Understanding Cross-lingual Pragmatic Misunderstandings in Email Communication

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Communication tools such as email facilitate communication and collaboration between speakers of different languages, who use two primary strategies—English as a common language and machine translation (MT) tools—to help them overcome language barriers. However, each of these communication strategies creates its own challenges for cross-lingual communication. In this paper, we compare how people's interpretations of an email sender's social intention, and their evaluation of the email and the senders, differ when using a common language versus MT in email communication. We conducted an online experiment in which monolingual native English speakers read and rated request emails written by native English speakers, emails written by bilingual Chinese speakers in English, and emails written in Chinese then machine-translated into English. We found that participants interpreted the social intentions of the email sender less accurately for machine-translated emails than for emails written by non-native speakers in English. Participants also rated the senders and emails less positively overall for machine-translated emails compared to emails written by non-native speakers in English. Based on these findings, we suggest design possibilities that could better aid multilingual communication.

CCS Concepts: • **Human-centered computing** → **Collaborative and social computing** → Empirical studies in collaborative and social computing

KEYWORDS: Multilingual communication, computer-mediated communication, machine translation, pragmatic misunderstanding

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1 INTRODUCTION

Increased accessibility to the Internet and computer-mediated communication (CMC) technologies have allowed people to interact with others across national, cultural, and linguistic boundaries. CMC tools such as email and videoconferencing have enabled global organizations and virtual teams to collaborate on common problems [37,44,75]. Also, in people's social lives, CMC tools such as social media sites offer new opportunities to develop relationships with people from other countries and cultural backgrounds [20,60,92]. The linguistic and cultural diversity afforded by globally-used CMC tools provides many benefits in terms of bringing a broad array of expertise and perspectives to bear on a problem (e.g., [26,74,89]) and offering chances to build meaningful social relations across borders (e.g., [56.108]).

These benefits can only be realized, however, when language and cultural differences are overcome. To overcome language differences, there are two main approaches. One is conversing in a common language (often English) to allow everyone to participate in the conversation regardless of their native language [30,52]. However, the asymmetric language fluency between native speakers (NS) and non-native speakers (NNS) of the common language can negatively affect interpersonal and work processes [1,34,50] and impose cognitive burdens for NNS who must use a second language [98,99]. These gaps in linguistic fluency imposed by using a common language are compounded by cultural differences in social norms and communication styles. For instance, native speakers often misjudge the social intentions of non-native speakers as "impolite"

or "inappropriate" due to NNS's inadequate use of linguistic rules in the common language and incompatible social norms such as taboo topics [6,28,53].

Technical advances in natural language processing (NLP) provide an alternative approach for cross-lingual communication that may address the problems that arise from using a common language. Machine translation (MT), an NLP approach that converts text or speech in a source language into other languages, can allow everyone to speak in their own native language. In theory, MT tools allow people to overcome language barriers and communicate with others who use different native languages [58], and they are being increasingly incorporated into popular CMC tools such as Gmail [42], Facebook [31], and Skype [91]. However, despite rapid recent improvements in MT algorithms, research shows that people often experience difficulties understanding the literal meaning and extracting the key information from MT-translated outputs due to translation errors [16,65,71,111]. Social intentions can also be lost in MT outputs; systematic evaluations of MT quality suggest that the main sentiment and pragmatic forces in the source text (e.g., politeness, sarcasm) often disappear or are replaced with opposite meanings in MT-translated outputs [16,78,86].

Together, the technical limitations of MT technologies, difficulties using common languages, and cultural differences can increase the chance of "cross-lingual pragmatic misunderstandings" when the social intentions of senders are not interpreted as intended by a communication partner [101]. Such misjudgments of social intentions can have detrimental social consequences such as invoking stereotypes or making erroneous judgments about groups of people [54,101]. For example, a conventional expression to invite someone politely in Chinese (e.g., '来跟我们吃饭，不然我可生气了!'; the literal translation: 'Come and eat with us, or I will get mad at you!') may sound rude and demanding to native English speakers (excerpt from [45,69]). Although NS will get the main meaning of this message pretty clearly (e.g., "they want me to join the dinner"), they may not get the NNS sender's social intentions in the message (e.g., being polite, friendly).

Previous research on pragmatic misunderstandings has focused primarily on when NNS communicate with NS using a common language (e.g., [28,45,83]); less is known about how the problems in communicating social intentions differ when using machine translation. Also, it is still an open question how the use of MT versus common language affects social evaluations of the messages and message senders.

Another unanswered question is the potential effect of providing information about the language background of message senders (i.e., whether the message is written by NS or NNS) and about the presence of MT (i.e., whether the message is machine-translated or not) on the interpretation of social intentions and social evaluations of NNS-written messages. In text-based CMC, it is sometimes not so apparent if the message is written by NNS or machine-translated, which can cause people to attribute disfluency in conversation to the sender (e.g., incompetent) or the message (e.g., untrustworthy) rather than the MT algorithm [3,28,51,79].

To answer these questions, we conducted an online experiment in which monolingual native English speakers read and rated six emails that make requests of the receiver: two written by native English speakers, two written by native Chinese speakers in English, and two written by native Chinese speakers in Chinese, then machine translated into English. Further, some participants were provided with information about the email sender's language background and the presence of MT, while others were not. After reading each email, participants rated it on twelve social intention dimensions, including perceived politeness and boldness, the clarity and appropriateness of the email, their social attraction toward the writer, and their willingness to accept the request in the email.

Overall, the results showed that participants interpreted NNS senders' social intentions less accurately for machine-translated emails than for emails written in English. Also, participants rated the senders and emails less positively overall for machine-translated emails compared to emails written by NNS in English. When information about the sender's language background was provided to the participants, their evaluation of both email and senders improved.

In the remainder of the paper, we first discuss related work and pose our research questions and hypotheses. Next, we describe the experimental procedure and present our findings. We conclude by discussing possible design implications of this work to reduce pragmatic misunderstanding and better support cross-lingual communication.

2 BACKGROUND

We first describe prior work on cross-lingual pragmatic misunderstanding and address how the use of common language and MT might affect pragmatic misunderstandings. We then examine previous literature that compared the effects of common language versus MT on multilingual communication. Finally, we describe how information about the language background of communicators and the use of MT might affect multilingual CMC.

2.1 Cross-lingual Pragmatic Misunderstandings

Communication, whether cross-lingual or not, involves the exchange of communicative intentions, and language is a vehicle to allow the exchange of each other's intentions. Therefore, figuring out others' social intentions (i.e., being polite, sarcastic, etc.) is an integral activity of any communication [64]. To make sense of the senders' communicative intentions, message recipients work on understanding the meaning of others' utterances using the linguistic content of the message, contextual cues around the message, paralinguistic cues such as facial expression, the state of the ongoing conversation, and their overall knowledge of the sender [18].

In CMC, making sense of the social intentions of senders is especially challenging because many of the paralinguistic and physical cues that help people assess social intentions in face-to-face conversation are attenuated or missing [27]. Especially in email communication, most emails are still primarily text, so available cues to assess the social intentions of senders are often limited. Thus, people sometimes misinterpret the cues in email texts, even in their native language [12,25].

These challenges are compounded when communicating with people from other cultures who speak different languages because of differences in linguistic conventions and cultural norms. Thomas articulated the challenges in interpreting communicative behaviors and social intentions of linguistically different others as "cross-lingual pragmatic misunderstandings" when people fail to "assign force and effects to the speaker's words correctly" [101: p. 93]. These cross-lingual misunderstandings often occur when people transfer communication strategies from their native language to another language where those strategies are not normative either in terms of linguistic construction or social appropriateness [45,101].

Cross-lingual pragmatic misunderstandings have been examined extensively in the context of multilingual communication using a common language, where speakers of different native languages use a common language such as English [e.g., 30,82]. Prior research showed that NNS often experience difficulties in conveying their social intentions using the common language due to insufficient understandings of linguistic conventions and social norms [101]. A number of studies have collected example conversations that illustrate how cultural differences can contribute to cross-lingual pragmatic misunderstandings (e.g., [51,100]). Analysis of linguistic features from such examples shows a number of linguistic characteristics such as higher-than-

expected directness, underuse of syntactic and lexical modifiers [6,53], omission of greetings and closings, inappropriate forms of address [28], and incompatible perceptions of social status [8,15], all of which could lead the recipient to misjudge the social intentions in messages.

Machine translation is an alternative to using a common language; however, recent systematic evaluations of MT systems indicate that translation also often impairs the communication of social intentions, failing to preserve emotional, contextual, and pragmatic meanings in source languages. For example, the main sentiments in source texts are often not preserved in machine-translated outputs because key sentiment words are replaced with opposite sentiment words [78,86]. MT systems also often fail to translate cultural or idiomatic expressions adequately [13,48,57]. These systematic evaluations of MT quality provide valuable insights into the limitations of current MT technologies that can lead to cross-lingual pragmatic misunderstandings.

Overall, prior research shows that both MT and common language use possess limitations that can increase the chance of cross-lingual pragmatic misunderstandings, focusing on identifying the kinds of linguistic features that NNS and MT tend to generate that impede communication. Since both strategies possess limitations in communicating social intentions, less is known about which would be better for reducing pragmatic misunderstandings.

