

# Understanding the Effects of Profile Display in Multilingual Computer-Mediated Team Formation

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## ABSTRACT

Collaborating across language barriers is cognitively, communicatively and socially taxing, which may disincentivize people to continue working in a language-diverse team after experiencing it. It remains unclear how socially displaying potential collaborators' language and personal profiles in advance may affect multilingual team formation especially in computer-mediated virtual environments. We conducted an online study with native English speakers and native Japanese speakers in Gather Town. Participants were asked to form teams and complete a slogan generation task under one of the following conditions - no profile display, constant profile display, and adaptive profile display to supplement language and personal cues. We studied how participants' searching cost for partners and their attitude towards multilingual teamwork shifted under these conditions. Our findings reveal the use of different team formation strategies depending on language backgrounds and profile display designs. We seek to understand language-technological effects on team formation, and explore designs to facilitate multilingual diversity in online teamwork.

## CCS CONCEPTS

• **Human-centered computing** → **Collaborative and social computing**.

## KEYWORDS

cross-lingual collaboration, team formation, virtual environment

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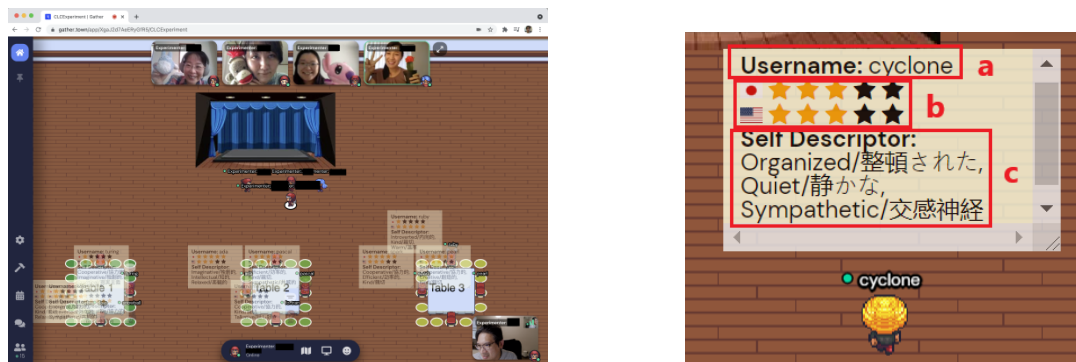
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## 1 INTRODUCTION

As one cornerstone technology for global teams, computer mediated communication (CMC) tools provide the feasibility for non-collocated team members to collaborate across time, geography, and culture [5]. However, a set of communicative challenges compared to face-to-face (FtF) communication could potentially emerge due to the properties of CMC tools, such as the inevitable reduction of visual and social cues. Previous research in CSCW have explored what cues to provide in different virtual settings to improve the overall communication experiences and outcomes [3]. In multilingual teams, previous studies have inspected the effects of added communication channels through machine translation [7], automated transcription [6] and chatbots [2]. However, most of these studies focused on understanding and supporting global teams of which members have been assigned and team structure has been formed. It remains unknown how CMC with different cues available (or unavailable) to people impact multilingual and multicultural team formation.

In the process of team formation, there is a learning curve for individuals to explore, getting familiar with potential teammates and gaining information about the feasibility to collaborate with one another in a team [4] [1]. In global work, working around cultural differences and language barriers are additional costs to consider and knowledge to acquire. Online multinational team formation presents a unique challenge to using CMC tools to mediate this process. As a software tool, CMC can be designed to modify cues present to people. When CMC channels reduce or amplify specific cues available for individuals to learn about one another, individuals' attitudes toward working with partners from diverse language and cultural backgrounds may also shift based on the cues available to them.

