

# Gaze-Point Analysis of EFL Learners while Watching English Presentations: Toward Effective Teaching

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*Various studies point out the importance of eye contact for effective presentations. This research aims to cross-analyze the number of times presenters made eye contact with the gaze points of the audience during two English presentations to obtain useful information for teaching and learning English presentations in English as a Foreign Language (EFL) classrooms. Although there are many studies on presenters' eye contact and subjective evaluation by audience, only a few include an objective analysis of audience behaviors. This research used an eye-tracking system to analyze the gaze points of 16 participants (audience) watching two English presentations. After recording the gaze points, the heat maps and time-series graphs of the gaze points were extracted. The results show that the audience tend to stop watching a presenter who makes little eye contact in the first 26 seconds of the presentation. These results are expected to provide resource for EFL teachers to develop more detailed instructions and materials on delivery skills.*

*Keywords: EFL, ELT, Eye contact, Gaze-Point Analysis, Presentation*

## Introduction

### Background

Globalization has increased the importance of speech and presentation skills in teaching and learning English language in English as a Foreign Language (EFL) environments. The importance of public speaking skills has been pointed out in situations where English is actually used, such as in international business settings (Fujita, Yamagata & Takenaka, 2009; Fuyuno, 2015). Under these circumstances, it is expected that EFL learners will have more opportunities to deliver public speeches in English as well as their native languages.

The need for effective public speaking education has increased alongside the need for English public speaking skills. According to the Common European Framework of Reference for Languages (CEFR), production is one of the key skills on the communicative language skill frames (Council of Europe, 2018). The CEFR provides language competency scales for various learning levels. For example, for CEFR B2 level, production activities include “Can give a clear, systematically developed presentation, with highlighting of significant points, and relevant supporting detail.” and “Can give a clear, prepared presentation, giving reasons in support of or against a particular point of view and giving the advantages and disadvantages of various options” (Council of Europe, 2018, p. 74). The teaching materials provided by the Council of Europe also provide task examples for presenting opinions in each proficiency level (Goullier, 2007). In 2018, the CEFR incorporated a new concept “mediation”. It defines skills for placing appropriate opinions on sensitive topics in situations such as public meetings and professional meetings (Council of Europe, 2018, pp. 220-221).

Other examples can be seen in Japan where English has been taught as EFL in official schools. Japan has conducted National Center Test for University Admissions since 1990 as a standardized examination for university entrance. Although the English module in the test still consists of reading and listening questions, the need for a system that appropriately evaluates practical English skills, including speaking skills, has been discussed in the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT). The ministry plans to utilize English tests that have speaking components such as conversation and speech in a few years (MEXT, 2017). In some universities, private standardized tests such as TOEFL and IELTS are already used to measure English language ability during the admission process. In the near future, it is likely that more universities will impose oral examinations such as speeches and interviews in light of the growing globalization. MEXT also revised national Courses of Study for official school curricula in 2017. For example, the new guidelines for English modules in primary and secondary education set “speech/presentation” as one of the major skill objectives. They also emphasize the development of oral communication skills and established new modules that specialize in strengthening productive speaking skills (MEXT, 2019).

As the above examples show, public speaking skills have become part of major learning goals for EFL learners. However, EFL learners find it difficult to speak publicly in English. Public speaking is a prime trigger of social phobia, and previous studies in the field of psychology have shown that many people, regardless of nationality or generation, feel anxious about public speaking (Kessler, Stein & Berglund, 1998). In addition, public speaking is a difficult task to teach in English language teaching (ELT) classrooms. It has been widely pointed out that delivery skills such as eye contact, speech speed, and gestures play important roles in the effectiveness of public speaking (Griffin, 2011; Sellnow, 2004). Although there are various textbooks on public speaking in English, many of them focus on content organization and less on delivery skills. In cases where advice on delivery skills is provided, they tend to be ambiguous or subjective such as making eye contact as much as possible. Furthermore, no objective indicators that teachers and learners can share as goals appear in many cases (cf. Griffin, 2011; Jaffe, 2012; Sellnow, 2004). For example, there are insufficient descriptions of how to actually make effective eye contact, how often, and in what direction (cf. Elwood, 2015; Jaffe, 2012). More objective data analyses are needed in this aspect.

Many studies have examined the relationship between the characteristics of delivery factors of English public speakers and a subjective assessment by their audience (Fuyuno, Komiya & Saitoh, 2018; Fuyuno, Yamashita, Kawase & Nakajima, 2014; Fuyuno, Yamashita & Nakajima, 2016). However, only a few quantitatively analyzed the objective behavior of audiences. Information on how much audiences actually look at a public speaker and how speakers' eye contact affects their behavior will be useful for the development of teaching materials and teaching methods. For example, when a teacher plans to instruct students how to make eye contact in detail, one of the goals of the instruction is to foster (presenting) students' skills to effectively guide audience eye movements. This underlies the present study's focus on gaze-point analysis of EFL learners (audience) while watching English presentations.

