EcoScript: A Real-Time Presentation Supporting Tool using a Speech Recognition Model

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***Abstract*—Delivering scripted content while maintaining ideal vocal qualities and engaging with an audience during a presentation is challenging. While recent tools use advanced technologies such as VR and AR to support presentations, these can be cumbersome in real presentation environments. To address these issues, we conducted a preliminary survey with 81 participants to identify the desired features when using PowerPoint Presenter Mode. Based on the survey results, we propose EcoScript, a web-based presentation-supporting tool that focuses on real-time voice feedback and script tracking. A user study with 20 participants showed that EcoScript significantly enhances time management, voice modulation, and overall satisfaction, indicating that it effectively resolves common challenges encountered in the presentation process. These results suggest a direction for the future of presentation technology, promoting the development of more accessible and practical presentation support tools.**

***Index Terms*—Public Speaking, Presentation Tool, Speech Recognition, User Experience Design**

I. Introduction

Effective oral communication skills are essential across personal, academic, and workplace settings [1], [2]. These skills extend beyond merely delivering information; they encompass sharing ideas and persuading others, crucial for influencing stakeholders and advancing organizational goals [3]–[7].

However, the presentation process entails numerous challenges, such as time management, effective content delivery, and interaction with the audience [8], [9]. To overcome these issues, various technological support tools have been researched and developed, including automatic oral presentation feedback systems [10]–[12], and real-time presentation feedback using AR glasses [13], [14].

Yet, those AR and VR-based presentation support tools can burden presenters. The weight and discomfort of these devices may hinder user experience [15], [16] and limit their practical effectiveness in real presentation situations. Additionally, presenters need to focus on their presentation content and audience reactions, and having to manipulate additional technical equipment can instead add to their burden in the presentation situation.

Considering the challenges in current presentation technologies, this study proposes a new approach to enhance the overall presentation experience for presenters. To identify design implication of a presentation supporting tool, we first conducted an online survey with 81 university student and asked desired features and challenges before and during a presentation. The survey found that over 80% of respondents pre-write scripts and use these during presentations. They often utilize features like presenter notes to assure they do not make mistakes in public and to reduce the burden of memorizing long scripts. They also used features like elapsed time monitoring, and next-slide preview. Additionally, participants showed significant interest in receiving voice feedback during presentations.

Leveraging insights from the formative survey, we focused on developing a web-based prototype that utilizes voice recognition technology to track the presentation script and provide real-time analysis of the presenter's volume, pitch, and speaking rate through graphs. Our system, EcoScript, enables presenters to track the script using only their voice, significantly enhancing convenience during presentation execution.

As for the evaluation, we validated the effectiveness of EcoScript through a user study involving 20 participants, who reported significant improvements in presentation convenience. This success underscores the advantages of employing advanced voice recognition technologies in presentations, which not only enhance the convenience for the presenter but also increase process efficiency. EcoScript intelligently progresses the presentation based on the completion of the script on the current slide or automatically scrolls through text that exceeds the visible window area. Additionally, the real-time voice feedback graph displayed by EcoScript helped participants maintain a steady voice throughout their presentations.

Based on these results, this study has made important contributions to the development of presentation skills and tools by deeply understanding the difficulties faced by presenters during the presentation process and proposing a technological approach to address them. Advancing this research can create an environment where presenters can concentrate better and communicate their messages more effectively.

II. Related Work

A. Automatic Oral Presentation Feedback System

The automatic oral presentation feedback system is a system designed to improve oral presentation skills. It analyzes various modalities of information obtained from the presenter during the presentation and provides feedback [17]–[19]. These systems have mainly been studied to automatically evaluate the

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presentation or interview skills of students or interviewees and help them practice presentations. For this purpose, they analyze the user's voice and non-verbal behaviors such as gestures and facial expressions to provide feedback [10], [13], [18]. Since presentations are conducted through language, most of the research on automatic oral presentation feedback systems deals with voice analysis [17]–[20]. Our study also follows the current trend of automatic oral presentation feedback systems, providing real-time graphs of common voice analysis features such as volume, pitch, and speaking rate. In addition, this study has adopted the function from previous studies to highlight the part that the presenter has already read, allowing the presenter to make eye contact with the audience and easily return to the original position in the script after the interaction [21]. This helps maintain the continuity of the presentation and allows the presenter to focus more on their presentation. Furthermore, we propose a UI that, instead of displaying the entire script for each slide, presents the script divided into multiple cue cards based on each subheading within a slide. This reduces the presenter's cognitive load [22] and supports smooth presentation while interacting with the audience.