To better understand how CMC-modified cues affect computer-mediated team formation, we conducted a between-subject experiment by manipulating how personal profiles display cues of language proficiency and personality traits for avatars in a 2D online virtual environment, Gather Town. We ran a week-long study consisting of seven 2-hour team-formation sessions. In each session, a group of 10-13 participants, with about half of them as Japanese native speaker and another half as English native speakers, joined the same virtual space to form teams and then collaborated on a slogan generation task. Each session was randomly assigned to one of the three profile display conditions: no display of profile, constant



**Figure 1: Screenshots of the online teamwork environment. Left: Participants working on a slogan generation task with their teammates in Gather Town. Right: With our plug-in extension enabled, a profile containing a subject's username (labeled a), language proficiency information (labeled b), and personality descriptors (labeled c) displays on top of the avatar.**

display of profile, and adaptive display of profile in the proximity to other subjects. We aim to answer the following research questions:

- (1) Do profiles alleviate the teammate searching cost for participants since personal information is more transparent?
- (2) How do profiles change the attitude to form a diverse team once people have collaborated with each other under the specific condition?

## 2 METHOD

We implemented a software add-on to enhance the functionality of Gather Town, so that it renders a personal profile block which contains users' self-reported language proficiency and personality traits. The rendering of the profile block is constantly updated to follow the movement of a user's avatar (see Figure 1). The timing to prompt the profile is adjustable based on different proximity settings. Profiles either are absent (no display), display all the time (constant display), or pop up when participants get close enough (adaptive display). Meanwhile, the add-on also logs avatars' moving patterns on the map for follow-up analyses. A between-subject experiment was conducted with multilingual participants recruited from Japan and United States to compare three conditions of different profile settings. The entire study was conducted online with multinational participants physically located in either Japan or United States.

### 2.1 Participants

76 participants were recruited for this study, including 50 females, 25 males, and 1 non-binary. 34 native English speakers were recruited through a popular participant recruitment platform, Prolific and lived in the US. 42 Japanese speakers resided in Japan and were recruited through a Japanese recruitment service of similar functions to Prolific. Upon recruitment, the Japanese participants were instructed to expect working with native English participants although we did not set any restrictions for their English proficiency.

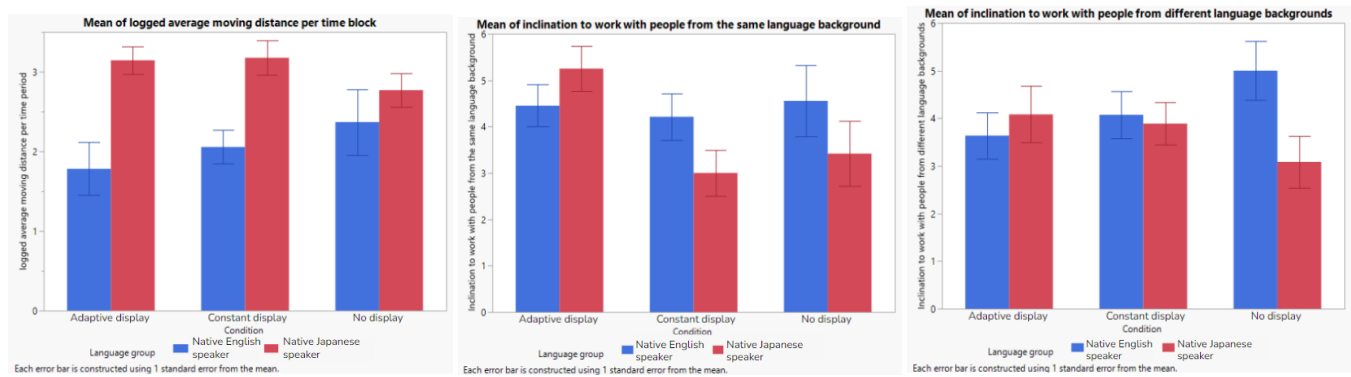
The educational level of the native Japanese participants (20 females, 22 males, avg age 34.2) ranged from holding a high school diploma to a graduate degree. Based on self-assessed English proficiency using a 7-point Likert scale (1 = very poor, 7 = very good),

native Japanese participants' English listening, reading, and writing skills are above 3.5 (all means range from 4.00 to 4.73). However, with moderately low speaking skills ( $M = 3.38$ ). More than half of them do not regularly engage in English conversations in their everyday lives (16.67% never and 35.71% occasionally/not on a monthly basis).