Gaze-point analysis is a method widely used in various academic fields such as computer vision, multimedia communication, and educational technology. There are many studies on website/application development that aim to improve usability by analyzing users' gaze points (Goldberg, Stimson, Lewenstein, Scott & Wichansky, 2002; Granka, Joachims & Gay, 2004). Eye-tracking technology can detect and record the gaze points of participants in a chronological order, thus enabling researchers to analyze user behavior during on-screen tasks. In the field of educational technology, there have been many studies on visual materials to examine the relationship between multimedia slides and learners' gaze points. Yang, Chang, Chien, Chien and Tseng (2013) analyzed how students gaze at texts and pictures of visual materials used by a teacher in a classroom. Their results showed that the students concentrated more on the textual content. Slykhuis, Wiebe and Annetta (2005) analyzed how students react to science-related photographs in a classroom setting. In their experiment, participants were shown a PowerPoint presentation with embedded photographs that were classified according to their information roll characteristics. Their results indicated that complimentary photographs received significantly more attention from the participants than other types of photographs.

In the context of foreign language teaching, eye tracking has been used mainly in the field of learners' reading and writing skill analysis (Anson, Rashid Horn & Schwegler, 2009). For example, Bax (2013) has analyzed types of words EFL learner look at during an English reading activity, and the ways in which their gaze points move in a reading section when taking an English examination such as IELTS. In addition, there has been a study that combined videos and eye tracking technology. Winke, Gass and Sydorenko (2013) examined how L2 learners read captions when watching video in target language by performing eye tracking analysis. Regarding the use of multimedia data with eye tracking technology, as described above, gaze-point analysis has also been widely used in academic research on educational technology (Yang et al., 2013). However, studies on teaching public speaking with a focus on the gaze points of audience are scarce.

As the previous studies show, the eye tracking technology has already been established and applied to research of foreign language teaching and educational technology. Examinations of these previous studies led authors to conceive the possibility of applying eye tracking technology for analysis of audience behavior in public speaking. If the method is applied, it enables us to perform a concrete and objective analysis of when audience watches at the speaker, and also to cross analyze speakers' eye contact behavior with gaze points of audience. If such data are obtained, it will be useful information for EFL teachers in teaching students when and how to make eye contact in a presentation.

In this study, we prepared English presentation videos with two speakers who maintained different eye contact levels, asked the participants (audience) who are EFL learners to watch the videos, and recorded the gaze points of each participant. In previous studies that analyzed the subjective evaluation of the audience, speakers' eye contact was regarded as one of crucial factors that determine the quality of overall performance. The present study aims to provide objective verification of how speakers' eye contact affects audience behavior.

## **Purpose of the Study**

The purpose of this study is to examine the following points based on the background provided in the previous section. Details of each research question is described below.

1. Do the audience watch a speaker more if the speaker maintains eye contact? (RQ1)
2. Are there changes in the gaze-point characteristics as a presentation progresses? (RQ2)
3. Does the audience's subjective evaluation of speakers' eye contact and the subjective evaluation on overall presentations differ depending on speakers' eye contact amount? (RQ3)

Regarding RQ1, previous studies have shown that the higher the number of eye contact a speaker makes, the higher the subjective evaluation of their impression and performance by the audience (Fuyuno et al., 2014; 2016). However, the relationship between speakers' eye contact and the audience's gazing behavior is yet not clear. Therefore, we aim to analyze when and how the audience is actually watching speakers by using presentation videos of two speakers with varying number of eye contact made. The results are expected to be concrete information for developing more detailed teaching materials and instructions for teaching delivery skills in EFL classrooms.

Regarding RQ2, since gaze points are recorded as time-series data in an eye-tracking analysis, we can specifically analyze the characteristics of audience's gaze points chronologically as a presentation progresses. In this study, time-series graphs of eye-tracking results are extracted to ascertain if the audience's gaze behavior changed throughout the presentations. The changes, their characteristics, and when they occur in relation to the presentations can become focal points in education.

Regarding RQ3, previous studies have found a relationship between the audience's subjective evaluations of speaker's eye contact and of the overall presentation. Although the purpose of this study is to analyze audience's objective behavior through gaze-point analysis, a subjective evaluation questionnaire was also administered to examine the relationship between the results of the gaze-point analysis and the subjective evaluation.

