check, *“I don’t know if this is exactly how they write it so I would have to go into Google Scholar.”* Alex exits the word processor to search for the paper that coined this concept, querying *“silverstein evolope [sic] of co eval”* (top-right of Fig. 2). He opens the paper and finds the term in the abstract. Alex reflects, *“You’re not supposed to grammatically be able to do with English normally. Sometimes [the tool] will say this is wrong and I’m like, ‘Well maybe it’s wrong, maybe it’s not. I just want to know: Am I writing it the way other scholars in the field write it?’”* This workaround suffices but it is cumbersome to go back and forth between many sources, building up over time to be a labor-intensive process.

These workarounds have their limits; informants know technology does not have every word they need. Some informants maintain vocabulary notes that are more helpful than search engine result pages or spell checkers. Lisa says *“sometimes if I google a word, it doesn’t give me the definition I want in biology...I have to learn new jargon and then keep it straight [when colleagues] use the same*

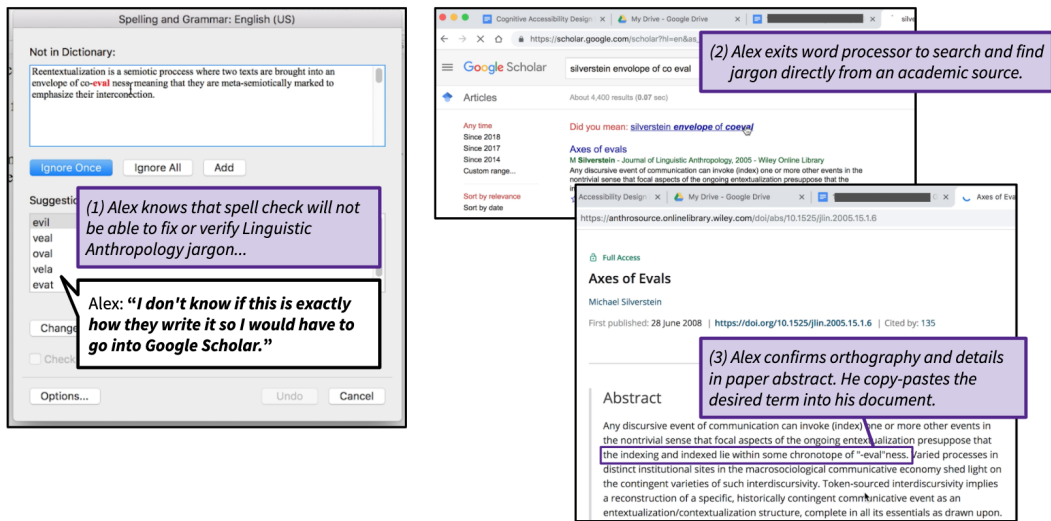


Fig. 2. Annotated screenshots of Alex's workaround when spell checkers are unhelpful for jargon.

word in different contexts." As she was onboarded to different labs, Lisa asked colleagues, "hey, what does this [term] really mean in this context?" and continually updated her notes. Connecting this finding to how spell checkers are not meeting dyslexic writers' needs, both Alex and Lisa call out how jargon is socially defined based on "the way other scholars in the field" write it and developed workarounds. This prompts questions of how to improve writing tools to better support the social practices of curating jargon as language evolves over time.

**5.2.2 Wanting tools to better support dyslexic ways of knowing.** Informants mention various tools that already make writing practices more accessible to them or have not yet fulfilled their potential to do so. For example, dyslexic writers prevent the consequences of misspelled references by using citation managers. Although Alex tries to not worry about spelling in rough drafts, he will "make sure I use Zotero [114] from the start because otherwise I've gotten into people being like 'Who are you talking about? Who said this?' [when readers see misspelled citations]" Alex knows that as an academic he must cite other scholars in research papers. He says this scenario is a "funny one where it's not even about judging me as a person for my spelling errors. It's about judging my ability as an academic to know other people in the field." Zotero's browser plugin gathers citation data and its word processor plugin formats citations and bibliographies. These tools work for the writer and ease the labor of preparing citations, instead of generating more work like spell checkers.