As for the native English participants (31 females, 3 males, avg age 29.65), the education level also ranged from holding a high school diploma to a graduate degree. Based on self-evaluate Japanese proficiency using a 7-point Likert scale, native English participants can barely understand any Japanese in terms of listening, speaking, reading, and writing (all means range from 1.09 to 1.50). Most native English participants do not involve in Japanese conversations on a daily (79.41% reported never) Because of the technical issues during the online study, we excluded the data from one participant from native English speaking group under constant display condition due to incomplete data collection. Participants were recruited to attend one of the seven Gather Town sessions that can accommodate up to 12 people each, with an expectation of 6 Japanese native speakers and 6 English native speakers. Each Gather Town session was then randomly assigned to one of the three profile display conditions: no display (2 sessions,  $n=21$ ), constant display (3 sessions,  $n=32$ ), and adaptive display (2 sessions,  $n=23$ ).

### 2.2 Procedure

In the beginning, native Japanese and English speakers joined separate 10 minute Google Meet sessions in which researchers briefly informed them of the entire experiment pipeline in their native languages. Then, participants downloaded the software and extensions necessary to participate in the study and completed the initial setup, registering their usernames, Japanese and English language proficiency, and 3 personality traits. Once finished, they entered the Gather Town space to receive a more detailed explanation of the two tasks (team formation and then slogan generation task) in both Japanese and English. The participants were first instructed to form a group of three or four. They were given 20 minutes to rotate around tables and talk to as many people as they wished. They were also told that they were free to communicate in any



**Figure 2: How profile display and language background influence searching cost in finding team members and attitudes toward working with partners from the same versus different language backgrounds: (Left) Moving distance of Japanese and English native speakers by profile display conditions. (Middle) Inclination to work with people from the same language background. (Right) Inclination to work with people from different language backgrounds.**

language of their choice. After forming groups, participants were asked to engage in a 20-minute decision making task in which participants worked with their group members and generated slogans for a Japanese product in English. A Google Doc containing descriptions of the Japanese product and work space for slogan documentation was provided for each group. At the end of the task, participants completed a post experiment survey written in their native language, followed by a 10-15 minute individual interview in their native language. Subjects were monetarily compensated after study completion.

### 3 CURRENT RESULTS

During the experiment, we collected participants' movement traces, work results on the slogan generation task, survey responses, and data from the post-experiment interviews. The semi-structured interview aimed to gain deeper understanding on attitudes and decisions associated with the team-formation process. Some interview questions we asked included "How did you decide which person to talk to?", "How did you decide which table to join?", and "What did you think about the profiles?" Due to limited space available in the poster, here focused on movement data during team formation and survey responses that probed people's attitudes toward joining multilingual teams.

#### 3.1 Searching cost during team formation

We computed subjects' moving distance during the team formation phase when subjects were actively searching for conversational partners to form teams from the log file. We detected whether participants were moving based on the displacement of participants' position in the virtual space over time in the log data. Since the team formation task lasted 20 minutes, we partitioned the team formation data to 10 2-minute temporal blocks, which aims to capture participants' major movements while neglecting those local variations occurred during a relatively short period of time (e.g., people moving back and forth around the same spot in seconds). We then calculated the value of log-transformed moving distance per time block for each participant.

A significant main effect of language background has been observed on average moving distance ( $F(1, 67) = 21.35, p < 0.0001$ ) in mixed-effect two-way ANOVA, with Japanese speakers traveling a greater distance than English speakers to find potential team members across all three conditions (Figure 2 Left). It shows that Japanese speakers tended to move more to approach other participants in the virtual space. While the reasons behind were not entirely clear, it could be associated with the language barrier and/or the cultural differences involved in multilingual team formation. Also, with no profile display, English native speakers had the highest average moving distance ( $M = 2.37, SE = 0.41$ ), and Japanese native speakers had the lowest average moving distance ( $M = 2.77, SE = 0.21$ ). The difference between English native speakers and Japanese native speakers was not significant (n.s.).