2.2 Comparing Common Language vs. MT

These differences in the kinds of communication barriers introduced by MT and common language use raise questions about how they differ in terms of supporting multilingual communication.

A main line of work in this vein examined the effects of using common language vs. MT on real-time collaborative tasks. For example, Gao and colleagues' study of NS-NNS dyads collaborating on map navigation tasks showed that participants using a common language perceived less difficulty in understanding others' messages, experienced less overall workload, and had better task performance than participants using MT [40]. Yamashita and colleagues explored the effects of MT on referential communication tasks (e.g., arranging and matching tangrams) among participants whose native languages were different. They found that groups using MT were less efficient in establishing joint understanding than groups using a common language and experienced particular trouble negotiating the meaning of referring expressions and identifying referents [113,114]. Further, Wang and colleagues also found that NS-NNS dyads collaborating on brainstorming ideas rated message comprehensibility higher when using a common language than MT [111].

However, using MT can benefit non-native speakers, particularly in their message production processes. In Wang and colleagues' study, NNS participants generated more original ideas when using MT vs. a common language, perhaps because they could more freely express ideas in their native language [111] Further, research on second language learning shows that MT has significant benefits for NNS in academic writing contexts. By reducing grammatical and lexical errors (e.g., [33,66,106]), MT can improve overall writing quality and clarity [62,66,81] compared to when MT is not present. However, it is unclear whether the use of MT can facilitate higher levels of pragmatic competence, as most of these studies focused on the linguistic aspects of academic writing (e.g., grammatical accuracy, lexical density, fluency) [67].

Taken together, findings of prior studies suggest that the use of a common language is more effective at ensuring message comprehensibility than the use of MT, whereas NNS can benefit from MT in producing more grammatically correct messages and by being able to express their thoughts more easily.

The current study looks to build on prior research. First, we focus on the problems of expressing and interpreting social intentions rather than on the linguistic problems that these approaches introduce in the message itself, such as linguistic correctness and comprehensibility of messages. Given that NNS often fail to convey their intentions effectively when using a common language (e.g., [6,28,29,51,100]) and MT often cannot preserve the main sentiment and pragmatic forces in the source text (e.g., [16,78,86]), which would be better for expressing and interpreting social intentions between a common language and MT?

Additionally, given that prior studies were conducted either in academic writing education or synchronous text chat contexts for collaborative tasks, it might be worthwhile to explore how the results would be different in email communication. Clark and Brennan [18] suggest that detecting and repairing misunderstandings in CMC tends to be more costly than face-to-face interaction, especially in channels that are not synchronous and sequential. Email provides a good example of these problems: emails are still primarily text, so available cues to assess the social intentions of senders are often limited. Email is also normally asynchronous. Furthermore, people sometimes misinterpret the cues in email texts, even in their native language [9,20,25]. Thus, studying how the relative advantages of common language use versus MT affect communication of social intentions in email contexts is an open and important question.

2.3 Effect of Information about Communicator's Language Background and MT Uses

With the problems of communicating social intentions in email, it is sometimes not apparent if a message is written by a non-native speaker or MT-translated. When disfluencies occur, people often attribute them to the sender, leading to negative perceptions of either the sender (e.g., incompetent) or the message (e.g., untrustworthy) [3,79].

Sometimes affordances of CMC channels can help message recipients realize that a sender is from a different linguistic background and/or using translation tools. For example, people may infer the language background of senders (though, not always correctly) by looking at their names, profile elements such as current or past location and affiliations, and declarations of language proficiency. Further, many popular social media and online review sites such as Facebook and bookings.com provide tools that either allow users to manually translate text in other languages or provide labeled automatic translations (e.g., "powered by Google Translate") [22]. However, in email contexts, where such profile elements are usually absent, it may be hard to figure out if the email sender is NS or NNS. Also, when people use MT to compose emails, they might copy and paste the MT outputs into emails without signaling that MT is in use.

Knowing that a sender may be facing language challenges can significantly affect multilingual communication, but it is not clear whether it would have positive or negative effects. Several studies show that clear indicators that individuals are NNS (e.g., disfluency, foreign accents) in face-to-face conversation can encourage NS to adjust their expectations about how their counterparts behave and speak [41,94,101].

On the other hand, a number of field experiments have demonstrated that a clear indication of one's ethnic background may have negative effects. For example, Bursell found that job applicants with foreign-sounding names received significantly lower call-backs than job applicants with common names, even when the applicants' education and work experience were the same [11]. Similarly, Gaddis and Ghoshal show that people with ethnic names were less likely to receive responses from roommate seekers than those with common American names, even when the qualification of the senders was identical, and they both used grammatically correct English [38].

There have been fewer studies that examined the effects of information about the presence of MT, mainly by Gao and colleagues, who conducted a lab experiment in which monolingual native

English speakers and bilingual native-Chinese speakers collaborated on a map navigation task using a text chat interface [39]. They manipulated both the belief about the use of MT (whether participants were told that MT was present or absent) and the actual use of MT (whether the system was actually utilizing MT or their partner was communicating in a second language). When participants were told that they were communicating through MT, they made fewer attributions of miscommunication to their partner than when they were told that MT was absent. Also, participants who believed that MT was present evaluated their partners more favorably than those who believed MT was absent. They speculated that a belief that MT was present might lead participants to attribute miscommunication to MT capacity rather than their partner, so participants had more positive evaluations of their partners.

In contrast, a study conducted by Hale and Eleta suggests that the majority of participants had a low propensity to read and interact with messages they knew were machine-translated [49]. They conducted an online experiment in which American participants viewed several English and machine-translated Spanish reviews for a tour. The results indicated that about 70% of the participants did not choose to read the machine-translated reviews at all and they were less likely to book the tour with machine-translated reviews.

As such, prior studies indicate both positive and negative effects of information about communicators' language backgrounds and the presence of MT. It raises an interesting question of how such kinds of information would affect social perceptions and outcomes in email communication contexts.

3 The Current Study

The current study looks to deepen our understandings of cross-lingual pragmatic misunderstandings. Previous research revealed the linguistic problems that common language and MT methods introduce in the message itself and overall comprehension of message content. In the current study, we focus specifically on problems that common language use and MT introduce around communicating the sender's social intentions (e.g., politeness). Moreover, we explore how these interpretations shape recipients' social perceptions of NNS senders and NNS-written messages. Lastly, we look into the effects of information about the sender's language background (i.e., whether the message is written by NS or NNS) and about the presence of MT on the interpretation of social intentions and social evaluations of NNS-written messages.

We focus on email communication contexts where much cross-lingual collaboration and communication takes place (e.g., [47,55]), and many cases of pragmatic misunderstanding have been reported (e.g., [6,93,115]). In particular, we study "request acts," a speech act in which the sender attempts to get the receiver to co-operate on an action [9]. By definition, making requests is a face-threatening act that risks "impinging the hearer's claim to freedom of action and freedom from imposition" [9: p. 201]. To minimize the impositions on receivers and achieve the desired goal of gaining agreement to the request, senders use various linguistic means such as making their speech indirect and polite while making their point clear enough [105].

As such, composing a persuasive as well as socially appropriate email to request something requires highly sophisticated language use, including appropriate word choices and syntactic structures [14,15,28]. Therefore, NNS frequently encounter challenges in composing socially appropriate request emails in academic and business settings [28,107]. However, when senders' social intentions are not conveyed as intended in language, message recipients might evaluate both the requests and the senders as negative and inappropriate, in turn decreasing the likelihood that the request will be granted [68]. This social process makes request acts an ideal context for

research on how people interpret social intentions and how those interpretations affect social evaluations.

3.1 Study Overview

Figure 1 provides an overview of the study design. We conducted a mixed-design online experiment using three types of emails: "**NS email**" written by native English speakers, "**NNS_EN email**" written by NNS using English, and "**NNS_TR email**" written by NNS in their native Chinese and machine-translated into English. Email type was a within-subject variable, and the existence of information about the sender's language background and use of MT mediation was a between-subjects variable.

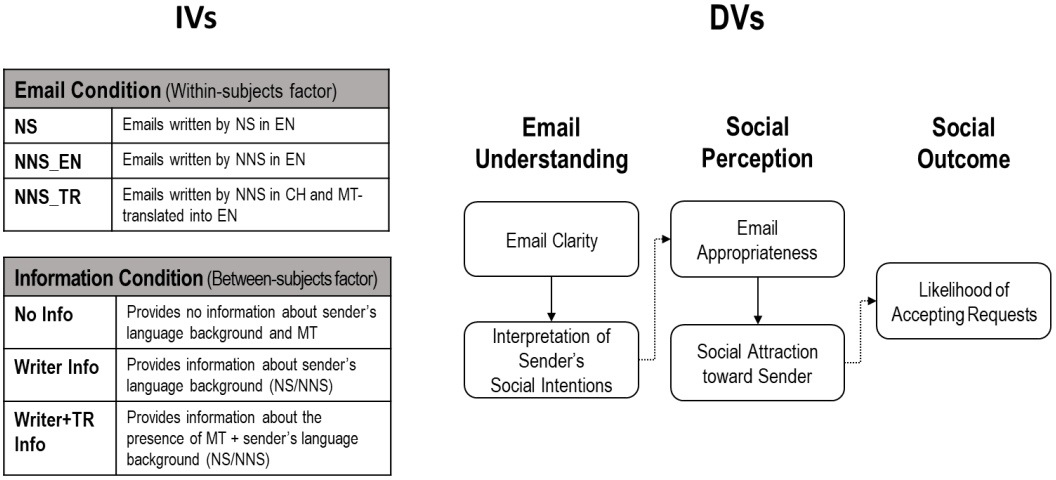

Figure 1. Research model overview.