B. Real-Time Feedback During Presentations

Real-time feedback has been demonstrated to significantly impact the development of presentation skills, supporting presenters in real-time adjustments and improvements [10], [12], [13], [23]–[25]. These studies emphasized the importance of non-verbal signals during presentations and explored methods to improve them through a technological approach. For example, Schneider et al. developed a real-time feedback tool to provide users with feedback on their non-verbal communication and demonstrated that this tool could contribute to the improvement of presentation skills [10]. Similarly, Tanveer et al. utilized Google Glass to provide real-time feedback on the presenter's voice volume and speaking rate, which could increase awareness of non-verbal behaviors during presentations [13]. Inspired by these studies, our system provides real-time voice feedback during presentations, helping presenters monitor and immediately adjust their speech volume, pitch, and rate. This approach not only enhances awareness of non-verbal communication but also contributes to more confident and effective presentation delivery.

III. Formative Study: Online Survey

In this section, we describe the design approach for the AI-based presentation aid tool prototype, along with its user interface and key functionalities.

A. Survey Design

We conducted a 12-day survey using Google Forms with 81 participants recruited from university communities. Of these participants, 43 were between 18 and 24, while the rest were aged between 25 and 34. The survey required participants to have experience with preparing and delivering PowerPoint presentations and included 28 questions, taking approximately 5 minutes to complete. Participants were eligible for coffee vouchers through a random draw.

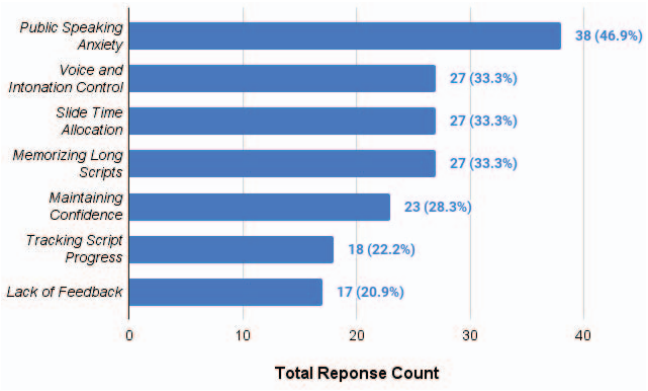


Fig. 1: Challenges in Presentation. Multiple answers were allowed (N = 81).

B. Results

As seen in Figure 1, the survey responses show that 46.9% of participants reported having fear and anxiety about public speaking as their primary challenge, and thus rely on scripts heavily. One-third of the participants reported difficulties in remembering their prepared scripts during delivery. Participants (33.3%) also reported difficulty maintaining appropriate vocal characteristics during presentations. They specified nervousness as hindering their ability to focus on aspects such as speaking pace, tone, and vocal clarity. Furthermore, 22.2% of participants faced difficulty tracking their place in the script after attempting eye contact and gestures to engage the audience, especially with long scripts that required scrolling. Lastly, 20.9% of participants indicated that the lack of instant overall feedback was a challenge. Participants also experienced difficulty in time management.

Hence, presenters' challenges can be condensed into four main categories: anxiety, lack of real-time vocal feedback, content tracking burdens, and time management issues. These findings emphasize the necessity for real-time automated support software to ease presenter challenges.

IV. EcoScript

Based on the identified presenter's needs, we propose the web-based software prototype EcoScript to facilitate time management, real-time voice feedback, and content tracking. The overall user interface is depicted in Figure 2. We utilized React [26] for frontend development and FastAPI [27] for backend server construction.

A. Presentation Slide Control and Presenter Mode Access

The current slide being presented is displayed in the Figure 2c area, allowing presenters to review pre-stored scripts and slides. They can navigate to the next slide using the button in Figure 2d. The button in Figure 2b allows the user to start or stop functions such as the timer, script tracking, voice analysis and feedback.

Fig. 2: A screenshot example of the user interface: (a) timer progress bar area, (b) presentation mode start/stop button, (c) current slide area and preview board, (d) slide page control buttons, (e) real-time voice feedback graph area, (f) cue cards and script tracking area, and (g) cue card font and page control button area.

B. Countdown-Style Timer

As shown in Figure 2a, EcoScript employs a countdown approach rather than the conventional count-up method used in other presentation software. Presenters can intuitively monitor the time elapsed relative to the designated presentation time through a progress bar.