## **Method**

### **Movie Data**

The presentation videos used for the experiment were filmed at a foreign language presentation contest held by a Japanese university. During the contest, speakers who passed a preliminary screening took the stage. The screening was based on scores given to essays which the registered students had submitted. Thus, the quality of the contents, the grammatical/lexical complexity of the passages, and the English proficiency of the speakers were controlled at a certain level. The camera used was fixed on a tripod and the presentations were shot from the same position, angle, and resolution. In the present experiment, presentation videos by two speakers are used. Hence, they will be referred to as Movie A and Movie B respectively. Movies A and B were chosen because of the difference in the number of times the speakers made eye contact. To unify the conditions, only the first three minutes of each presentation was used. The themes of the presentations were about train rail system (Movie A) and technology and war (Movie B). The two speakers were both engineering majors.

The presentations were held in a large university classroom and scored by a panel of three judges sitting in front of the speakers. None of the authors was on the panel. The four evaluation items are: content, composition, English

fluency, and delivery. In the scoring for delivery, which included evaluation of eye contact, Movie A received 57.7 points out of 100, while Movie B received 85.5 points. We also quantitatively analyzed the number of eye contact made by using the multimedia annotation platform ELAN which was developed at the Max Plank Institute for Psycholinguistics. Two annotators independently annotated the frequency and length of eye contacts in the videos. Table 1 shows the results. The frequency was consistent among the annotators. For the duration data, average values of the two annotators are used. The speaker in Movie B had higher frequency and maintained eye contact for longer than the speaker in Movie A.

Table 1  
*Eye contact frequency and duration in Movies A and B*

Movie	Frequency of eye contact per minute	Total duration of eye contact per minute (sec)	Average duration of eye contact (sec)
A	8.5	15.0	1.7
B	13.5	31.9	2.3

For both movies, the speakers used slide materials on an equipped screen. The positional relationship of the screen and a podium for speakers in the frame of the videos and a sample screenshot from the movie are shown in Figures 1 and 2.

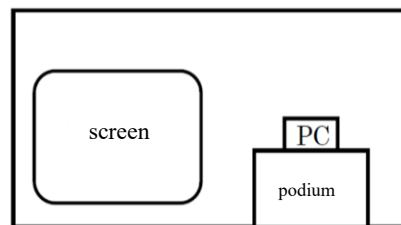


Figure 1. The positional relationship of the screen and a podium for speakers



Figure 2. Sample screenshot of presentation movie

## Experiment Devices

Movies A and B were played on a 23-inch flat monitor screen and participants' gaze points were recorded using a Tobii Eye Tracker 4C (Figure 3). The distance between the screen and participants was approximately 60cm. The Tobii Eye Tracker 4C is a screen-based eye tracker that uses pupil center corneal reflection. The device is used by attaching on to the monitor screen. The device offers advanced image-processing algorithms and enabled us to estimate the position of the eye in space and the point of gaze with high accuracy. It is reliable and widely used for academic research in various fields (cf. Girardi, Lanubile, Novielli & Fucci, 2018; Veliyath, De, Allen, Hodges & Mitra, 2019).

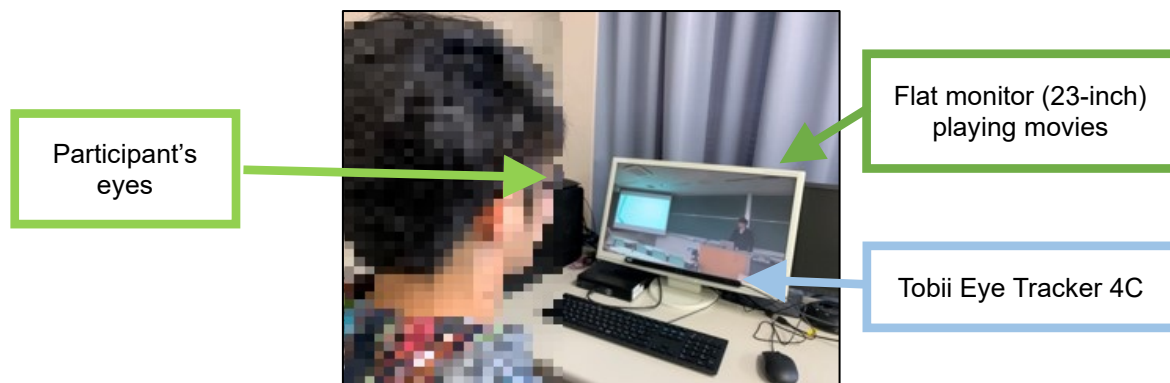


Figure 3. Setting of devices during the experiment

## Participants

The participants were 16 Japanese EFL learners. They are university students aged 20–22 who are not majoring in English. All participants joined the experiment voluntarily.