In the experiment, monolingual native English speakers read and rate six emails (two each of NS, NNS_EN, and NNS_TR emails) under one of three randomly assigned information conditions: "No Info" vs. "Writer Info" vs. "Writer+TR info." More information on the study materials is described in the methods section.

In the "**No Info**" condition, participants were not provided any information about the language background of email senders and the use of MT.

In the "**Writer Info**" condition, participants were provided with clear cues indicating the language background of senders, whether the email sender is a NS or NNS of English. For example, for NNS_EN and NNS_TR Emails, the names of senders were changed from English to common Chinese names (e.g., Alex -> 张伟), along with clear text instruction that the sender of this email is not a native English speaker. For NS emails, the instructions indicated that the sender is a native English speaker.

Finally, in the "**Writer+TR Info**" condition, we provided information both about whether the writer was NS or NNS and about whether or not MT was present. For the NNS_TR emails, we added a box with the MT interface that showed that the email was originally written in Chinese and now translated to English by Microsoft Bing Translator. We also noted that the email was machine-translated from Chinese to English in the study instructions. Other types of emails (NS and NNS_EN emails) remain the same as in the "Writer info" condition.

After the random assignment of the information condition (No Info vs. Writer Info vs. Writer+TR Info), participants read and rated six emails: two NS, two NNS_EN, and two NNS_TR emails. For each email, we gave participants a brief scenario outlining the nature of the request and asked them to imagine themselves as the receiver of the request. They then answered questions about email understanding (email clarity, interpretation of sender's social intention), social perception (email appropriateness, social attraction towards sender), and social consequence (likelihood of accepting the requests) (see **Figure 1**). These dependent measures were constructed based on the perceptions around request acts [14,29,63]. The procedure to construct the emails is described in the methods section.

3.2 Research Questions and Hypotheses

Based on NS's higher English fluency, we first hypothesize that NS participants would rate emails written by other NS (NS email) as having higher overall clarity than emails written by NNS using either English as a common language or MT (H1a).

Prior work revealed that the comprehensibility of NNS-written messages was rated lower when using MT than when using English as a common language in text chat conversation [23,70]. However, for email, which often requires longer and more structured writing, MT might help people write clearer emails based on findings suggesting that MT helps to reduce grammatical errors and improve overall quality of writing [66,106]. Therefore, we predict that the clarity of emails will be higher for emails translated by MT than emails written in English by NNS (H1b).

H1a People will evaluate the clarity of emails higher for NS emails than NNS-written emails.

H1b People will evaluate the clarity of emails higher for NNS_TR emails than NNS_EN emails.

Further, based on NS's higher skills in writing in their native language and higher pragmatic competence in employing linguistic means to convey their social intentions [21,28,105], we predict that NS readers would be able to interpret the social intention better for emails written by other NS (NS email) than NNS-written emails (H2a).

Between NNS-written emails, we suspect that NNS_EN emails will be better at conveying social intention such as politeness than NNS_TR emails (H2b). We make the opposite prediction that we made for clarity (H1a) because pragmatic aspects of language and idiomatic expressions are still problematic even in state of the art MT systems [16,78,86]. While MT could help NNS to compose the message with high clarity, it may not be so effective in converting their social intention in the source text into MT outputs. In contrast, while NNS using English may not be as adept as NS at employing English language conventions to convey their social intentions, their attempts to convey their intentions are still likely to be better than MT.

H2a People will interpret the social intentions of email senders more accurately for NS emails than NNS-written emails.

H2b People will interpret the social intentions of the email senders more accurately for NNS_EN emails than NNS_TR emails.

Similarly, the higher pragmatic competence of NS could allow them to employ effective strategies to make their emails sound more appropriate for the request situation than NNS senders could [28], either through using a common language or MT. Further, higher clarity and appropriateness ratings would likely translate into a more positive social evaluation of senders and a higher likelihood of accepting requests (H3-5).

H3: People will rate evaluate NS emails as more appropriate than NNS-written emails.

H4: People will evaluate senders as more socially attractive when reading NS emails than NNS-written emails.

H5: People will be more willing to accept the request when reading NS emails than NNS-written emails.

Between NNS_EN and NNS_TR emails, unlike the questions on clarity and accuracy, there is less evidence to support directional hypotheses around social perception (email appropriateness, email sender attraction) and social outcomes (request acceptance likelihood). Using English as a common language, NNS might not be able to express their social intention fully and present themselves as socially attractive depending on their second language proficiency and cultural exposure. In contrast, using MT, NNS might be able to employ richer ways to express themselves and to present themselves as socially attractive using their native language. Therefore, it is possible that NNS_TR email could contain richer social cues compared to NNS_EN email. However, it is also possible that those richer cues can disappear in the process of machine translation. Given that both strategies possess limitations, we pose this issue as a research question (RQ1):

RQ1: How do ratings of social perception (email appropriateness, social attraction towards senders) and social outcomes (the likelihood of accepting requests) differ between NNS_EN and NNS_TR emails?

Providing salient cues about the language background of senders who are NNS can influence perceptions of emails and email senders. Prior research shows mixed results regarding the effects of information about a sender's language background. Some studies showed that clear indicators that communication partners are NNS could encourage NS to adjust their expectations of how their counterparts behave and speak [94,101], whereas other research showed the existence of implicit discrimination based on such indicators [11]. Therefore, we ask the following research question:

RQ2: How do ratings of email understanding (clarity, accuracy in interpreting social intention), social perception (email appropriateness, social attraction toward the sender), and social outcome (likelihood of accepting requests) differ when people are provided with information that the sender is a NNS compared to when such information is not available for NNS-written emails?

Also, people may adjust their assessments of message quality and senders when they are aware that MT is being used in the communication. Gao and colleagues showed that when people believe that a conversation is mediated by MT, people attribute fewer collaboration problems to their NNS partners and evaluate them more positively [39]. However, people may have low willingness to interact with machine-translated messages; therefore, signaling the presence of MT may not always have a positive effect [49]. Therefore, we ask the following research question:

RQ3: How do ratings of email understanding (clarity, accuracy in interpreting social intention), social perception (email appropriateness, social attraction toward the sender), and social outcome (likelihood of accepting requests) differ when people are provided with the information the email is machine translated compared to when they were only aware that the sender is a NNS for NNS_TR emails?

4 METHOD

4.1 Study Material Construction

To construct the set of NS, NNS_EN, and NNS_TR emails, we recruited 37 monolingual native English speakers and 45 native Chinese speakers born in China using the campus recruitment pooling platform at a large U.S. university. Participants were compensated with either experimental participation credits (required by many courses in the departments that established this recruitment pool) or an $8 gift card. More than 90% of the participants were between 18-25 years old.

We excluded native Chinese speakers who had lived in English-speaking countries for more than eight years to ensure that they had received the majority of their K-12 education in Chinese rather than English speaking contexts. On average, native Chinese speakers had resided in English-speaking countries for 3.45 years (Median: 3; SD = 2.33); of the 76% who reported their latest TOEFL (Test of English as a Foreign Language) score, the average was 107.3 (SD = 5.62). This is at the 92nd percentile of all TOEFL takers [104], suggesting that they generally had a high level of English proficiency [104].

Participants were given eight scenarios about situations in which a person had to make a request in a daily, academic, or business context through email. These scenarios were adopted from prior cross-lingual pragmatics studies that used a Discourse Completion Task (DCT) in which participants were prompted to compose messages for the given scenarios [9,96,115]. We edited the prompts to better suit the email communication contexts.

For each scenario, English native speakers were asked to compose a request email in English (a total of eight emails). Bilingual Chinese speakers were asked to write request emails for each scenario, four in Chinese and another four in English. When they had completed writing each email, we asked them to indicate the communicative intentions that they tried to convey in their email using 12 item semantic differential scales (e.g., How [polite, friendly, strong] do you think your email sounds?"). These social intention dimensions were adopted from prior literature that involved the assessments of general attitudes toward emails (e.g., [93,110]) and also previous studies investigating intercultural email perceptions (e.g., [28,61]).

After filtering out the cases when participants did not provide the relevant email contents or did not fill out the semantic differential scales meaningfully (e.g., marking "1" for all items), we collected 168 emails from native English speakers, 108 emails from Chinese speakers writing in English, and 112 emails from Chinese speakers writing in Chinese.