C. Real-Time Voice Feedback

The key elements of vocal feedback we focused on are pitch, volume, and speed. All voice features are updated in real-time on the feedback area as bars. Voice pitch is manually adjusted within the normal range of 50Hz to 250Hz for males and 120Hz to 350Hz for females based on prior studies [28], [29]. To analyze the presenter's voice features, during the presentation, we used a Praat Python Library [30]. This library enables the analysis of the voice volume and pitch of the speaker's voice. Speed is calculated at 0.5 seconds per word, measured by the words per second analyzed through the Google Cloud Speech to Text(STT) API. The area in Figure 2e shows real-time feedback graphs of voice features like volume, speed, and pitch. The bars of the graph are divided into a total of 8 sections to represent the degree of numerical values. If sections 1, 2, 7, and 8 of the graph are colored, they indicate abnormal values and are displayed in red. Sections 3 through 6, when colored, represent optimal values and are shown in green.

D. Script Tracker

The presenter's voice is converted into text via the Google Cloud STT API [31] and matched in real-time with the pre-saved script. As the spoken words align with the script, the corresponding text is highlighted in the 'Your Script' area of Figure 2. Words already read are grayed out, and the next three words are highlighted in yellow. The scroll adjusts automatically to keep the referenced line visible. Once all the text on a cue card is read, it advances to the next cue card automatically, allowing the presenter to focus on the presentation without manual navigation. Note that the EcoScript does not track presenter's speech if it is not on the script such as when answering questions. Additionally, the system improves script management efficiency by breaking the script into multiple subheadings instead of showing the entire script on a single slide. This enhances the presenter's ability to recall content easily, improving both the flexibility and the level of attention. Presenters can navigate to the next cue cards in case of voice recognition errors. These controls are located in Figure 2.

V. Evaluation

We evaluated Ecoscript in terms of convenience, effectiveness, and user experience compared to Microsoft PowerPoint through a within-subject study with 20 participants. Since most participants in the formative study used MS PowerPoint, it was chosen as the comparison platform.

A. Participants

Participants averaged 23.8 years old (12 female, 8 male), mainly university students, including some working professionals and graduate students. Selection criteria included no visual or auditory impairments, prior experience with PowerPoint's presenter mode, and familiarity with preparing presentation scripts.

B. Experiment Settings

We used Tobii Pro Glasses 3 wearable eye tracker to monitor eye movements, focusing on screen areas and audience eye contact during presentations. Two 5-minute presentations from Stanford University's 2022 HCI course lecture slides (CS147)[1] were provided, covering "Early Stage Prototyping" and "Design Thinking Process for User Experience Design." Two laptops were used for the presentations: one with EcoScript and the other with Microsoft PowerPoint. To create a realistic presentation environment, the presentations were projected onto a screen, and audience pictures were placed in front.

C. Procedure

Participants received a 5-minute presentation slide and script PDF in advance to familiarize themselves with the content. Upon arrival, they received a brief tutorial on EcoScript and Microsoft PowerPoint presenter mode.

Before starting, participants were instructed to maximize eye contact with the audience, maintain an ideal voice level, and keep within a five-minute limit. Presentation order was counterbalanced. Participants were immediately asked to rate their experience using a 7-Likert scale to gather their opinions on each tool.

VI. Results

A. Ideal Ratio for Volume, Speed and Pitch

Based on the collected logs, we assessed the proportion of the duration where each of the following metrics was considered ideal (see Section IV-C) over the entire presentation time:

[1]https://hci.stanford.edu/courses/cs147/2022/au/

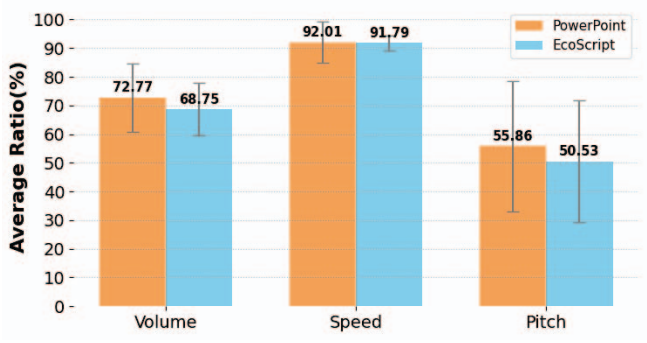


Fig. 3: Average ratio of ideal voice features (i.e., volume, speed, and pitch). Error bars indicate standard deviation.

volume, speed, and pitch. The result is shown in Figure 3. While we expect to see higher ratio with EcoScript than PowerPoint, the difference between the two conditions were not significant based on Wilcoxon signed-rank test.

