Senior Project Proposal Department of Computer Science Calvin University

Title: AI for Revision **Author**: Jiho Kim **Date**: October 1, 2024

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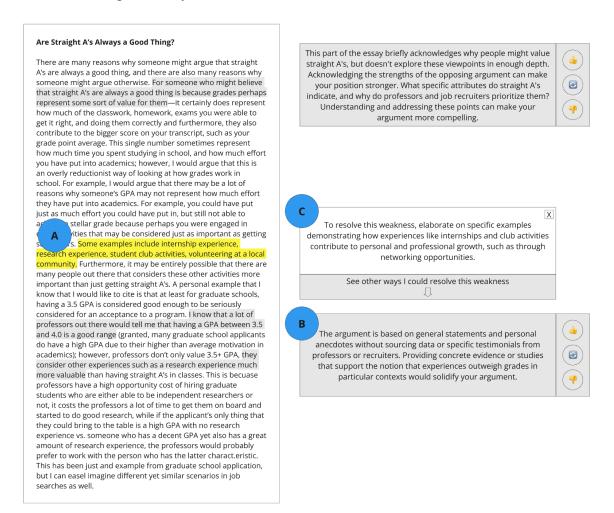


Figure 1. Possible UI affordances at different states of the system. After the user self-evaluates aloud using the voice interface, the system could (A) highlight the related phrase in their text, (B) provide an explanation of why the highlighted phrase might be problematic, and (C) if the user agrees with the AI's explanation of the issue, the system provides a way for them to reflect on how they could resolve it in the next draft.

Background and Problem

Writing effectively to meet readers' needs and expectations is a cognitively demanding task. Often, writers concentrate on their own thought processes rather than the reader's perspective, leading to egocentric prose that mirrors their inner dialogue rather than facilitating effective communication—termed "writer-based" prose [4]. While this type of writing can help writers process their own ideas, such as in freewriting, it prioritizes

self-expression over transforming thoughts into language that suits the reader. To transform "writer-based" prose into "reader-based" prose, writers must revise their text to align with the readers' needs and expectations. This revision process involves self-reflection to identify discrepancies between the intended and actual text, diagnose problems, determine necessary changes, and then implement those changes [3]. Successfully recognizing cognitive dissonance that creates such discrepancies by reading their text from a reader's perspective initiates this process. However, writers' intimate familiarity with their intentions and knowledge of the topic creates a cognitive bias, preventing them from seeing their text as an external reader would [5]. Therefore, there is a need to develop a tool to help writers overcome this bias and effectively revise their writing to meet readers' needs and expectations.

Brief Description of Solution Being Provided

Writing pedagogies commonly used in classrooms and writing centers emphasize self-evaluation (i.e., reflection) as a method of revision [3,9]. However, many people often avoid self-evaluation because they struggle with detaching themselves from their writing, abstracting key points, predicting changes for future drafts, or viewing revision as an opportunity for major improvement rather than minor edits [1]. A study has shown that this stems from low self-efficacy in writing [8], leading to prose that does not serve the needs and expectations of readers. While a related work by Benharrak et al. [2] have explored the potential of AI-generated feedback to promote reflection, studies also indicate that external feedback alone, such as teacher evaluations, is insufficient to foster meaningful self-evaluation [1,6]. To address this gap, I propose a cognitive support system that facilitates guided monologue using a voice interface to enable low-effort self-evaluation. The system will initially prompt the writer to clarify their rhetorical problem through questions focused on audience, purpose, and desired impact. As the writer progresses, the system will also prompt them to think aloud about weaknesses in their writing that do not help solve the rhetorical problem they previously defined. While the writer thinks aloud, the system could provide affordances to help balance attention between global and local issues in their writing, offering insights and highlighting problematic areas based on the writer's reflection (see Figure 1). By tracking revisions, the system will also help reinforce effective editing strategies, promoting engagement with AI and encouraging self-reflection in future drafts.

Research or Development Objective

This is a research project aimed at publication at ACM UIST '25, which traditionally has a full paper deadline in the first week of April. Therefore, Fall 2024 and the Christmas Break will be dedicated to needfinding (potential collaboration with an English professor teaching an introduction to written rhetoric at Calvin), iterative system design and implementation, and formative studies. Spring 2025 will focus on both formative and summative studies, as well as meeting the publication deadline.

Your Interest and Qualifications

This research project builds on a workshop paper [7] that I authored and presented at the HAI-GEN workshop at ACM IUI '24. I am highly motivated to continue this work, as it closely aligns with my research interests in human-computer interaction, an area I intend to explore further, potentially as a graduate student. I have excelled in relevant courses,

including Societal Structures and Education, Oral and Written Rhetoric, African American Literature, Predictive Analytics, Software Engineering, Database Management Systems, Artificial Intelligence and Machine Learning, and Statistics. I gained valuable research experience working with Prof. Ken Arnold during Summer 2023, which led to the publication of the aforementioned workshop paper. Additionally, I further expanded my research experience by working with Prof. Juho Kim and his graduate students as an intern at KIXLAB at KAIST during Summer 2024, resulting in a work that is aiming for publication at NAACL '25. These experiences have equipped me with the research skills necessary to lead this research to a successful conclusion. I plan to dedicate approximately 15 to 20 hours per week to this research project.

Collaboration with Advisor, Outside Experts and Users

I will meet weekly with my advisors, Prof. Anthony Chen and Prof. Ken Arnold, for 30 minutes to receive feedback on my current research direction. Prof. Ken Arnold will be my primary advisor, while Prof. Anthony Chen will serve as an external co-advisor. Prof. Anthony Chen is an Associate Professor of Human-Computer Interaction with appointments in Electrical and Computer Engineering and Computer Science (by courtesy) at the University of California, Los Angeles. He holds a Ph.D. from Carnegie Mellon University, an M.Sc. from the University of Calgary, and a B.Eng. from Zhejiang University. This research will involve extensive needfinding, user studies, and usability testing, focusing primarily on stakeholders such as students and instructors of English composition classes, tutees with appointments in a writing center, tutors working in a writing center, and any users interested in revising a working draft to meet the needs and expectations of their audience.

Resources Required

Resource	Source/Provider	Cash Cost
OpenAI API access	NSF IIS-2246145	\$100
User studies	NSF IIS-2246145	\$400
Total Cash Cost		\$500

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