From these, we first selected six scenarios (see **Table 1**) that had higher variability in semantic differential ratings. Emails from two omitted scenarios that had lower variability in semantic differential ratings were not used in this study. It was to make sure that the emails in each scenario possessed a varying degree of social intentions. We then randomly picked 15 email samples per scenario, five from each email condition (NS, NNS_EN, NNS_TR). Overall, we included a total of 90 emails (30 NS, 30 NNS_EN, and 30 NNS_TR emails) for the study. The 30 NNS_TR emails written in Chinese were translated to English using Microsoft Bing translator [7].

For each of the selected emails, we created screenshots that resembled the interface of Google Gmail [42]. We carefully selected a set of gender-neutral English names for both senders and recipients to minimize potential confounding issues regarding the gender of the communicators (e.g., [80,84]). Also, we kept the subjects of the emails the same across all emails for a given scenario (e.g., "Seeking advice," "Looking to connect").

Table 1. The six chosen scenarios with high variability of social intention ratings.

1	You ask your professor you took a class with a while ago to introduce you to someone who may be hiring in your chosen career path.
2	You would like to take a week off from work to attend the wedding of a friend who lives abroad. You are emailing your boss to ask for a week off.
3	You have an interview for a new job next week, but you realize you cannot make it on the scheduled date. You are emailing the hiring manager to reschedule.
4	You are interested in working at a particular company and heard that an alumnus of your college currently works there. You are emailing this person to ask if they would speak with you about their company in a video call.
5	You are in charge of a fundraising campaign at work to help needy children. You are emailing your colleagues to ask them to donate to this campaign.
6	You received an email from your apartment management office fining you for not recycling properly. You believe the fine is an error and are emailing the office to ask them to cancel it.

Finally, to manipulate presenting information about writers' language backgrounds for the Writer and Writer+TR Info conditions, we created separate instructions and email screenshots by changing the names of the email senders to common Chinese names for NNS_EN and NNS_TR emails. Also, for the Writer+TR Info condition, we added a clear indication that the email had been translated from Chinese to English for NNS_TR emails. **Figure 2** shows examples of the instructions and email interface in the three different conditions for NNS_TR emails.

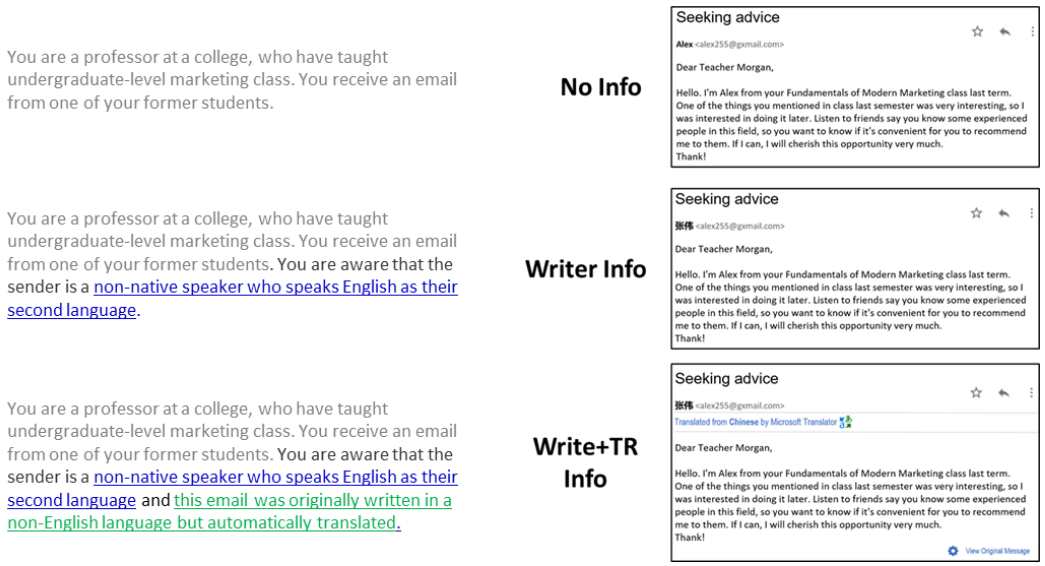

Figure 2. Example scenario prompts and email screenshots and prompts by condition for NNS_TR email

4.2 Study participants

For the study itself, we recruited participants on Prolific (https://www.prolific.co), an online participant pooling platform. Participants had to reside in the U.S., be monolingual native English speakers, and be at least 18 years old. Participants were compensated $3 for their time. On average, it took about 15 minutes to complete the online experiment.

A total of 257 participants were recruited. We excluded participants who did not complete the survey, who completed the survey in less than half the normal average time and thus were unlikely to have been reading the questions carefully (N = 14), and who did not pass intermittent attention checks that asked them to click "7" in response to show they were reading the questions (N = 18). After filtering, the responses from 225 participants were included for the data analysis.

Fifty-five percent of included participants were females, and the average age was 29.1 years old. The sample was 78.3% White, 11.8% Asian, 10.6% African American, 2% Native American, and 6.1% other. Most participants (82.4%) held college or higher degrees. About 70% of participants used email at least more than once a week.

4.3 Study Procedures

After reading and agreeing to the consent form, participants were randomly assigned to one of the information conditions (No Info, Writer Info, or Writer+TR Info). Then, participants were told that they would read and rate six emails in various personal and business-related situations. To reduce possible confounding effects of specific scenarios and specific email contents on the results, we randomized the set of emails that each participant was given, subject to the constraint that all participants were given one email from each scenario and two emails from each of the three types of emails (NS, NNS_EN, NNS_TR). For example, one participant was given NS emails from scenarios 1 and 6, NNS_EN emails from scenarios 3 and 4, and NNS_TR emails from scenarios 2 and 5. However, another participant was given NS emails from scenarios 3 and 5, NNS_EN emails from scenarios 1 and 2, and NNS_TR emails from scenarios 4 and 6.

For each email, we first briefly described the scenario, including the relationship between the sender and the participant as a receiver (e.g., "You are the manager at the office. You receive an email from one of the junior staff members on your team."), without explicitly informing them of the nature of the request.

After reading each email, participants were asked to indicate their interpretation of the sender's social intention using the same twelve-item semantic differential scale that email writers filled out (e.g., "How [polite, friendly, strong] did this email sound to you?"); the scale items are shown in **Table 2**. They also answered questions about the perceived clarity and appropriateness of the email, their social attraction towards the email sender, and their likelihood of accepting the request. After they completed the survey questions for all six emails, they answered a set of basic demographic questions.

4.4 Measures

Participants answered the following questions after reading each email.

Clarity of email. Participants' evaluation of the clarity of emails was measured using two 7-point Likert scales ("This email delivers the main point well.", "This email conveys the intention well."). The questions formed a reliable scale (Cronbach's $\alpha = .93$) and were averaged to create a measure of the clarity of email.

Accuracy in interpreting sender's social intentions. Participants rated each email on twelve, 7-point semantic differential scales shown in Table 2. Factor analysis with Varimax rotation indicated the presence of two factors, one corresponding to email politeness (disrespectful-respectful, impolite-polite, unfriendly-friendly, uncooperative-cooperative, unsympathetic-caring, distant-close) and another corresponding to email boldness (shy-bold, weak-powerful, indirect-direct, ambiguous-clear). These factors accounted for 41% and 21% of the variance, respectively. The remaining two items (undemanding-demanding, informal-formal) were excluded as they loaded on both factors. By averaging the items loading on each factor, we

created measures of perceived social intentions on "perceived email politeness" (Cronbach's α = .86) and "perceived email boldness" (Cronbach's α = .76).

Alignment between the writer's social intentions and the reader's (participant's) interpretations was measured by the absolute difference between the participant's and writer's ratings on each social intention factor. This absolute difference indicated the magnitude of pragmatic misunderstandings; lower absolute differences between participant's vs. writer's politeness and boldness ratings indicated higher accuracy in interpreting corresponding social intentions.

Table 2 Factor analysis of the twelve semantic differential scales

Social Intention Dimensions	Factor 1 (Email Politeness)	Factor 2 (Email Boldness)
Disrespectable-Respectful	**.861**	
Impolite-Polite	**.859**	
Unfriendly-Friendly	**.852**	
Uncooperative-Cooperative	**.844**	
Unsympathetic-Caring	**.831**	
Distant-Close	**.715**	
Shy-Bold		**.757**
Weak-Powerful		**.733**
Indirect-Direct		**.667**
Ambiguous-Clear		**.641**
Undemanding-Demanding	-.466	.596
Informal-Formal	.516	.372

Appropriateness of email. Participants' evaluation of the appropriateness of emails was measured using two 7-point Likert scales ("Everything said in the email was appropriate.", "The sender's communication style was very suitable to the situation."). The questions formed a reliable scale (Cronbach's α = .89) and were averaged to create a measure of the appropriateness of email.

Social attraction towards email sender. Participants' evaluation of the email sender was measured using eight 7-point Likert scales (e.g., "I have a feeling that the sender is a very competent person.", "I would like to have a friendly chat with this sender.") adapted from an existing measure of interpersonal attraction [76]. Factor analysis with Varimax rotation indicated the presence of one factor, and the questions formed a reliable scale (Cronbach's α = .96), so they were averaged to create a measure of the social attraction towards the email sender.