B. Audience Interaction: Eye Contact

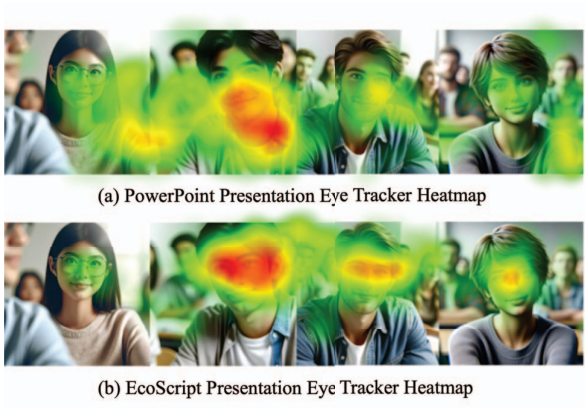
Figure 4 shows the gaze tracking logs as a heatmap during the experiment when participants looked at the audience's photo. Note that the color becomes progressively more red if participants glanced at the location more frequently and for longer duration throughout the recording.

Both PowerPoint and EcoScript had similar numbers of eye contacts, but EcoScript maintained these contacts for a longer duration. This suggests that EcoScript is more likely to enable quick identification of key segments in the script in real-time, allowing presenters to focus more on the audience and maintain engagement.

C. Subjective Ratings

Unlike the objective metrics (i.e., the ideal ratios), Wilcoxon signed-rank tests showed that EcoScript was considered significantly better than PowerPoint for all five metrics ($p < .001$ for all). The results are shown in Figure 5.

1) Efficiency in Presentation Time Allocation (Time): Participants perceived that it is more efficient to manage time with EcoScript than PowerPoint. The average rating was 5.50


(a) PowerPoint Presentation Eye Tracker Heatmap

(b) EcoScript Presentation Eye Tracker Heatmap

Fig. 4: An example of eye tracking analysis comparison of P8

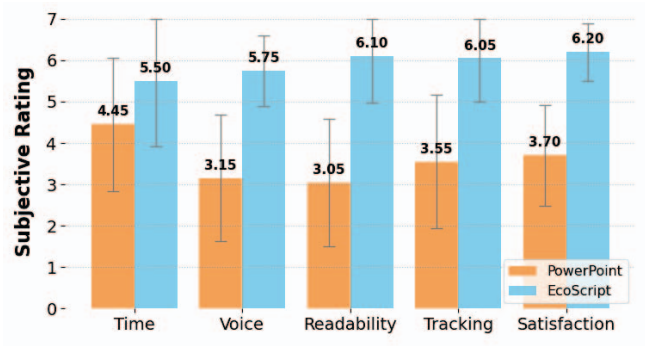


Fig. 5: Average scores in terms of subjective metrics; higher the better. Error bars indicate standard deviation.

(*SD=1.57*) for EcoScript which was significantly higher than the average of 4.45 (*SD=1.61*) for PowerPoint.

EcoScript received positive feedback for this metric for its visual aids of displaying the remaining time. In contrast, PowerPoint participants reported that it is difficult to manage time as having to check the time, which results in mental strain and disruption while checking the script.

2) Stability of the Presenter's Voice (Voice): EcoScript was rated higher for voice stability, with an average score of 5.75 (*SD=0.85*) compared to the average of 3.15 (*SD=1.53*) for PowerPoint, indicating that participants felt that EcoScript help them maintain more consistent voice quality.

Participants highly valued the real-time voice feedback of EcoScript. They appreciated the visual feedback for reducing nervousness and boosting self-confidence. However, some mentioned challenges with the rapid movement of the feedback bar.

3) Ease of Reading Long Scripts (Readability): Again, EcoScript received the average score of 6.10 (*SD=1.12*) for the readability of the script which was significantly higher than that of PowerPoint ($M = 3.05$, *SD=1.54*).

Most Participants appreciated the cue card format and voice-activated screen advancement, which allowed them to focus on the audience without controlling the script manually. This setup facilitated appropriate pauses with automatically advancing small paragraphs.

Moreover, participants mentioned that the combination of automatic scrolling and visual highlighting made it easier to manage lengthy scripts, enabling smooth content delivery.

4) Ease of Tracking the Script Position (Tracking): EcoScript scored higher for ease of tracking script position, with an average of 6.05 (*SD=1.05*) compared to the average of 3.55 (*SD=1.61*) for MS PowerPoint.