## Procedure

The experiment was performed in a laboratory with one participant at a time. First, the participant was given an overview of the experiment and calibrated the device alongside the experiment coordinator. The eye tracker needs to be calibrated to detect the eyes of each participant and confirm if it was tracking appropriately. In this experiment, the calibration successfully tracked all 16 participants without any need for a repeat trial. After the calibration, the presentation movies were played one after the other. Participants answered a questionnaire after watching each movie. To control the order effect, Movies A and B were played in a random order to each participant. The outline of the experimental procedure is shown in Figure 4.

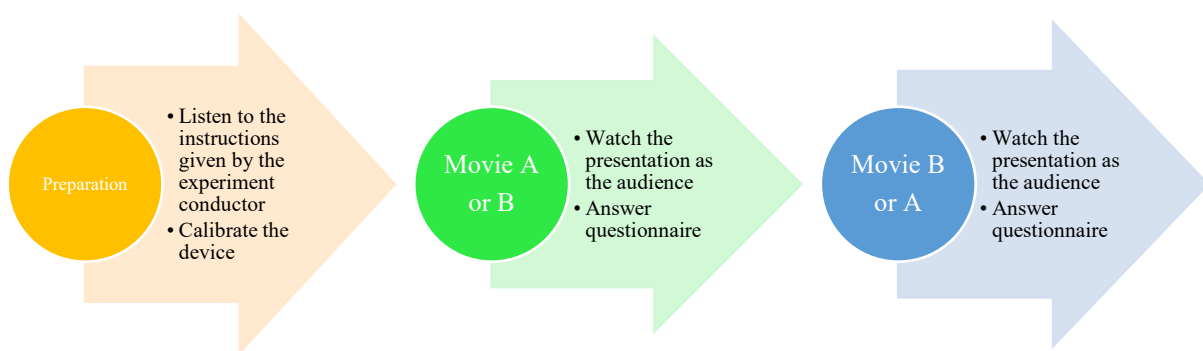


Figure 4. Outline of the experimental procedure

## Questionnaire

The questionnaire consisted of five items with five-point Likert scales and an optional free comment space on an A4 sheet (Figure 5). The original questionnaire was administered in Japanese. The items were translated to English by the authors. This study discusses the results of the "eye contact" and "overall impression" from the questionnaire.

For each item, please select a number that is the closest to your impression. (1:Poor, 3: Average, 5:Excellent)					
Way of speaking :	1	2	3	4	5
Gesture :	1	2	3	4	5
Eye contact :	1	2	3	4	5
Organization (if the presentation was easy/hard to follow) :	1	2	3	4	5
Overall impression :	1	2	3	4	5
Any comments? :					

Figure 5. Sample of the questionnaire sheet

## Result

Firstly, regarding RQ1 "Do the audience watch a speaker more if the speaker maintains eye contact?", gaze rates directed toward speakers were calculated. It was figured as the ratio of total gazing time directed toward speakers to total analysis time.

Table 2  
*Gaze rates directed toward the speakers by each participant*

Participant	Gaze rate directed toward speaker in Movie A (%)	Gaze rate directed toward speaker in Movie B (%)
1	39	59
2	42	62
3	19	61
4	32	49
5	26	58
6	32	65
7	12	49
8	45	45
9	58	83
10	44	51
11	34	60
12	33	59
13	29	55
14	24	61
15	14	47
16	30	43
<i>Mean</i>	32.15	56.67
<i>(SD)</i>	(4.76)	(11.92)

Movie B received a higher rate for gaze points from 15 out of the 16 participants. We performed a t-test on the data and it was confirmed that there is a significant difference at significance level of .01 in the gaze rates for Movie A ( $M = 32.14$ ,  $SD = 4.76$ ) and Movie B ( $M = 56.66$ ,  $SD = 11.92$ );  $t(15) = -8.572$ ,  $p < 0.001$ . Figure 6 shows a graph of the speaker gaze rates of the 16 participants.