Yet, informants identified a disconnect between citation managers and spell checkers as tools for academic writing. While citation manager extensions co-exist with base word processor features, spell checkers may mark cited author names as erroneous. Kyle wants editing tools to "not say every proper noun is spelled incorrectly...It'd be nice if I could just focus on [the errors] instead of having to go through every single proper noun and figure out which ones are wrong and which ones are right." This demonstrates how co-existing tools can be counterproductive in academic writing for dyslexic writers. Although it is unreasonable for spell checkers to contain every academic's name, it is reasonable to synchronize an author's curated citation manager data. Synchronization could prevent spell checkers from improperly flagging proper nouns and start addressing aforementioned customization issues.

Informants discuss the unfulfilled potential of voice-based interfaces. These systems include speech-to-text in office tools, like Microsoft's Learning Tools [43], and automated transcription services. Lisa says these interfaces have nontrivial learning curves because of differences in how academic language is written and spoken. Her younger brother also has a learning disability and *"has learned how to speak the way we write [for voice typing], which is an idea that not a lot of people who have learning disabilities think about."* Kyle uses voice typing or exports transcripts of voice recordings as word processor files. However, automated speech-to-text tools share the limitations of spell checkers. As the systems map audio segments to words, they are prone to real-word errors and unreliable on jargon. Authors have to scrutinize text to fix inaccurate transcriptions; this manual editing work is disproportionately inaccessible to dyslexic writers regardless of text entry modality.

This subsection revealed how informants creatively re-purposed references from their local work contexts to rely less on the general-purpose spell checkers and editing plugins they know are counterproductive on academic language. However, these time-intensive workarounds to bridge gaps left by and created by editing tools are unsustainable for written deliverables with a substantial page length and iteration. While other demographics use similar strategies for building familiarity and writing for a particular field, we emphasize that dyslexic writers use these strategies throughout their career because difficulties persist regardless of prior experience. After developing and using these workarounds, dyslexic writers must eventually leverage personal networks and ask close nondyslexic ties for the remaining support they need before submitting their writing.

### 5.3 Cultivating ad-hoc collaborations for individual writing tasks

After devoting substantial time with tools and workarounds, dyslexic writers need copy editing support from human editors. Alex says, *"No matter how much technology is used...[I] can't get the document to a publishing-ready state [on my own]."* He initially tried requesting copy editing as an accommodation, but this was not readily available from disability services. When he was redirected to the writing center, Alex asked for *"a proofreader rather than a writing tutor or more intense editor,"* but was denied. Similarly, Kyle tried requesting grant funds to hire editors for research papers but was told that was *"not acceptable."* A personal editor is not plausible to hire for every writing assignment, especially on a student budget and in earlier stages of academic careers. Informants then expend social capital to ask nondyslexic people in their personal network to edit for them.

Some informants frequently incorporate collaboration into individual writing assignments. Mason affirms that *"if you have learning disabilities, the strongest asset you have is people."* He *"asks my friends to proofread everything...Since I've done this quite a lot with [them], now [they are] able to tell immediately what I have to do."* Mason frequently seeks out this feedback because *"not everyone can understand precisely what kind of person you are and the way you think. Therefore you have to find somebody else that is somewhat of a middleman that helps you talk to other people that you don't know well."* He implies his intermediate collaborations are necessary for his written deliverables to successfully communicate to the final readers. However, these stakeholders are typically not named in submissions and scholars cannot rely on this strategy at all points in their careers.