With MS PowerPoint, participants manually checked their script position, often losing their place while making eye contact. In contrast, EcoScript's automatic tracking and highlighting features reduced this stress, aiding smooth presentation flow.

Especially, participants appreciated quickly locating their position in the script after eye contact. However, challenges included estimating remaining time without knowing the num-

ber of paragraphs left and needing adjustments for speech recognition errors.

5) Overall Satisfaction (Satisfaction): The overall satisfaction with EcoScript was significantly higher, as reflected by an average score of 6.20 (*SD=0.70*) compared to that of PowerPoint (*M=3.70; SD=1.22*). Participants responded that the enhancements offered by EcoScript, including real-time feedback and automatic scrolling, contributed to this result as reasons for their survey responses.

Additionally, participants expressed a demand for features such as additional functionality to facilitate interaction with the audience, a stopwatch feature for practice purposes, a feature to display key points on cue cards, and a memo function. Furthermore, some participants reported feeling some fatigue from the real-time feedback. As a result, they responded that they only occasionally referred to the feedback to avoid disrupting their concentration. Another finding was that participants used free gestures instead of frequently manipulating the mouse or keyboard, as they relied on the automatic script tracking feature.

VII. Discussion

A. Cognitive Load of Real-Time Feedback

Real-time feedback can improve the presentation quality by allowing participants to objectify their performance immediately [13], [32]. However, this feedback sometimes leads to fatigue. Some participants found it difficult to assimilate real-time feedback while presenting. One noted feeling overwhelmed as EcoScript frequently updated vocal parameters like volume, speed, and pitch. Despite this, they recognized the benefit of understanding their vocal statistics. Participants appreciated the real-time feedback during the presentation because it improved the ease of reading long scripts, made it easier to track the script position, and enhanced overall satisfaction. However, some found it disturbing to focus on the script. Considering that intermittent feedback on voice features are known to be more effective than continuous feedback [13], we plan to investigate the optimal frequency and timing of providing feedback to prevent any potential cognitive overload.

B. Comparative Analysis of Voice Features Stabilization

We hypothesized that participants would make presentation with more ideal voice metric with EcoScript than the baseline condition with real-time feedback. However, as shown in Figure 3, log analysis revealed similar average voice features for both tools, consistent with considerations of cognitive overload. Despite similar objective measures, subjective feedback were more positive towards EcoScript than the baseline; participants stated that EcoScript's feedback helped refine their presentation style and boosted confidence. This indicates that EcoScript's real-time feedback enhances metacognitive awareness, facilitating better voice control and increasing presenter confidence reflecting the metacognitive theory [33], which relates to understanding and regulating one's cognitive processes.

C. The Need for Hands-Free Solutions

Our study validated EcoScript's automation features in real-time presentations. Features like automatic scrolling of cue cards and slide transitions aligned with the presentation script enable presenters to use natural gestures. Inspired by prior research [34] that enabled hands-free interaction for presentation control, we plan to explore other ways to support hands-free interaction such as voice-driven screen management as discovered in our study. For instance, the system can detect voice commands like "next, please" for slide transitions. We expect this tailored automation to enhance audience interaction and improve non-verbal communication, making presentations more natural and engaging for both presenters and audiences as found in [11], [21], [23].

D. Limitations

Our study has the following limitations. First, the accuracy of speech recognition is not perfect, leading to potential errors in script tracking and causing confusion during presentations. Additionally, our experiments were conducted in a controlled, low-noise environment. However, to ensure robustness in real-world situations, noise-canceling techniques need to be added. Second, while we provided ideal voice feedback metrics to Korean speakers using standard language, it is necessary to consider feedback that reflects diverse vocal attributes, such as nationality and dialect. Additionally, people who speak English as a second language or with a specific accent may find it challenging to use our system accurately due to speech recognition limitations. Lastly, the experiment focused primarily on enhancing presenters' skills, so evaluations were mostly conducted from the presenter's perspective, not from the audience's standpoint.

VIII. Conclusion

This study analyzed the difficulties faced by presenters and proposed a solution in the form of a software prototype called EcoScript. We identified key issues such as anxiety, lack of feedback, and difficulty in tracking content during presentations. To address these, we proposed EcoScript, which utilizes voice recognition technology to track scripts and provide real-time feedback on voice characteristics. Through user testing, EcoScript was found to enhance the convenience and overall quality of presentations using voice control. In conclusion, our research highlights the significance of leveraging voice recognition technology to provide real-time support to presenters during presentations, paving the way for advancements in presentation support tools.

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