Likelihood of accepting the request. Participants' evaluation of the likelihood of accepting the request was measured using two 7-point Likert scales ("I will reply to this email.", "I will accept the request in this email."). The questions formed a reliable scale (Cronbach's α = .84) and were averaged to create a measure of the likelihood of accepting the request.

4.5 Data Analysis

To test the hypotheses and investigate the research questions, we conducted 3 (**Email Condition**: NS vs. NNS_EN vs. NNS_TR emails) x 3 (**Information Condition**: No Info vs. Writer Info vs. Writer+TR Info) Mixed Model ANOVAs that took into account the fact that each participant read and rated six emails that were randomly selected from the larger email set. We utilized Satterthwaite's approximation method that adjusts the estimation of variance, which generally provides more robust and conservative results [59]. As a result, the degrees of freedom can be a

non-integer value [73]. In addition, we calculated the partial eta squared (η2) to measure the effect size of the main and interaction effects (criteria: small: .01, medium: .06, large effect: .14) [19]. Post-hoc LSD comparisons (i.e., Fisher's Least Significant Difference) were used to compare the measures between conditions.

5 RESULTS

We first describe the results from a descriptive analysis that examines the general characteristics of the emails in this study and the correlation between measures. Then, we report the analysis results for each measure to test hypothesis and investigate research questions. Finally, we present the results from an additional analysis that factored the NNS writer's length of stay in English speaking countries into the models.

5.1 Descriptive Analysis

We first checked to make sure there were no systematic differences between groups on the between-subjects factor of information condition (No Info, Writer Info, Writer+TR Info). Chi-square tests of independence on participants' age range, gender, race, education level, occupation, and frequency of email use indicated there was no significant difference in individual factors by between-subjects group (all individual measures: $p > .05$).

We then compared the characteristics of the emails divided by email condition. Overall, email senders' politeness intention was moderately high (grand mean = 5.14, SE = .10), and there was no significant difference between the three email conditions in politeness intentions ($p = .47$). Senders' boldness intention was also moderately high (grand mean = 5.44, SE = .09), again, with no significant difference between conditions ($p = .88$).

We also investigated the linguistic characteristics of the emails, using the popular grammar checking tool Grammarly [43] to examine word count, readability as measured by Flesch's reading ease score [32], number of grammar errors, and patterns of word choice (i.e., percentage of unique and rare words). A series of one-way ANOVAs were conducted to examine the effect of email condition while controlling the types of scenarios.

A significant main effect of email condition was found only on the number of grammar errors ($F [2, 72] = 15.67$. $p < .05$). Post-hoc comparisons showed that NNS_EN emails (M = 3,0, SE = .34) contained significantly more grammar errors than NS (M = 1.8, SE = .34, $p < .05$) or NNS_TR emails (M = 1.6, SE = .34, $p < .01$); there was no significant difference in the number of grammatical errors between NS and NNS_TR emails. There was no significant main effect of email condition on word count, readability, or percentage of unique and rare words (words that do not belong to the 5000 most commonly used English words) ($p > .05$ respectively). Further, we also examined the effect of years living in English-speaking countries on linguistic characteristic measures for NNS_EN emails. We did not find any significant correlation between years living in English-speaking countries and linguistic measures, including the number of grammar errors.

Finally, we examined correlations between measures, as shown in **Table 3**. Overall, email clarity and other social perception and outcome measures were positively correlated. However, differences between intended vs. perceived politeness and boldness intentions were negatively correlated with email clarity and other social perception and outcome measures.

Table 3 Correlation between Measures

	1	2.1	2.2	3	4
1. Email Clarity	-				
2.1. Difference between intended vs. perceived Politeness Intention	-.237**	-			
2.1. Difference between intended vs. perceived Boldness Intention	-.36**	.359**	-		
3. Email Appropriateness	.646**	-.362**	-.274**	-	
4. Social perception towards email sender	.586**	-.329**	-.236**	.795**	-
5. Accepting requests	.583**	-.308**	-.234**	.663**	.678**
** p < .01					

5.1 Email Clarity

H1a and H1b predicted that people would evaluate the clarity of emails the best for NS emails and the worst for NNS_EN emails. To test this, we ran a mixed ANOVA of the form outlined above using the measure of email clarity as a dependent variable.

There was a significant main effect of email condition on email clarity ($F [2, 91.297] = 44.56$. $p < .01$, $\eta 2 = .49$). Post-hoc comparisons showed that participants evaluated email clarity significantly lower for NNS_TR email ($M = 4.48$, $SE = .11$) than NS ($M = 5.93$, $SE = .11$, $p < .001$) and NNS_EN emails ($M = 5.69$, $SE = .11$, $p < .001$). However, there was no significant difference between NS and NNS_EN emails ($p = .14$). Therefore, H1a predicting greater clarity of NS email was only supported for NNS_TR email. H1b, predicting greater clarity of NNS_TR email compared to NNS_EN email, was not supported.

Further, there was a significant main effect of information condition ($F [2, 551.97] = 21.80$, $p < .001$, $\eta 2 = .06$) such that participants rated the clarity of emails higher when they were provided with information about the email writer's language background (Writer Info condition: $M = 5.56$, $SE= .09$, Writer+TR Info condition: $M = 5.54$, $SE = 09$) versus the No Info condition ($M = 5.01$, $SE = .08$) ($p < .01$ respectively). However, there was no significant difference between the Writer and Writer+TR Info conditions ($p = .85$).

Based on a significant interaction effect between email and information conditions ($F [4. 1042.29] = 5.73$, $p < .001$, $\eta 2 = .02$), we ran a series of pairwise post-hoc comparison tests to examine how the information about writers' language backgrounds and MT use affected participants' evaluation of email clarity. As shown in **Figure 3**, the clarity of both NNS_EN and NNS_TR email was evaluated significantly higher when participants had information that the email sender was NNS than without this information ($p < .01$), but there was no significant difference for NS email ($p = .34$). As NNS-written emails received higher clarity ratings under the Writer and Writer+TR conditions, the significant gap between NS and NNS_EN email under the No Info condition ($p < .001$) became insignificant ($p = .26$). However, the clarity ratings for NNS_TR email remained significantly lower than other types of email in all information conditions ($p < .001$). Finally, there was no additional effect of the information about MT use on NNS_TR email, as there was no significant difference in email clarity between Writer and Writer+TR Info conditions for NNS_TR email ($p = .80$).

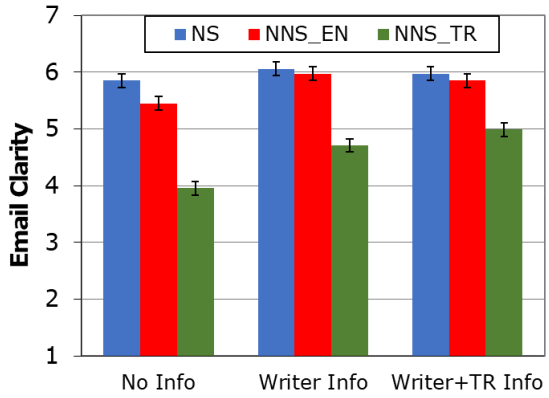

Figure 3. Email clarity on a scale of 1 (extremely unclear) to 7 (extremely clear) as a function of email and information conditions.

Taken together, for NNS written email (NNS_EN and NNS_TR email), revealing the writer's language background has positive effects on email clarity (RQ2). However, there was no additional effect of the information about the use of MT on NNS_TR email (RQ3).

5.2 Accuracy in Interpreting Social Intentions

H2a and H2b predicted that people's accuracy in interpreting the social intentions of email senders would vary between email conditions. Specifically, we hypothesized that people would interpret the social intentions of the email sender most accurately for NS email and least accurately for NNS_TR email. As a reminder, the interpretation accuracy was measured as the absolute difference between the writer's and reader's ratings on each calculated social intention factor. We ran mixed ANOVAs of the form outlined above using the absolute difference scores for politeness and boldness dimensions as dependent variables.

5.2.1 Accuracy in Interpreting Politeness Intentions

For politeness intention, there was a significant main effect of email condition ($F [2, 89.36] = 5.38$, $p < .01$, $\eta 2 = .10$). The difference for NNS_TR email ($M = 1.65$, $SE = .07$) was significantly larger than that of NS ($M = 1.32$, $SE = .07$, $p < .05$) and NNS_EN email ($M = 1.45$, $SE = .07$, $p < .01$). However, there was no significant difference between NS and NNS_EN emails ($p = .22$). This result partially supported H2a since interpretation accuracy for NS email was significantly higher only for NNS_TR email, but not for NNS_EN emails. H1b, predicting higher interpretation accuracy for NNS_EN email than NNS_TR email, was supported.

In addition, there was a significant main effect of information condition on accuracy at interpreting politeness ($F [2, 872.8] = 3.01$, $p < .05$, $\eta 2 < .01$). Pairwise comparisons showed that participants in the No Info condition ($M = 1.54$, $SE = .04$) were less accurate than participants in the Writer ($M = 1.43$, $SE = .05$, $p = .07$) or Writer+TR Info conditions ($M=1.45$, $SE= .05$, $p = .02$). However, there was no significant difference between the Writer Info vs. Writer+TR Info conditions ($p = .71$).