Informants' ad-hoc collaborators are well-aware of their experiences of dyslexia because of the closeness of their relationships. These people consisted of select family members, close friends, and colleagues from prior walks of life. Carina says her writing process involves requesting feedback from a fellow pre-med classmate who is *"really good at writing, is a really close friend of mine, and he very explicitly knows. Like he went through that English class with me where I struggled a lot. He knows that I have trouble with this and this and writing, so we always talk about it before we do [the assignments]."* Riva speaks highly of her younger sister who has *"seen me struggle with the dyslexia my whole life, and I'd seen her struggle with other things...she edits my work for me, because she is the best."* Carina and Riva discuss their ad-hoc collaborators being physically present alongside

them throughout many writing assignments. We infer these close ties have a deep understanding of their specific writing challenges.

As dyslexic writers advance in academic careers, the less likely their friends and family will have the domain-specific expertise or bandwidth for these ad-hoc collaborations. Mason cultivated friendships where he can be open about his disability and exchange drafts with writers in related fields—his relational configuration is not something we can assume everyone has and does not excuse the lack of support from institutions. Both the individual workarounds and calling in people to help are costly and potentially infeasible for lengthy research papers that undergo frequent iteration as Alex describes, *“every time I work on the paper, there’s potential for me to input more spelling errors.”* This indicates that institutional services should support students with different editing needs and personal circumstances such that dyslexic writers’ academic success does not rely on family and friends’ availability.

Informants explained they could reach out to close ties for writing support but not colleagues. Derek, who is open about dyslexia with friends and family, says *“I don’t know if I’ve ever...shared it in a work context, but for the most part that’s probably where I’d be most guarded.”* Dawn describes her reluctance to share drafts with people she is less familiar with, *“I normally try not to work with others when writing is involved... If I show them my writing, I’ll preface with, ‘I’m dyslexic, that’s why it’s bad’, kind of thing.”* If a course assignment requires sharing drafts, she admits *“I know that there are probably a billion mistakes in it...I would want to have the time to go over and correct it before I share with the other person. But then I never feel like it’s correct enough, so I just try to not work with others in terms of writing.”* This reveals another complexity in obtaining writing support beyond status-quo systems: Dawn will disclose and frame her dyslexia as a deficit in order to justify why her writing has mistakes. We infer from Derek and Dawn’s experiences that ad-hoc collaborations previously described are necessary to prevent the negative value judgments on their writing.

This subsection revealed how dyslexic people compensate for gaps left by—and widened by—editing tools through ad-hoc collaborations with nondyslexic friends or family. This work often occurs unbeknownst to nondyslexic instructors, reviewers, or peers, who may assume errors in final drafts are a mark of laziness or a rushed submission. In actuality, dyslexic scholars devote *more* effort on writing and ask others to be involved because existing tools and services do not fulfill their needs. This applies to the entire continuum of written communication—including coursework, publications, emails, presentations, class discussion forums, resumés—and adds up over time to become barriers to academic success. To complicate this further, dyslexic writers’ experiences are shaped by the relational contexts and power dynamics of writing, as we describe next.

#### 5.4 Navigating societal norms and expectations for written deliverables

Despite the good intentions of developers and university administrators, the failure to make writing processes equitable leaves dyslexic individuals on their own to negotiate accessibility in collaborations. Informants expend labor to educate nondyslexic people, as most people are unaware about experiences of dyslexia during the writing process. This labor is shaped by the context-dependent stakes and expectations of academic roles throughout stages of professional development. Below we describe how dyslexia is experienced in relationships and implicates the nondyslexic classmates, supervisors, or others who exchange writing with informants.

**5.4.1 Navigating power dynamics and disability experiences throughout one’s career.** Informants explain how power dynamics inform disclosures and consequences of experiencing dyslexia, which change throughout professional development. Alex juggles different roles as a PhD candidate. He discloses his disability to faculty at the start of their mentor-mentee relationships because *“there’s a real risk of people thinking that I’m lazy. Especially at [university], there’s such a strict hierarchy that*

to give a faculty member something that looks like it hasn't been proofread, um, is very rude." Alex collaborates with faculty when taking graduate courses and conducting research. He must disclose because he knows that without an explanation, erroneous writing sent to faculty can be perceived as disrespectful or wasting faculty time. However, when he was an undergraduate, Alex was "not in a position to ask people to question how much spelling really matters" and hoped instructors would not penalize him. These findings indicate that Alex learned over time about different strategies and outcomes for educational labor in different power dynamics.