The result showed that adding transparency of individuals' language background and personal descriptions through profile display can impact different language groups quite differently. When there's no such transparency, the searching costs of the two language groups were similar. In other words, being able to see other people's profiles, and knowing that self profiles are visible to others as well, can either motivate individuals to search either more or less, depending on what's the naive language they spoke.

From our initial analysis of the interview data, when asked about their movement during team formation, English native speakers reported two main approaches: they either stayed at one table and waited for people to approach and communicate, or they actively traveled around the space to meet different people. Japanese native speakers, on the other hand, reported that they would go from table to table to listen to different conversations and decide whether they could join these discussions. One reason cited for leaving a table is when English native speakers' speaking was difficult to understand to them. Profiles might have served the function to confirm the presence of language gap, potentially driving Japanese speakers to move further to explore other teams.

### 3.2 Attitude towards multilingual collaboration with different profile displays

To understand how experiencing specific display conditions impact people's attitudes toward working with people from different versus same language background, we conducted ANOVAs on two survey items, one asking about the inclination to work with people from the same language background, and another asking about the attitude toward working in a team with language diversity.

For Japanese native speakers, there's a significant effect of profile condition on inclination to partner with people from the same language background ( $F(2, 39) = 4.43, p < 0.05$ ) (see also Figure 2 Middle). Post-hoc t-test showed significant differences between adaptive display and constant display conditions, and between adaptive display and no display conditions ( $ps < .05$ ) where Japanese speakers think it is more important to join a group with other Japanese speakers when the profiles only showed in a short proximity and think it is less important for them to team up with other Japanese speakers when the profile is displayed all the time (Figure 2 Middle).

As for participants' inclination to partner with people from different language backgrounds, the availability of profiles seemed to decrease the importance to form a diverse team for English native speakers, but has the opposite effect on Japanese native speakers (Figure 2 Right). The observations of within-language group variations across display conditions were not statistically significant. However, it's interesting to note that the initial discrepancy between English and Japanese native speakers on the inclination toward working in with partners of diverse language backgrounds ( $F(1, 70) = 5.40, p < .05$ ) were mitigated or equalized by the introduction of profile displays (n.s.).

The initial analysis of the interview also suggested that the multilingual participants could explore different strategies when looking for potential teammates. English native speakers could have focused more on whether they could communicate with the people they encountered during team formation. This emphasis on communicability seem to diminish the attention to diversity especially when profile displays were available. However, Japanese native speakers seemed to have an ideal team composition involving people of both language backgrounds in mind, and they would use the displayed information and travel to find partners that fit this description. The reason to the noticeably higher inclination for Japanese speakers to work with people from the same language background in the adaptive display condition remains unclear, and we will need to investigate further to understand the mechanism behind this major attitude shift.

## 4 SUMMARY AND FUTURE WORK

In this poster, we reported initial results from an online experimental study, investigating the effects of supplementing personal profiles of language proficiency and other personal descriptions on multilingual team formation. Profile displays appeared to impact people's perceptions of cross-lingual communication cost, motivating multiple team formation strategies, such as to join teams with visible similarities in language proficiency and/or to leave teams by confirming the inability to communicate across language gaps. Profile displays also appeared to equalize people's attitudes toward

working in a multilingual team, which can potentially lead to the formation of attitudinally-aligned multilingual teams. The initial results mainly came from the logged behavioral data and responses to survey items. Our ongoing coding and analysis of interview data will further complement the current results.

Our ongoing and future work will focus on further understanding how different cultural values and practices in teamwork associated with different language backgrounds shape the behaviors and attitudes in multilingual team formation. While promoting multilingual team diversity is important, understanding and supporting individuals' decisions toward working in language-diverse teams is also critical. We seek to explore how additional visibility and transparency of multilingual proficiency can be utilized toward bridging language gaps, such as through translation, code-switching, and/or awareness and empathy of the presence of non-native speaking team members.

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