Further, we found a significant interaction effect between email and information condition ($F [4, 1165.57] = 2.60$, $p < .05$, $\eta 2 < .01$). As shown in **Figure 4**, there was no significant effect of information condition on NS email ($p = .65$) and NNS_EN email ($p = .35$). However, for NNS_TR email, there was a trend that participants in the Writer Info and Writer+TR Info conditions were

more accurate at interpreting politeness intentions than participants in the No Info condition (p = .06, p < .01, respectively). However, there was no significant difference between Writer Info vs. Writer+TR Info condition (p=.54). While the accuracy for NS email was significantly higher than that of NNS_EN email under the No Info condition (p < .001), there was no significant difference between them under the Writer and Writer+TR conditions (p= .28). The accuracy for NNS_TR email remained significantly lower in all information conditions (p < .05).

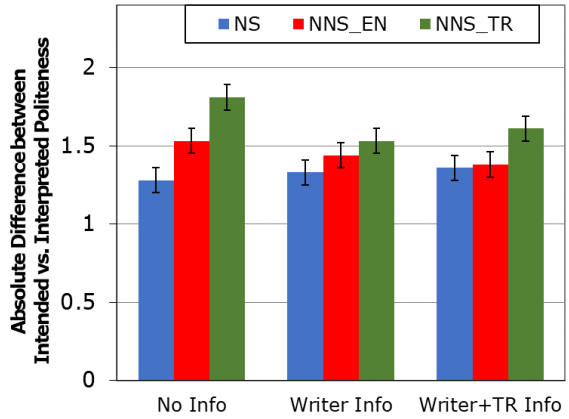

Figure 4. Absolute difference between intended versus interpreted politeness by email and Information condition.

A significant interaction effect was found only for NNS_TR email, so we further explored how the difference between intended and interpreted politeness varied around NNS_TR email using the raw (rather than the absolute) value of the difference (i.e., participants' rating minus email writer's rating on politeness intention). Overall, participants underestimated the politeness intention of NNS_TR email (M = -.59, SE = .17) more strongly than for NS (M = -.11, SE = .16, p < .05) and NNS_EN email (M =.08, SE = .16, p < .01). The degree of underestimation was greater for participants in the No Info condition (M= -1.05, SE = .22) than participants in the Writer Info (M = -.26, SE = .22, p < .001) and Writer+TR Info conditions (M = -.43, SE = .23, < .001). However, there was no significant difference between the Writer and Writer+TR Info conditions (p = .32).

5.2.2 Accuracy in Interpreting Boldness Intentions

The pattern of results was similar for the boldness dimension. There was a significant main effect of email condition on accuracy in interpreting boldness intention (F [2, 87.88] = 5.01, p < .01, η2 = .10). Pairwise comparisons showed that the difference score on boldness intentions was larger for NNS_TR email (M = 1.72, SE = .10) than NS email (M = 1.29, SE = .10, p < .05) or NNS_EN email (M = 1.36, SE = .10, p < .01). However, there was no significant difference between NS and NNS_EN email (p = .63). This result partially supported H2a since interpretation accuracy for NS email was significantly higher only for NNS_TR email but not for NNS_EN emails. H1b, predicting higher interpretation accuracy for NNS_EN email than NNS_TR email, was supported.

A significant main effect of information condition was also found (F [2, 1158.90] = 7.41, p < .01, η2 = .001). Pairwise comparisons showed that participants in the No Info condition (M = 1.56, SE = .06) were less accurate at interpreting boldness intention than participants in the Writer (M = 1.37, SE = .06, p < .01) or Writer+TR Info conditions (M = 1.45, SE = .06, p < .01). However, there was no significant difference between the Writer Info and Writer+TR Info conditions (p = .13).

Unlike the politeness dimension, there was no significant interaction effect between email and information conditions on the boldness dimension (p = .27).

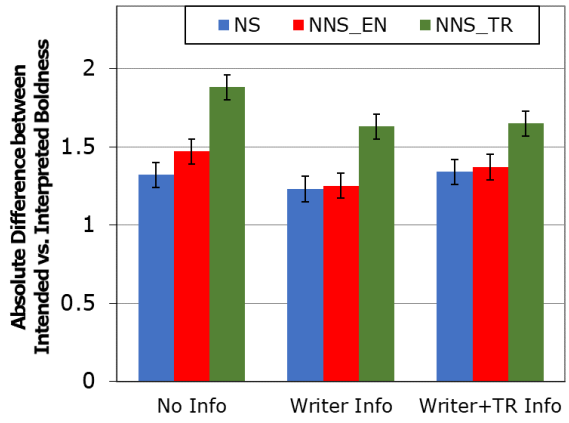

Figure 5. Absolute difference between intended versus interpreted boldness by email and Information condition.

Taken together, for NNS written email (NNS_EN and NNS_TR email), revealing the writer's language background has positive effects on email clarity (RQ2). However, there was no additional effect of the information about the use of MT on NNS_TR email (RQ3).

5.3 Email Appropriateness

H3 predicted that participants would evaluate NS email as more appropriate than NNS_EN and NNS_TR email. To test this hypothesis, we first examined the main effect of email conditions on email appropriateness using a Mixed ANOVA described above.

There was a significant main effect of email condition on participants' evaluation of email appropriateness (F [2, 97.8] = 23.17, $p < .001$, $\eta 2 = .32$). Pairwise comparisons showed that participants evaluated the appropriateness of NS email (M = 5.30, SE = .13) higher than NNS_EN (M = 4.92, SE = .13, $p < .05$) and NNS_TR email (M = 4.07, SE = .13, $p < .001$), thus H3 was supported. Participants perceived NNS_EN email as more appropriate than NNS_TR email ($p < .001$) (RQ1).

There was a significant main effect of information condition (F [2, 514.10] = 24.55, $p < .001$, $\eta 2 = .08$) such that the appropriateness of emails was perceived higher for participants in the Writer (M = 5.07, SE = .10, $p < .001$) and Writer+TR Info conditions (M = 4.88, SE = .10, $p < .001$) than in the No Info condition (M = 4.34, SE = .09). However, there was no significant difference between the Writer and Writer+TR Info conditions (p = .10).

Further, we found a significant interaction effect between email and information condition (F [4, 1033.81] = 3.76, $p < 01$, $\eta 2 = .01$). As shown in **Figure 6**, there was no significant effect of information condition on NS email (p = .14). However, for NNS-written emails, participants in the Writer and Writer+TR Info conditions evaluated the emails as more appropriate than participants in the No Info condition ($p < .01$). However, there was no significant difference between Writer vs. Writer+TR Info conditions ($p < .05$) in both NNS_EN and NNS_TR emails. As NNS-written emails received higher appropriateness ratings in the Writer and Writer+TR conditions, the significant difference between NS and NNS_EN email in the No Info condition ($p < .001$) became

insignificant (p= .56). However, the appropriateness ratings for NNS_TR email remained significantly lower than other types of emails in all information conditions (p < .001).

Taken together, for NNS written email (NNS_EN and NNS_TR email), revealing the writer's language background has positive effects on email appropriateness (RQ2). However, there was no additional effect of the information about the use of MT on NNS_TR email (RQ3).

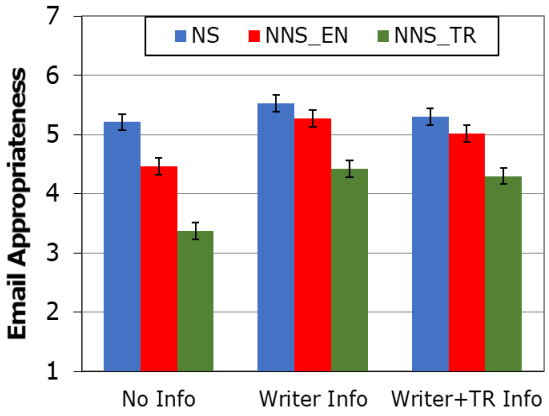

Figure 6. Email appropriateness on a scale of 1 (extremely inappropriate) to 7 (extremely appropriate) as a function of Email and Information conditions

5.4 Social Attraction towards Email Senders

H4 predicted that participants would evaluate the senders of NS email as more socially attractive than the senders of NNS_EN and NNS_TR email. To test this, we ran a mixed ANOVA of the form outlined above using the measure of the social attraction towards email sender as a dependent variable.

There was a significant main effect of email condition on social attraction towards email sender ($F [2, 104.71] = 11.78$, $p < .001$, $\eta 2 = .18$). Pairwise comparisons showed that participants evaluated email senders as less attractive when reading NNS_TR email ($M = 4.10$, $SE = .11$) than NS ($M = 4.86$, $SE = .11$, $p < .001$) and NNS_EN email ($M = 4.60$, $SE = .11$, $p < .001$) (RQ1). However, there was no significant difference between the NS and NNS_EN email conditions ($p = .11$). Therefore, H4 was partly supported, only for NNS_TR email.