The stakes change when dyslexic scholars are in higher positions of power. When Alex teaches, he types feedback to students instead of handwrites. He uses a spell checker because while the tools are imperfect, his writing with spell checkers is less erroneous than not using one at all. He also discloses to students because "I want to make sure that they read my comments and that my comments aren't too riddled with spelling errors. Then I also say 'I'm dyslexic, if you can't read anything in the comments, let me know.'" As an instructor, Alex gives constructive feedback on his students' writing. He discloses his dyslexia so students feel comfortable asking for clarification and do not misconstrue his misspellings. These findings illustrate how Alex must make judgment calls with everyone and expend educational labor, whether he is in a lower or higher position of power.

Alex's stories demonstrate how dyslexia does not go away after some amount of academic success. Through trial and error, dyslexic writers develop awareness of tool limitations, nondyslexic people's expectations, and risks of (not) disclosing in different relationships. Dyslexic people continue shouldering the labor of anticipating adverse reactions and explaining disability throughout their careers. This brings up questions of how to elevate nondyslexic people's awareness and alleviate the one-sided burden of anticipating, disclosing, and educating.

**5.4.2 Tactfully disclosing in teams.** Some informants adopt leadership roles to establish accessible team practices. Riva discloses dyslexia along with other skills, "I make self-deprecating jokes all the time...I think it's so funny. 'Yeah, I can't read or spell'...people know too that I actually try to play to my strengths in group work." She unpacks how disability shapes team dynamics, "I also will run the group calendar or set up our agenda for the meetings and be like, 'We have to get these things done, because I know what it's like to force yourself to power through and get things done.' So I will try to take on other roles so that I don't have to edit, and I will let people know. People know me really well now. I'm really vocal about it." We infer that Riva's enthusiasm to set agendas benefits the whole team. Being "really vocal about it" is a personal choice and another form of invisible labor.

Dyslexic adults' co-authoring experiences call attention to how value judgments of teammates' skills are entangled with disability. Riva has a broader understanding that teammates bring different skills whether or not they claim skills are disability-related: "Some people like to edit. I'll just be like, 'I don't love editing. I don't think it's one of my strengths,' and people in groups would be like, 'Okay, I don't want her to do something she's bad at, so let's not have her do that.'" Although spelling tests are not assigned in Riva's course, spelling and grammar are still aspects that can be consequential in grading. Riva says her teammates want her to focus on what she can contribute best rather than the editing tasks she makes clear are not her strengths. She unapologetically presents disability and negotiates contributions to group work such that teammates do not fixate on symptoms. Riva's strategizing goes beyond the activities that single-user assistive technology can support.

However, collaborators can be antagonistic towards dyslexic ways of being. Kyle says "collaborating with other people is always a pain because people will do nothing until the day of the deadline because they're standard academics." In group projects, he will "be writing for weeks, there'll be no feedback [from coauthors] whatsoever, silence silence silence, and on the day of the deadline, everyone jumps in [for a long meeting or all-nighter]...I can't do that, so then I just have to step back." Kyle knows writing is exhausting for dyslexic bodyminds, so he adapts his schedule and spaces out



writing sessions to make consistent progress well before deadlines. In contrast, his collaborators contribute most during intense writing sprints the night before the paper is due, which conflicts with dyslexic writers' necessity to pace themselves. Common practices of procrastination conflict with dyslexic writers' coping skills and best practices, making team configurations pose barriers to dyslexic writers' participation.