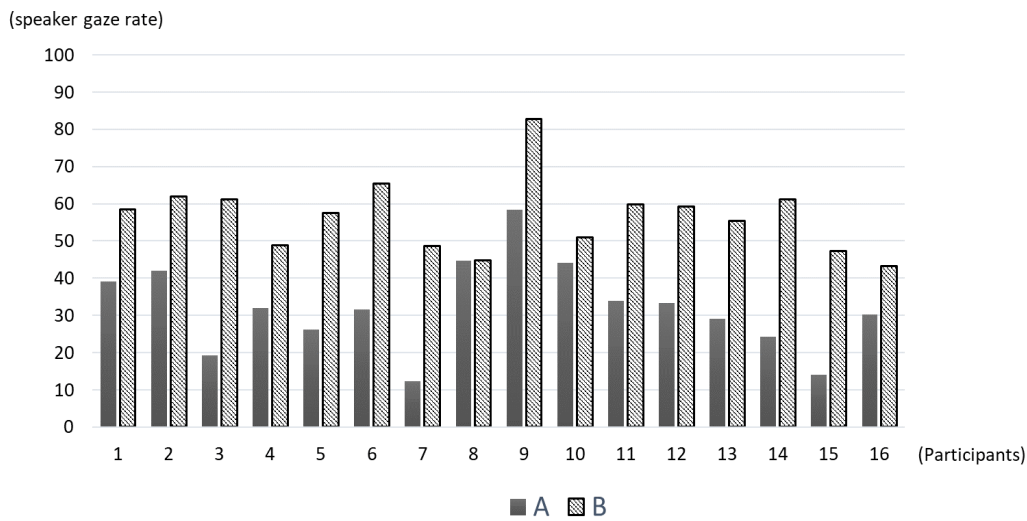


Figure 6. Participants' gaze rates

Figure 7 are heat maps that integrate all 16 participants' gaze points. The parts gazed at more are displayed in a red. While the screen (on the left side) and the speaker (on the right side) are watched in Movie A, the speaker was obviously gazed at more than the screen in Movie B, suggesting that the difference in the number of time the speakers make eye contact caused a difference in audience gaze points.

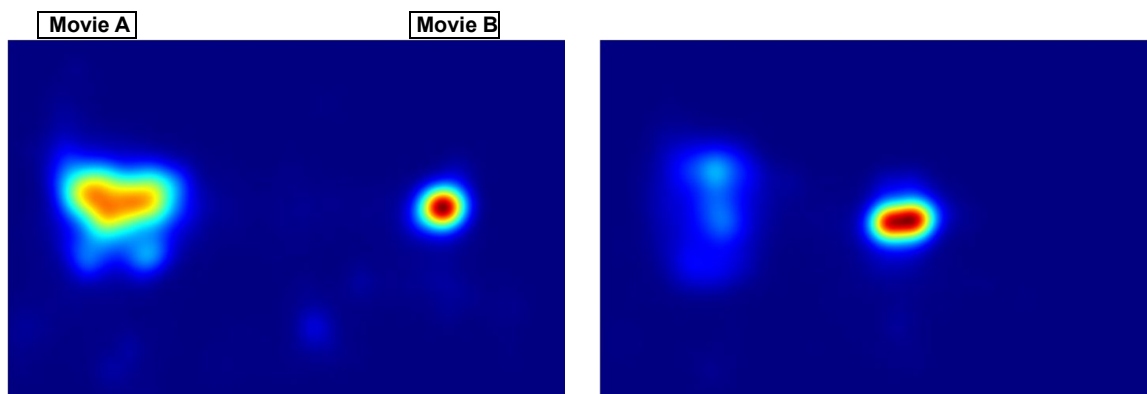


Figure 7. Heat maps of all participants' gaze points (left: Movie A, right: Movie B)

Regarding RQ2—“Are there changes in the gaze-point characteristics as a presentation progresses?”—Figure 8 shows the gaze points of all 16 participants on the x-axis. The red lines represent averages. As mentioned earlier, a screen was positioned on the left and a speaker to the right in the video frame (cf. Figure 1). It was possible to observe which one of the right or left was watched at each time stamp in the eye-tracking analysis results by extracting the gaze points on the x-axis. In Movie A, participants tended to gaze away from the speaker after about 30 seconds into the presentation. On the other hand, in Movie B, the speaker was continuously watched as well as the screen.