There was also a significant main effect of information condition ($F [2, 470.97] = 28.72$, $p < .001$, $\eta 2 = .10$) in which participants in the Writer ($M = 4.76$, $SE = .09$, $p < .001$) and Writer+TR Info conditions ($M = 4.72$, $SE = .09$, $p < .001$) evaluated email senders as more socially attractive than participants in No Info condition ($M = 4.07$, $SE = .08$). However, there was no significant difference between the Writer Info and Writer+TR Info conditions ($p = .75$).

Further, we found a significant interaction effect between email and information condition ($F [4, 1117.7] = 6.75$, $p < .001$, $\eta 2 = .02$). As shown in **Figure 7**, there was no significant effect of information condition on NS email ($p = .15$). However, for both NNS_EN and NNS_TR email, participants in the Writer Info and Writer+TR Info conditions evaluated email senders as more socially attractive than participants in the No Info condition ($p < .001$). No significant difference was found between the Writer and Writer+TR Info conditions in both NNS email conditions ($p > .05$). As NNS-written emails received higher social attractiveness ratings under the Writer and Writer+TR conditions, the significant difference between NS and NNS_EN emails in the No Info

condition ($p < .001$) became insignificant ($p = .42$) in the Writer and Writer+TR conditions. However, social attraction ratings for NNS_TR email remained significantly lower in all information conditions ($p < .001$).

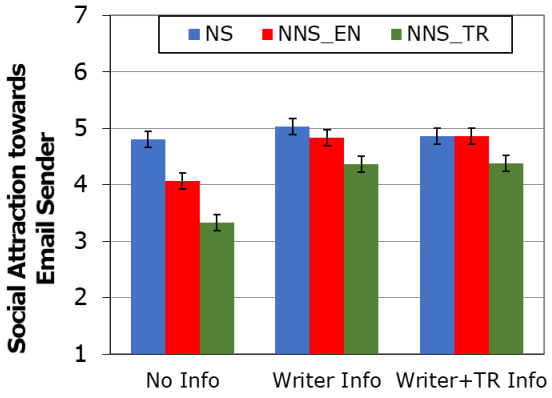

Figure 7. Social attraction towards email senders on a scale of 1 (extremely unattractive) to 7 (extremely attractive) as a function of email and Information conditions.

Based on the results of post hoc analysis of the interaction effect, the writer's language background information had a positive effect on the social attractiveness towards email sender for NNS_EN and NNS_TR email (RQ2). However, there was no additional effect of the information about MT use on NNS_TR email (RQ3).

5.5 Likelihood of Accepting Requests

H5 predicted that the likelihood of accepting the request would vary depending on the email condition. Specifically, we expected participants would be more willing to accept requests in NS email than NNS_EN and NNS_TR email. We ran a mixed ANOVA of the form outlined above using the measure of the likelihood of accepting requests as a dependent variable.

There was a significant main effect of email condition on the likelihood of accepting requests ($F [2, 93.26] = 9.78$, $p < .001$, $\eta 2 = .17$). Pairwise comparisons showed that participants were less willing to accept requests in NNS_TR email ($M = 4.66$, $SE = .13$) than NS email ($M = 5.43$, $SE = .13$, $p < .001$) and NNS_EN email ($M = 5.29$, $SE = .13$, $p < .001$) (RQ1). However, there was no significant difference between the NS and NNS_EN email conditions ($p = .42$). Therefore, H5 was partly supported only for NNS_TR email.

Further, there was a significant main effect of information condition ($F [2, 628.47] = 26.36$, $p < .001$, $\eta 2 = .07$) such that participants in the Writer Info ($M = 5.30$, $SE = .10$, $p < .001$) and Writer+TR Info ($M = 5.37$, $SE = .10$, $p < .001$) conditions indicated greater likelihood of accepting requests than participants in the No Info condition ($M = 4.71$, $SE = .09$). However, there was no significant difference between the Writer Info and Writer+TR Info conditions ($p = .49$).

Further, we found a significant interaction effect between email and information conditions on the likelihood of accepting requests ($F [4, 1074.29] = 4.85$, $p < .01$, $\eta 2 = .01$). As shown in **Figure 8**, there was no significant main effect of information condition on NS email ($p = .26$). However, for both NNS_EN and NNS_TR email, participants in the Writer Info and Writer+TR Info conditions indicated greater willingness to accept the request than participants in the No Info condition ($p < .01$). There was no significant difference between the Writer and. Writer+TR Info

conditions ($p > .05$). As NNS-written emails received higher ratings of acceptance likelihood under the Writer and Writer+TR conditions, the significant difference between NS and NNS_EN email under the No Info condition ($p < .05$) became insignificant ($p = .35$) in the Writer and Writer+TR conditions. The acceptance ratings of NNS_TR emails remained significantly lower in all information conditions ($p < .001$).

The results of post hoc analysis of the interaction effect indicated that the writer's language background information again increased the likelihood of accepting requests for NNS_EN and NNS_TR email (RQ2). However, there was no additional effect of the information about MT mediation on NNS_TR email (RQ3).

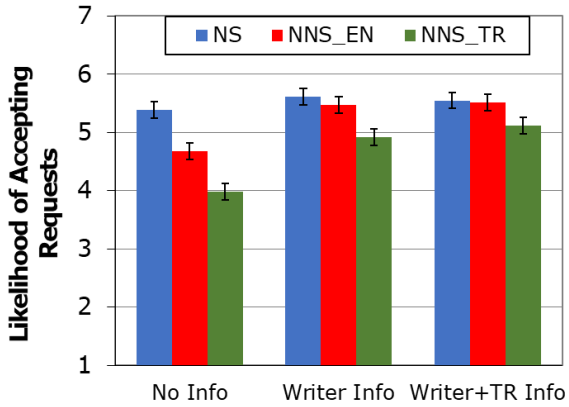

Figure 8 Likelihood of accepting requests on a scale of 1 (extremely unlikely) to 7 (extremely likely) as a function of Email and Information conditions

5.6 Effect of Length of Stay in English Speaking Countries for NNS-written Emails

Finally, we examine the effect of Chinese email writers' years of living in English-speaking countries on the main effects of email conditions. While in our study, grammatical errors were not associated with length of stay in English countries, other work has found a correlation between length of stay and both proficiency in a second language and understanding of the host culture [35,90]. Therefore, it is possible that length of stay would be associated with NNS's ability to express social intentions.

In order to address this possibility, we split the NNS_EN email samples into two categories that roughly divided the sample in half: **NNS_EN(↑2)** emails were written by Chinese speakers who had lived in English-speaking countries for more than two years (44.1%), while **NNS_EN(2↓)** emails were written by Chinese speakers who had lived in English speaking countries for two years or less (55.9%). We reran the above mixed ANOVA models with split NNS_EN categories to test whether the length of stay influenced the main effects of the email condition.

Overall, NNS's length of stay did not affect most of the main findings. In all measures but interpretation accuracy of politeness intentions, the patterns of main effects of email condition remained the same, and there was no significant difference between NNS_EN(↑2) and NNS_EN(2↓) email ($p > .05$).

However, the sender's length of time in English-speaking countries mattered for accuracy of interpreting senders' politeness intentions. NS readers' accuracy was significantly higher for NNS_EN(2↑) emails ($M = 1.26$, $SE = .10$) than NNS_EN(2↓) emails ($M = 1.59$, $SE = .09$) ($p < .05$).

Interestingly, there was no significant difference in accuracy in interpreting politeness intentions between NNS_EN(2↓) and NNS_TR emails ($p = .61$). This indicated that the ability of NNS to convey their politeness intentions may be limited when they have limited exposure to the culture of the second language.

6 DISCUSSION

In this paper, we investigated how the problems of interpreting social intentions from emails differ when using a common language versus MT, the two primary approaches in addressing language barriers in CMC. We also examined whether presenting background information about senders would affect those interpretations, social perceptions, and outcomes. **Table 4** presents the overall results from testing the hypotheses and RQs. Below we discuss each of our findings in turn, focusing on implications and further ideas around ways to reduce cross-lingual pragmatic understandings and ultimately improve cross-lingual communication.

Table 4. Summary of results.

Measures	Effects of email condition	Effects of information that sender's language background for NNS written emails (RQ2)	Effect of information about the presence of MT for NNS_TR emails (H3)
H1. Email clarity	NS = NNS_EN > NNS_TR	Writer = Writer+TR Info > No Info	Writer = Writer+TR info
H2. Interpretation accuracy of politeness Intentions	NS = NNS_EN > NNS_TR	(NNS_EN) Writer = Writer+TR Info = No Info (NNS_TR) Writer = Writer+TR Info > No Info	Writer = Writer+TR info
H2. Interpreting accuracy of boldness intentions	NS = NNS_EN > NNS_TR	Writer = Writer+TR Info > No Info	Writer = Writer+TR info
H3, RQ1. Email appropriateness	NS > NNS_EN > NNS_TR	Writer = Writer+TR Info > No Info	Writer = Writer+TR info
H4, RQ1. Social attraction toward email sender	NS = NNS_EN > NNS_TR	Writer = Writer+TR Info > No Info	Writer = Writer+TR info
H5, RQ1. Likelihood of accepting requests	NS = NNS_EN > NNS_TR	Writer = Writer+TR Info > No Info	Writer = Writer+TR info

6.1 Considerations around common languages and MT

Across all measures, we consistently found strong main effects of email condition. Overall, results indicated that emails in a common language outperformed MT in terms of clarity (H1b), interpretation accuracy of the sender's social intention (H2b), social perception, and outcome measures (RQ1). In addition to the benefits of common language to comprehensibility [40,113,114], our findings revealed additional advantages of the common language approach: 1) enabling more accurate interpretation of the sender's social intentions and 2) leading to better social perceptions and outcomes. In particular, our results suggest that NS readers were better able to assess social intentions when reading NNS emails written in a common language than machine-translated emails. Also, NS readers evaluated the email and email senders as more socially appropriate and favorable for emails written in a common language than machine-translated emails.