*5.4.3 Repeatedly experiencing ableist bias from instructors and reviewers.* Informants reflected on how academics tend to unknowingly conflate writing quality and competency. This was an issue for both coursework-related and publication-related writing. Better tools and disability-centered writing services are necessary because in peer review and other writing assessments, *"little errors usually make people have judgments about the totality of the work."* Kyle encounters barriers to publication when his reviewers *"think you're shirking your editing or shirking your academic rigor...or somehow performing identity of the academic wrong...The major thing I get rejected from journals for is bad writing."* However, it is not visible to reviewers that Kyle spends exorbitant time with editing tools and asks friends to proofread to *"remove as many of the little errors that I'm so bad at because I want people to treat my work with the respect I think it's worth."* Kyle directly troubles preconceived notions of *"identity of the academic."* He locates peer review as a process where the ableist expectation to produce error-free papers without adequate technological and institutional supports makes writing disproportionately inaccessible.

Some informants encounter ableist microaggressions when they ask instructors for writing support. Carina recalls instructors giving *"handouts in class that are like 'Everyone can write: just spend more time! Everyone can write: just really think about it!'...and then I meet with people [for editing help] and they're like 'I feel like you're just not putting in enough time and you're not trying enough.'"* She problematizes this response by comparing it to how people regard difficulty in STEM topics, *"You would never say that to someone if they were really struggling with a math concept. You wouldn't say 'Everyone can do math, everyone can just do math.'"* These instructors' comments invalidate Carina's experience with dyslexia and invisible labor in the writing process. Although there are good intentions in handouts to help *"everyone,"* this intention falls flat when dyslexic students experience systemic discrimination. This is even worse in combination with the lack of writing support from disability services.

This subsection presented how informants experience dyslexia in relational contexts. Dyslexic scholars develop strategies for managing their colleagues' expectations and clarifying access needs. This burden of disclosing and circumventing negative value judgments of their dyslexia is largely unacknowledged by the nondyslexic majority. Technology is not value-neutral as these disability experiences occur within and around tools such as spell checkers, collaborative writing features, and peer review platforms. We transition to the Discussion with a political stance that disabled people's issues are nondisabled people's issues and synthesize insights for CSCW.

## 6 DISCUSSION

Our findings illustrate how dyslexic writers skillfully manage the challenges of participating in academic writing practices. This involves identifying how tools break down when writing for academic audiences; re-appropriating other tools as language sources; expending social capital to cultivate ad-hoc collaborations for editing across the range of professional written communication; and navigating ableist expectations to prevent negative judgments on their writing. Higher education institutions have made commitments to supporting disabled communities. However, as our findings illuminate, current tools and practices do not support dyslexic writers' needs. In order to improve accessibility, we must understand the invisible labor of access and support this labor through sociotechnical means, including tools, services, and organizational practices.

## 6.1 Understanding Accessibility as Invisible Work

Early CSCW research by Star and Strauss argues “no work is inherently either visible or invisible. We always ‘see’ work through a selection of indicators: straining muscles, finished artifacts, a changed state of affairs...indicators change with context, and that context becomes a negotiation about the relationship between visible and invisible work” [92]. These interpretations depend on how “work” is defined and who is doing the “seeing” in the context of interest. As such, this theory prompts researchers and designers to be wary of how the visibility of work is negotiated by individuals and mediated by technologies in different contexts, and can have social stakes for the parties involved. The concept of invisible work has previously been applied to understanding various communities studied in CSCW, such as health professionals [42] and online workers [40]. More recently, the growing body of work about group interaction among disabled and nondisabled collaborators [9, 10, 21, 27, 93, 96, 104, 113] focuses on shifting accessibility from being a relatively invisible individual burden to a conscious team effort. In the present paper, we discuss how invisible work in dyslexic scholars’ academic writing processes indicates areas of improvement for accessibility in academia.