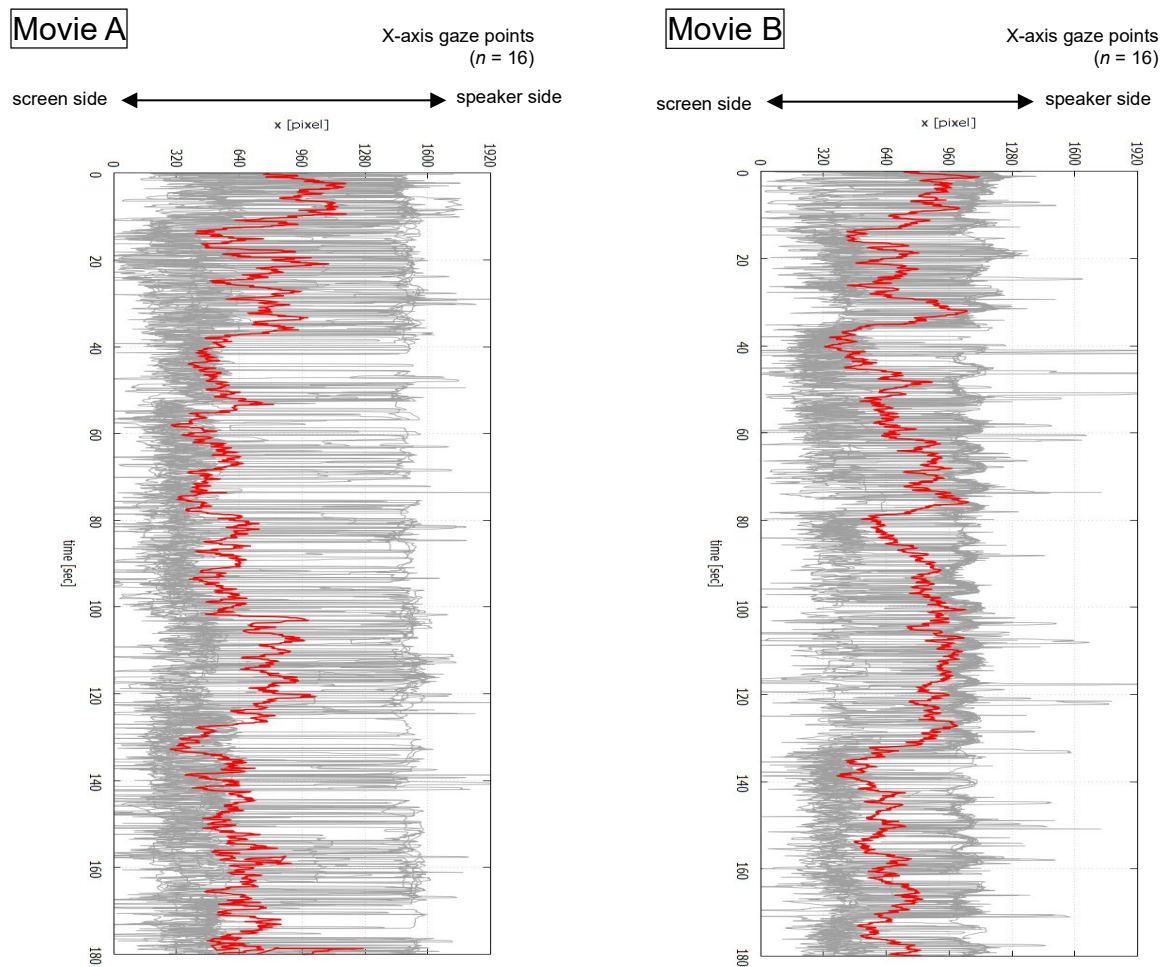


Figure 8. X-axis results of gaze points (left: Movie A, right: Movie B)

We looked into specific timings to examine the results in more detail. Figure 9 below shows enlarged graphs of the first 50 seconds of both presentations. In both cases, it can be seen that the screen and the speaker are both watched frequently for about the first 26 seconds or so. During this part, the speaker in Movie A made eye contact for 5 times and for 7.87 sec in total while the speaker in Movie B did so for 8 times and for 14.14 sec in total, and both speakers introduced themselves and the themes of the presentations. They both changed the slides on the screen several times: 2 times in Movie A and 3 times in Movie B. After that, slides on the screens were switched to the next slide in both presentations at the timing marked with green circles (about 35 sec). We can observe that the gaze points were concentrated on the screen sides in both presentations at the time. Below that, it can be seen that the gaze points were still concentrated on the screen in Movie A, but directed again at the speaker in Movie B.