Designers of CMC platforms need to take this result into account in helping communication partners make appropriate choices of when to use a common language and when to use MT features. In particular, adding MT features to an existing platform might paradoxically reduce people's ability to communicate across languages by encouraging the use of a suboptimal MT channel when a common language is available. Interfaces could help people avoid this risk by encouraging them to find a common language. For instance, Airbnb [2] and Uber [109] present the language(s) spoken by hosts and drivers, allowing customers to identify a common language

if one exists. Similar features in CMC platforms might encourage people to choose a common language over MT when possible.

Even though machine-translated emails had fewer grammatical errors than emails written in a common language, NS readers still rated emails written in common language more favorably. While grammatical errors were shown to negatively influence the evaluations of senders and messages (e.g., [3,69]), our findings suggest they may not be the most critical factors here. Rather, we speculate that the use of (even non-perfect) pragmatic devices shared in a common language is more important in conveying social intentions than grammatical correctness. Overall, our results indicate the immediate need for support that can facilitate better communication of social intentions in MT-mediated communication. Specifically, future tool developers will need to consider both ways to improve expressions of social intentions and the accuracy of interpreting social intentions.

For example, designers could consider adding cues to support better expression of social intentions. Emoji interpretation is reasonably (but not perfectly [77]) consistent across cultures [46,70], and emojis are a kind of paralinguistic cue that has been shown to help people make better sense of foreign language posts in social media [71]. CMC channels could encourage users to add more emojis through prominent access to tools for selecting them, perhaps even suggesting common emojis associated with social intentions that might be present in a given phrase or sentence.

Another design approach would be to use NLP techniques to provide additional cues for both writers and readers using MT in CMC. NLP algorithms are increasingly able to predict some aspects of pragmatic intentions in texts, such as politeness (e.g., [23]), (in)directness (e.g., [95]), and sarcasm (e.g., [4]). These NLP techniques are already being used in some tools such as "Boomerang Respondable" [10] to help writers understand how readers might perceive their messages. This approach could also be provided to readers to help them check their own interpretations of the sender's social intentions (e.g., [72])

Further, when NLP models for assessing pragmatic intent exist in multiple languages, they could be used to indicate cases where intent might be missing or altered in MT outputs. For instance, using both existing English language politeness models and a recent politeness model trained on Chinese [69], an interface could highlight messages where the politeness level in the original language is significantly different from its translation. This could help writers construct messages with social intentions more likely to be preserved in machine translation outputs, and readers identify where their perceptions of intent might not match the writer's actual intent.

Even though we found that using common language has advantages over MT, these advantages depend on the NNS's proficiency in a common language and cultural exposure. In this study, the NNS were Chinese native speakers, bilingual in English, who attended U.S. universities. Thus, they likely had a relatively high level of English proficiency and some exposure to communication conventions and norms in the U.S. Yet, even in this population, the length of stay in English-speaking countries, a reliable predictor of both higher language and pragmatic skills [35,90], had significant effects on their ability to express politeness intentions. For example, NNS who had lived in English-speaking countries for two years or less were not any better at expressing their politeness intentions using a common language versus using machine translation.

As such, designers should also consider the varying proficiency of the NNS in the common language and the capacity of the MT system to translate between the specific language pairs. As MT technologies improve both in overall quality and in the ability to communicate emotion and pragmatic forces such as politeness (e.g., [36,88]), this would help NNS express their social

intentions better even through MT. Also, disparities in the quality of MT output across different language pairs and different MT techniques [97,102] would also affect the relative value of common language versus MT-based communication. Finally, although our results did not support prior work that MT could enhance NNS's message production [66,81,106,111], this could eventually be achieved, as MT technologies improve both in overall quality and in the ability to communicate emotion and pragmatic forces such as politeness (e.g., [36,88]).

Lastly, we urge readers to interpret non-significant differences between emails written by NS and emails written by NNS in a common language with caution. As illustrated in Table 4, there was no significant difference between NS and NNS_EN email conditions in most measures except email appropriateness. This result could seem surprising given that a substantial body of literature in cross-lingual pragmatics has demonstrated that NS possess higher pragmatic competence in employing appropriate language means and conveying their social intentions effectively than NNS [e.g., 14,21,101].

However, our results still confirmed such previous findings. On the graphs for each dependent measure (see Figures 3-8), NS email received significantly more positive ratings than NNS_EN email, but only under the No Info condition that language background of senders was not provided. In other conditions where clear information about whether the email sender was NS or NNS was provided (i.e., Writer and Writer+TR Info), the gaps between NS and NNS_EN email become insignificant. This indicates that a simple cue about the language background of the sender can have a positive impact on interpretation of social intentions and social evaluations. In the following section, we will discuss this finding in greater depth.

6.2. Presenting information about writers' linguistic and cultural background

There were strong main effects of information condition on all dependent measures. When there was clear information about the sender's language background, NS readers perceived NNS-written email, regardless of whether written in common language or MT, as more comprehensible and more socially appropriate and attractive compared to when there was no clear indication about the sender's language background (RQ2). Also, they could better understand the politeness social intentions of senders for machine-translated email. For NNS written email, regardless of whether written in English or MT-translated, NS participants had more favorable evaluations about email and email senders when provided with a cue that the email sender was NNS.

Interestingly, providing information about the use of MT made no difference beyond the effect of knowing a sender was a NNS (RQ3). Unlike in Gao et al.'s study findings [39], there was no additional benefit of making the use of MT salient on the evaluation of the MT-translated emails and their senders. Here, NS readers might have already been primed to factor the possibility that messages had been translated into their assessments once they knew a sender was NNS.

On balance, this result extends prior findings that clear indicators that communication partners are NNS encourage NS to adjust their expectations on how their NNS counterparts behave and speak in face-to-face conversation [94,101]. Further, providing NS readers with cues that the sender is a NNS might increase the salience of potential differences in language, culture, and social norms, triggering a cultural perspective-taking in which people reason about potential cultural differences to understand the behaviors and intentions of culturally different others [85]. Our findings, in contrast to the findings that reported the negative consequences of revealing ethnic backgrounds for job seeking and roommate seeking [11,38], suggest that people become more "forgiving" of their non-native communication partners when they engage in casual interpersonal communication, whether it is done face-to-face or online.

Making these cues more salient in the course of a CMC exchange might increase the chance communication partners attend to cultural and linguistic differences, and this might be even more useful for the platforms such as email, where there are few available cues to make inferences about writers' backgrounds. However, revealing people's linguistic and cultural backgrounds does pose risks around triggering stereotypes and discriminations, as reported in other work [11,38]. Therefore, looking into how different interfaces might trigger stereotypes versus triggering sensemaking is important for future work.

6.3. Limitations

There were several limitations to this study. First, while focusing on "request acts" fit the research questions well, the results might not be generalizable to other communicative acts. Also, within request acts, the types of requests, the social distance, and the power distance between sender and receiver can have profound effects on the way people write and perceive messages []. Instead of manipulating all these factors in the study design, we made sure to create multiple scenarios having different types of requests and power relations. However, a future study needs to consider such social and contextual factors in greater detail.

Second, although we investigated the effect of NNS writers' English proficiency and linguistic characteristics of NNS-written emails, we were not able to directly measure NNS's language ability and the capacity of the MT system in use. Future studies may want to measure NNS writers' language proficiency in the common language and consider the varying quality of MT outputs and include these factors in the data analysis.

Third, we only included participants from a U.S. population who spoke English as their native language, and the email materials we used were created from bilingual native Chinese speakers. This leaves open questions about the generalizability of our findings for broader populations who use different native languages.

Finally, previous work has shown different ways of presenting MT outputs, such as showing two versions of MT outputs at a time [40]. We cannot directly compare the results in these designs due to differences in study settings and procedures, but this would be a worthwhile goal for future research.

7 CONCLUSION

In this paper, we compare how the ways NS readers interpret senders' social intention and evaluate the email and email senders are different when NNS use a common language versus MT in composing the emails. Overall, our results suggest the emails written in English as a common language could allow NS readers to make a more accurate interpretation of social intentions than machine-translated emails. Participants also evaluated the email senders and emails more positively for emails written in English compared to machine-translated emails. Also, when information about the language background of the sender was provided to the NS readers, overall evaluations of the NNS-written emails, whether written in English or machine-translated, were more positive. Our findings inform design implications for tools that support better cross-lingual CMC.

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