The present paper reports on dyslexic writers’ explanations of how existing tools and services do not fully address their needs when preparing writing to submittable quality. We surface issues of access in both interim writing processes and summative judgments of written deliverables. The former is relatively invisible when what gets judged are the submitted versions of a document and whose names are ultimately mentioned as authors. Drawing on Star and Strauss, the work to create access by dyslexic writers and ad-hoc collaborators is an instance where “work may become expected, part of the background, and invisible by virtue of routine (and social status). If one looked, one *could* literally see the work being done – but taken for granted status means that it is functionally invisible [emphasis original]” [92]. In the present paper, the work being taken for granted is copy editing—a task that research shows [18, 30, 98] is especially difficult for dyslexic people, and is therefore a concern for making writing processes more accessible.

Dyslexic writers explain algorithmic editing tools are not enough to make writing processes accessible. Drawing again from Star and Strauss, this is an instance of how “...work does not disappear with technological aid. Rather, it is displaced – sometimes onto the machine, as often, onto other workers...more ‘shadow work’ or invisible work is generated, as well as the (sometimes) obvious social justice and inequity issues” [92]. In the case of our informants, editing work is displaced onto editing tools, co-authors, and members of their personal networks. Spell checkers nominally take on the work of proofreading, but our findings reveal dyslexic scholars repeatedly have to do more work to “double check the spell check” and catch when spell checkers incorrectly process jargon, compounding their editing labor rather than alleviating it. Furthermore, spell checkers have diminishing returns as academic careers become more specialized and use more terminology contrary to what the algorithms can process. To make writing processes accessible, dyslexic writers require support from human editors beyond what spelling and grammar checkers provide.

When looking for support from human editors, our informants noted copy editing was not readily available through disability services or the writing center. Disability services redirected them to the writing center, and the writing center did not fulfill their requests. Despite good intentions from staff and administration, these findings indicate a mismatch between what these institutional offices are set up to provide and what dyslexic scholars need. Because help is not available through institutions’ official channels, dyslexic writers create individual solutions for accessibility, including developing technology workarounds and expending social capital for ad-hoc editing collaborations. However, this work remains invisible to institutions and therefore unsupported. We discuss in the following subsection how these findings inform improvements to student services, whether writers identify as dyslexic or would benefit for different reasons.

Informants also shoulder invisible labor to negotiate accessible collaborative writing practices with regards to expectations for editing and deadlines. Drawing again from Star and Strauss, *“some invisibility is strategic managing of parts of oneself that are inappropriate or undesirable in the workplace – and this may be positive as in autonomous control of the self, or negative, as in hiding shameful aspects”* [92]. In the present paper, dyslexic writers consciously manage if and how to make their disability visible to collaborators. Some informants proactively take on project management roles to redistribute editing labor among teammates. Others encounter conflicts when they tell collaborators they cannot work intense sprints before deadlines, due to difficulties with writing for long blocks of time. Within current norms, such as when expectations for deadlines differ [59, 88], dyslexic co-authors unduly shoulder the burden of educating nondisabled people about disability and orienting the group to accessible practices. Sometimes dyslexic writers avoid collaboration altogether, so they do not have to expend invisible labor explaining their disability to nondyslexic people. As noted in prior CSCW research about collaboration among disabled and nondisabled professionals [10, 21, 104, 113], our findings indicate that improving accessibility in writing processes will also involve rethinking social-attitudinal aspects of collaboration to better acknowledge everyone’s access needs and negotiate inclusive participation.

It is problematic that academia repeatedly requires dyslexic people to take on invisible work to participate. Prior research with marginalized populations explains when individuals are repeatedly required to shoulder invisible work to participate in a community, that work is a harm in itself and often contributes to an individual’s decision to leave the community [102]. As such, the invisible labor of access discourages dyslexic people from staying in academia when the burden worsens throughout advancement. Redistributing this invisible labor to make academia more accessible will involve technological, institutional, and organizational changes, which we discuss next.

## 6.2 Towards Accessible Writing Tools and Practices

We argue that broadening participation in writing practices requires a combination of technological, institutional, and organizational changes. While the present paper focuses on these problems from the perspectives of dyslexic adults, having better supports will benefit many groups.