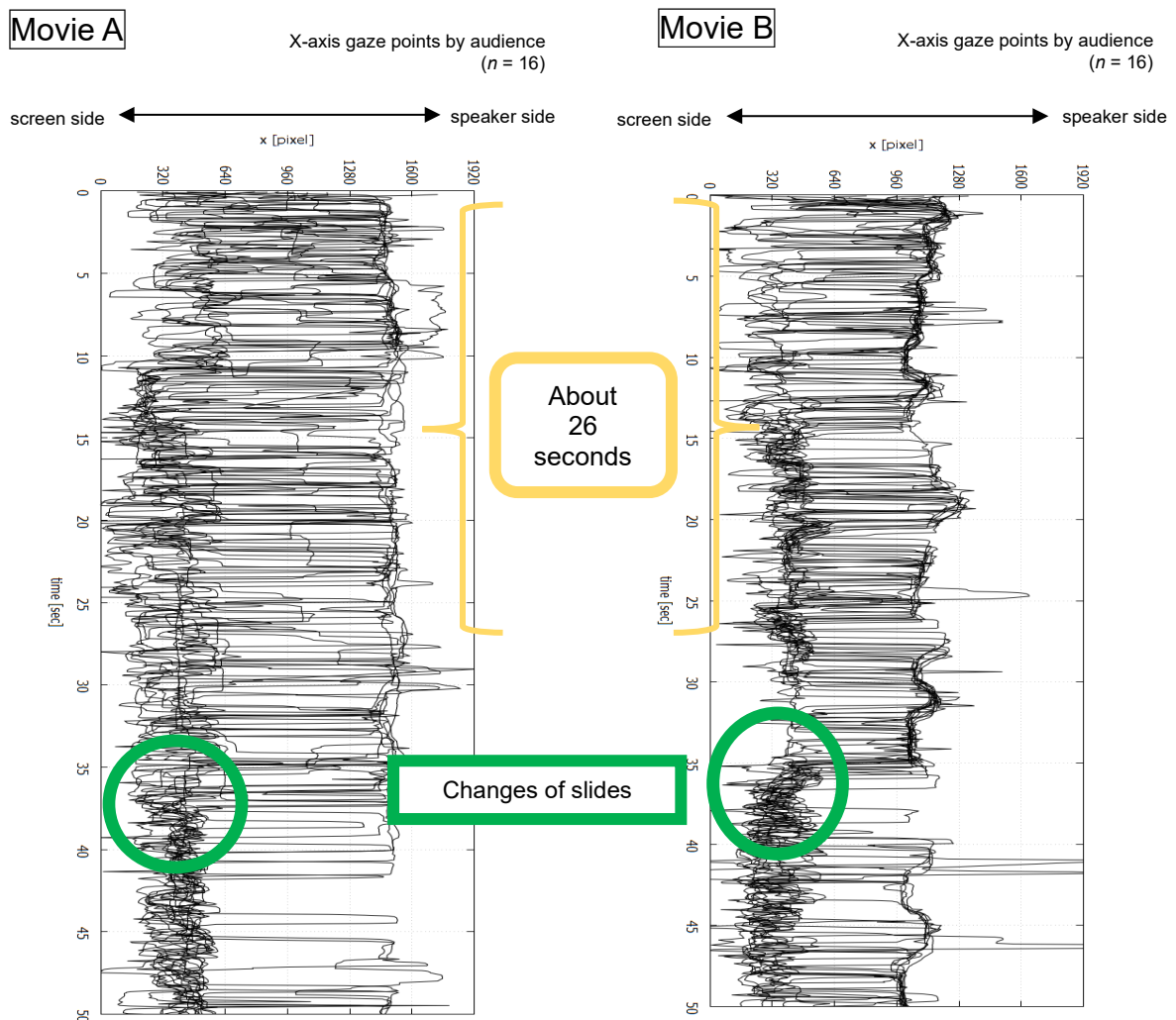


Figure 9. X-axis gaze points results for the first 50 sec of presentations (left: Movie A, right: Movie B)

In Movie A, where the number of eye contact made by the speaker is low, the speaker was not watched much after about 26 seconds from the start of the presentation. The audience tended to look at the screen more after that. On the other hand, in Movie B where the number of eye contact made by the speaker is high, both the speaker and the screen were continuously watched all through the presentation. These results show that the audience evaluate a speaker's delivery, including eye contact, in the first 30 seconds of watching their presentations.

Regarding RQ3- "Does the audience's subjective evaluation of speakers' eye contact and the subjective evaluation on overall presentations differ depending on speakers' eye contact amount?" -, Table 3 below summarizes the results for "eye contact" and "overall impression" from answers to the evaluation questionnaire.

Table 3  
*Questionnaire Results*

Participant	Eye contact		Overall impression	
	Movie A	Movie B	Movie A	Movie B
1	2	5	2	5
2	3	4	2	4
3	2	4	3	4
4	3	5	3	5
5	4	5	4	5
6	1	2	2	4
7	2	4	2	4
8	1	4	2	5
9	3	3	3	3
10	2	3	2	4
11	3	4	3	4
12	3	4	3	4
13	2	5	3	5
14	2	5	2	5
15	1	4	1	3
16	2	4	2	4
<i>Mean</i>	2.25	4.06	2.44	4.25
<i>(SD)</i>	(0.86)	(0.85)	(0.73)	(0.68)

The result of the audience’s subjective evaluation of "eye contact" showed that the average score for Movie B is higher than that of Movie A. This is consistent with the result of the quantitative analysis of speakers' eye contact frequency and duration (cf. Table 1). We carried out a t-test on the data and found that there was a significant difference at significance level of .01 in the audience’s subjective evaluation of the speaker’s eye contact for Movie A (M = 2.25, SD = 0.86) and Movie B (M = 4.06, SD = 0.85);  $t(15) = -7.39, p < 0.01$ .

