

Investigating Gaze Anchors: Effects on Gaze Movements and Online Communication

Atsuto Kurokochi¹[0009-0008-2314-9728], Koki Yanagii¹[0009-0004-1224-5053],

Kazuyuki Iso²[0009-0003-0807-4143], Masayuki Ihara³[0000-0002-7175-2352],

and Minoru Kobayashi¹[0000-0001-6737-1736]

¹ Meiji University, 4-21-1, Nakano, Nakano-ku, Tokyo, Japan

² Tokyo Information Design Professional University, 2-7-1, Komatsugawa, Edogawa-ku,
Tokyo Japan

³ RIKEN, 1-7-22, Suehiro-cho, Tsurumi-ku, Yokohama, Japan
{atsuto.kurokochi, koki.yanagii}@koblab.org,
iso@tid.ac.jp, {ihara, minoru}@acm.org

Abstract. Online meeting systems present the challenge of making communication more difficult. Since gaze is closely related to communication in face-to-face environments, we believe that clarifying the role of gaze in online communication may contribute to improving interaction in online meetings. Based on the findings of our previous study, we considered that gaze anchors play a more prominent role in online meetings than in face-to-face interaction and thereby facilitate online communication. We conducted an experiment with three conditions to investigate our assumption. The results of the experiment suggest findings that may support the effects of gaze anchors.

Keywords: Gaze Anchors, Gaze Analysis, Online Communication,

1 Introduction

1.1 Background

Online meeting systems make communication more difficult than face-to-face interaction because they reduce nonverbal cues such as gaze, body language, and shared physical space [1]. As gaze plays a key role in face-to-face communication, particularly in turn-taking [2, 3], clarifying its role in online meetings may help improve online communication.

1.2 Our Previous Study

To investigate the role of gaze in online communication, we conducted two experiments on gaze behavior before turn-taking in video meetings [4, 5]. Although they revealed several gaze patterns, the findings were inconsistent. This suggests that gaze behavior may have different characteristics in online and face-to-face communication.

2 The Concept of Gaze Anchors in Online Communication

We present the concept of gaze anchors. The concept assumes that gaze requires a focal point. When it exists, it provides a stable destination for gaze, eliminating the need to search for where to look.

We assume that gaze anchors exist in both face-to-face and online communication. However, the role of gaze differs between the two settings. Whereas gaze primarily facilitates the prediction of turn-taking in face-to-face communication, its involvement in turn-taking is not clearly observed in online communication. This difference suggests that other roles of gaze may become more prominent in online communication than in face-to-face communication. We considered that maintaining gaze on gaze anchors is one of the roles and thereby supports online communication.

To provide a theoretical basis, we review previous research on visual search. Yang et al. [6] showed that people continue gaze movements even when no target is present. Attar et al. [7] reported that the progress of visual search increases cognitive load. These findings suggest that gaze stability may reduce cognitive load. This reduction is expected to facilitate activities that rely on cognitive processes, such as communication.

3 Experiment

3.1 Overview

We conducted an experiment to investigate the effects of gaze anchors. 12 students (3 graduate and 9 undergraduate, 6 males and 6 females) from same Japanese university and laboratory participated in the experiment in 3 groups of 4 members. The meetings were conducted using a browser-based online meeting system on 13-inch laptops. We informed participants that their gaze, utterances, and videos were recorded using an eye tracker (Tobii Pro Glasses 2, 3 [8, 9]) and camera, and obtained their consent.

Each group participated in three 10-minute meetings with different discussion themes. Participants were not allowed to operate computers during the experiment. After each meeting, participants completed an online questionnaire consisting of 13 items to provide subjective evaluations and comments.

3.2 Experimental conditions

In this experiment, we compared the following three conditions: Video-On, Video-Of, Self-View (Fig.1). We focused on video images because they can be easily integrated into existing video meeting systems. In addition, video images carry social meaning in online communication and can serve as gaze anchors. Especially, self-view tends to attract users' gaze [10] and was therefore expected to serve as a stronger gaze anchors. The difference among the three conditions is the presence, absence, and amount of video images. By comparing these conditions, we aimed to investigate how video images function as gaze anchors and affect participants' gaze movement. Other elements that could serve as gaze anchors, such as shared materials, were excluded because they could confound the comparison among conditions.

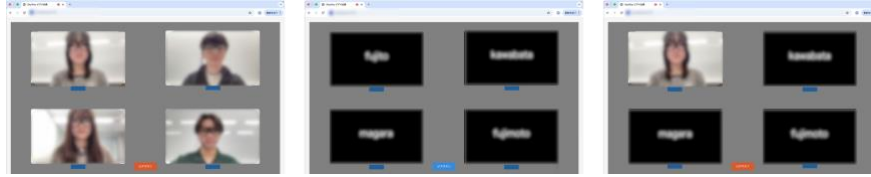


Fig. 1. Images of the online video meeting system. Videos of participants are displayed in three conditions. Video-On (left), Video-Off (center), and Self-View condition(right).

3.3 Results

The Friedman test was used for each analysis, and the Bonferroni method was used for post-hoc multiple comparisons. The significance level was set at $\alpha=0.05$. For the questionnaire item, "It was easy to speak up throughout the entire discussion," a significant difference was found between the Video-On and Video-Off conditions ($p=0.003$).

Gaze data was analyzed using Tobii Pro Lab [11]. For each dataset, five areas of interest (AOIs, i.e., areas where participants were likely to look) were defined, and these were defined based on first-person perspective photographs. The five areas of interest included the self-view, the three participant video areas and other. To investigate gaze fixation characteristics in each condition, we analyzed the average fixation duration (the average duration of fixations within the AOI). The Friedman test revealed a significant difference between the Video-On and Video-Off conditions ($p=0.006$).

4 Discussion

4.1 Implications from the Experiment for Gaze Anchors

The gaze analysis results showed that the average fixation duration was longer in the Video-On condition than in the Video-Off condition, suggesting more stable gaze movements. In addition, the questionnaire results indicated that participants found communication easier in the Video-On condition. Although the relationship between these findings cannot be conclusively determined, three participants commented that they "did not know where to look" in the Video-Off condition, and these comments suggest that the two findings may be related and may also support the effects of gaze anchors in online communication. The Self-View condition did not differ significantly from the other conditions, and participants' unfamiliarity with this specific screen configuration may have been one contributing factor.

4.2 Limitation

The participants were familiar with each other, which may have influenced the results. In addition, the experimental meeting design differed from actual meetings, where shared materials and flexible screen layouts are often used. The results should also be interpreted with caution because the dataset consisted of only 12 participants and the proportion of valid eye-tracking data was below 100%.

5 Conclusion

In this study, we proposed an assumption regarding the characteristics of gaze anchors in online communication and investigated it through experiments. We conducted a comparative experiment involving three conditions. The findings may support the proposed assumption. For future work, we plan to conduct experiments that more closely reflect actual meetings while addressing the limitations discussed above, such as participants' familiarity and data reliability. Based on the findings obtained from these experiments, we aim to further investigate the effects of gaze stabilization on online communication and apply these findings to the design of online communication support tools.

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