**6.2.1 Technological changes: Improving transparency and customization in writing tools.** Our findings show algorithmic editing tools underperform on domain-specific language. While these experiences are not unique to our informants, it is disproportionately more difficult for dyslexic writers to do post-hoc checking of spell checkers. Improving how writing tools both curate and check specialized vocabulary would better support the labor of dyslexic writers’ current workarounds, such as re-appropriating search engines to check jargon. This proposed technological development is analogous to how citation managers effectively augment the labor of saving information for and creating accurate citations—a tool workflow our dyslexic informants say is already effective for making citation tasks accessible. One possibility is a dictionary manager and dashboard integrated with spell checkers. To curate custom dictionaries, future work could explore the potential of human-in-the-loop workflows where writers import reference papers or web pages into a system that uses various text processing approaches to extract vocabulary. Next steps may include refining workflows for adding more terms and metadata, as well as exploring how this dictionary could be used to personalize both autocomplete and spell checking. However, these interface ideas come with the tradeoffs of substantial added overhead, potential difficulties with integrations between tools, and disruptions to a writer’s existing workflows. As such, these design explorations must be done in close collaboration with dyslexic scholars and their collaborators to understand what would make the tradeoffs worthwhile in the long term.

**6.2.2 Institutional changes: Designing disability-positive writing services.** Our findings show that despite good intentions from universities, the copy editing support most requested by informants was unavailable through disability services and writing centers. Future research could apply service design methods clarify use cases and editor best practices to support dyslexic ways of working. One possibility is to expand the scope of writing centers to include drop-in hours for copy editing with quicker turnarounds, which would better support our informants' needs. We echo Murphy, Rinaldi, and other writing center practitioners [51, 77] who recommend having open conversations with students about their preferences and not requiring students to immediately prove or disclose disability, as "*students often do not disclose their disability/disabilities until we have established significant rapport...tutors do not need to know a student's specific diagnosis or disability to still have a successful session,*" [51]. These changes would ultimately help redistribute what is currently invisible access labor for dyslexic writers and ad-hoc collaborators.

Disability-positive writing services can promote cultural shifts to affirm neurodiversity. Writing services by and for neurodiverse staff, students, and instructors would increase the visibility of disabled people succeeding in academia as well as supporting their access needs. To help build community, writing centers could facilitate writing groups or co-working spaces to promote neurodiverse writers exchanging process wisdom and technology insights. Neurodiverse co-working groups along these lines already exist in a volunteer-run online format [1]. When considered as part of a university ecosystem, dedicating funding and staff to sustaining these efforts would help ensure these spaces are active and new scholars are onboarded.

**6.2.3 Organizational changes: Rethinking review criteria, practices, and platforms.** Our findings indicate that organizational changes are necessary to mitigate ableist bias in peer review. As Disability Studies scholars argue [23, 24], technology reproduces disability by perpetuating ableist norms and contributing to social inequality. In the case of academic writing, peer review processes and platforms are complicit when dyslexic authors receive ableist comments that conflate writing quality with knowledge contributions. Peer review conventionally has no infrastructure, accommodation-based or otherwise, for authors to disclose accessibility concerns. Additionally, due to anonymization, reviewers have no way of knowing if a manuscript's issues are due to an author's difficulties with language and lack of available copy editing supports. To clarify, we are not recommending the removal of writing standards altogether. The criteria of delivering a well-written manuscript is not the problem as much as how the existing sociotechnical *processes* of preparing manuscripts are disproportionately inaccessible to dyslexic writers.

Future CSCW research could improve the interfaces that mediate author-reviewer interactions and conduct a broader investigation of how ableism manifests in reviewers' reasoning. One possibility is instead of providing a single open-ended text box for reviews, forms for peer review responses could be scaffolded along multiple criteria to prevent conflations of writing quality with research quality. We echo emerging perspectives in the dyslexia literature that push for academia "*to separate the ability to retrieve and produce verbal visual print from academic learning and performance*" [25]. These changes extend existing efforts by some research venues to better support non-native writers by asking authors about language fluency and asking reviewers to determine how much copy editing will be required. These organizational changes must be spearheaded by multiple stakeholders in solidarity with writers from diverse backgrounds.