Furthermore, regarding “overall impression”, Movie B was also evaluated higher than Movie A. A t-test was carried out on the data and it was found that there is a significant difference at significance level of .01 in the audience’s subjective evaluation of the overall impression for Movie A (M = 2.44, SD = 0.73) and Movie B (M = 4.25, SD = 0.68);  $t(15) = -8.69, p < 0.01$ .

A correlation analysis of the scores for "eye contact" and "overall impression" was performed to find the relationship between speakers' eye contact and overall evaluation of the presentations. There was a positive correlation between the scores for "eye contact" and "overall impression" in both Movies A and B (Movie A:  $r = 0.775, p < 0.01$ , Movie B:  $r = 0.657, p < 0.01$ ), showing the importance of eye contact on overall impression.

## Discussion

The average gaze rate directed at the speakers was higher in Movie B, in which the speaker made a lot of eye contact. This suggests that the audience watch a speaker more if she or he makes a lot of eye contact. Second, the gaze-point characteristics did not change in Movie B throughout the presentation, while the gaze-points tended to focus on the screen more than the speaker in Movie A. It was found that the audience stopped concentrating on the speaker in Movie A within 30 seconds from the start of the presentation. It shows that the audience evaluated speakers’ eye contact and engagement with them as early as 30 seconds into watching the presentations. Third, a subjective questionnaire was administered to verify the audience's evaluation of the speakers. The subjective evaluation for Movie B was significantly higher than Movie A for both "eye contact" and "overall impression". In addition, there was a

positive correlation between the subjective evaluation scores for "eye contact" and "overall impression" in both movies. The importance of eye contact in the subjective evaluation of presentations was confirmed, and it was shown that the ratio of audience's gaze points toward speakers and subjective evaluation for speakers had the same tendency: the more the speaker make eye contact, the higher the subjective evaluation by audience is.

These results are expected to provide useful information for future education. For example, we may emphasize the importance of the first 30 seconds in presentations in shaping positive impressions on audience, based on the evidence from gaze points analysis of audience when teaching EFL students and when developing teaching materials on English public speaking. From the results, it was also indicated that audience keep watching back to a speaker if a speaker maintains eye contact throughout the presentation, even if the speaker changes slides frequently. This shows the effectiveness of maintaining eye contact.

## Conclusion

### Summary of the Study

The present study aimed to provide objective verification of the effect of speakers' eye contact on audience behavior during English presentations to extract useful information for future education in EFL classrooms. We used two presentation videos with speakers with different eye contact levels. 16 EFL learners watched the videos and an eye-tracking device recorded their gaze points. The gaze-points analysis showed that the audience watched the speaker who maintained eye contact more than the speaker who made little eye contact. In the latter situation, the participants switched focus to the screen 30 seconds into the presentation. The results of the subjective evaluation questionnaire showed that the audience rated the speaker with a higher number of eye contact more, and that it correlated with overall impression scores for the presentation.

### Limitations and Research Prospects

There were certain limitations to this study. Although the presentation movies adopted in this study had advantages such as being filmed in an authentic public speaking environment and pre-screened for content and English levels, the theme and the slide materials were not controlled. Furthermore, we focused on the difference in number of speakers' eye contact in this study. However, there are many more factors to delivery such as gestures and manner of speaking. These factors can also be cross-analyzed with audience gaze points.

We are conducting a series of experiments using the same speaker conditions, content, but with a focus on other delivery factors such as the relationships between gestures of speakers/contents of slide materials/moving distance of speakers (when speakers walk around on stage) and gaze points by audience. These analyses may provide us more information for developing effective and detailed teaching materials and methods.

## Acknowledgment

This work was supported by JSPS KAKENHI Grant Number 16H03079 (Grant-in-Aid for Scientific Research (B)) and Kyushu University Research Activities Support Grant of 2019. An earlier version of this paper was presented at the 2019 JAEMS conference. The authors thank the audience for their important comments and suggestions.

The authors also would like to thank the organizers of the presentation contest for allowing us to film videos and collect necessary data for the study.

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