### 6.3 Limitations and Future Work

We envision future work opportunities in studying experiences of dyslexia with people across age groups, locations, career stages, and language boundaries. One limitation of the present paper is its scope on a specific subset of the English-speaking dyslexic population attending United States

universities. Another limitation is the present paper's sample did not have dyslexic postdoctoral researchers and faculty. Dyslexic adults in later career stages are likely to encounter different manifestations of ableism and power dynamics, providing additional insight on how accessibility issues and collaboration strategies change with role transitions.

Building on findings with dyslexic non-native speakers, we envision future research studying accessibility in writing practices as a collective concern among multiple demographics. We speculate there are commonalities among dyslexic writers, non-native speakers, and novices to a field, such as relying heavily on search engines to check jargon and asking peers to proofread. However, novices and non-native speakers might eventually overcome unfamiliarity with jargon during their journeys to become experts in their chosen fields. In contrast, writing difficulties due to dyslexia occur regardless of prior familiarity with the domain and become increasingly more complex to manage throughout career advancement. Additionally, there might be differences in how individuals negotiate in/visibility of their writing experiences. Disability is still stigmatized in many mainstream settings, which led informants to develop skills for both hiding or disclosing their dyslexia strategically to avoid mistreatment. On the other hand, a non-native speaker's experiences might be less stigmatized and apparent to colleagues during social interactions, influencing their in/visibility choices. We emphasize that these experiences are person-dependent and context-dependent, therefore requiring additional research to understand and support.

## 7 CONCLUSION

Technology-mediated writing is a focal topic in CSCW. Building on a growing subarea about disabled professionals and scholars' lived experiences [21, 36, 84, 104], there is still much to explore about accessibility in writing practices and other technology-mediated communication. Our findings show dyslexic writers navigate the interrelated processes of identifying how tools break down when writing for academic audiences; re-appropriating other tools as language sources; expending social capital to cultivate ad-hoc collaborations for editing help across the range of professional written communication; and navigating ableist expectations for written language.

Drawing from seminal CSCW theory by Star and Strauss [92] about visible and invisible work, we discuss dyslexic writers' experiences with developing technology workarounds and ad-hoc collaborations as a form of invisible work, indicating that current tools and services do not support their needs. To address these issues, we describe opportunities to rethink the design of editing tools, writing services, and peer review practices to make interim writing processes more accessible and reduce ableist bias in judgments of writing. This paper urges future work to continue critiquing and changing everyday work practices to prioritize the participation of disabled colleagues who have been historically minoritized in academia.

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## A PROMPTS FOR 30-MINUTE WRITING ACTIVITY

INSTRUCTIONS: The purpose of this activity is to observe your writing process and then discuss how to improve the design of word processors and other writing tools.

Choose one of the persuasive essay prompts from the list below and write a rough draft. You will have thirty minutes to write. For research purposes, the spell checking and auto-correct features built into Google Docs have been turned off. Afterward, we will re-activate spell check and ask you to walk through how you edit and proofread.

Please let the researcher know if you finish your draft early or if you have any questions.

1. According to some people, elderly drivers should be required to reapply for their driving licenses because with age comes diminished vision, hearing, and reaction time. How do you feel about this issue? Explain what you think should be done and why.

2. Medical researchers, cosmetic companies, and others often perform experiments on animals. Many people feel that experimentation on animals is wrong and should be stopped immediately because animals do feel pain, and there are other alternatives. How do you feel? State your position and explain your reasons.

3. Many of us spend hours in front of our computers and communicate more by e-mail or instant-messaging than in person. Some people believe that this is good because it helps shy people communicate more openly with others. Others believe that computer communication prevents us from developing interpersonal skills and limits our ability to have meaningful relationships with others. How do you feel about this issue? Use specific reasons and examples to support your position.

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