

The Multilingual Student Support Robot

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Abstract—International students in UK universities often struggle with interactions in English, particularly on their first days in the country. We have developed a multilingual support robot tailored to their needs. To evaluate the performance of the robot, 60 international students asked the robot, in either English or their native language (Modern Standard Arabic or Mandarin Chinese), for support on topics including campus directions, local tax exemption, financial aid, and official documents. Overall, users preferred to use their native language when interacting with the support robot, and using their native language in the robot interaction also had a positive effect on their perception of the interaction itself.

I. INTRODUCTION

One out of four students in the UK is an international student, where the vast majority come from non-EU countries (87%). The number of non-EU international students is on the rise: in 2024, there was a 20% increase in their number compared to the year before [1]. International students are defined by UNESCO as *individuals who have physically crossed an international border between two countries with the objective to participate in educational activities* [2], and they contribute a net economic impact of £37.4bn to the UK economy [3]. In the top non-EU countries of permanent address for the academic year 2022/23, we can find India and China, as well as UAE and Saudi Arabia [4].

While all international students must demonstrate a sufficient level of English to be able to enroll in a university in the UK, these students often struggle with interactions in English, particularly on their first days in the country. The students often experience significant culture shock [5] and, more specifically, what is known as “language shock” [6]: the everyday English they experience is often very different from the language that they were taught in their home country, and they often have difficulty adapting, at exactly the time when they need to navigate the necessary bureaucratic processes to settle into their new country and begin their studies.

To help these students, we have developed a multilingual student support robot which can speak Mandarin Chinese, Modern Standard Arabic, and English. The robot has been designed to answer questions about frequently-asked topics for newly-arriving students including campus directions, local tax exemptions, financial aid information and official documents, with the goal of being deployed in a student services center alongside human support workers.



Fig. 1. The robot system

In this paper, we evaluate the performance of the multilingual student support robot through a lab study where 60 international students used the robot to complete four tasks.

II. RELATED WORK

An important aspect of well-being is a sense of *belonging*, the lack of which can lead to stress and uncertainty [7]. This is especially crucial for new arrivals in a foreign country, such as international students [8], who may experience particular issues interacting with university student support services. A key challenge which newly arrived students face is learning to function in a new language. Foreign Language Anxiety (FLA) is described as “the worry and negative emotional reaction aroused when learning or using a second language” [9], and was found to be closely related to test-anxiety, “a type of performance anxiety stemming from a fear of failure” [10]. Chatbots and robots can be instrumental in providing support, as evident from a study where the participants reported a reduction of anxiety levels after several weeks of learning English with a chatbot [11]. However, care must be taken when developing any artificial speech-based system that it takes into account the linguistic needs of its target population and does not perpetuate existing biases from the natural-language processing and speech technology communities [12]–[14].

Most social robots use the dominant language of the country where they were developed, and often use “standard” accents such as General American or Standard Southern British English [14], whatever the local accent or dialect may

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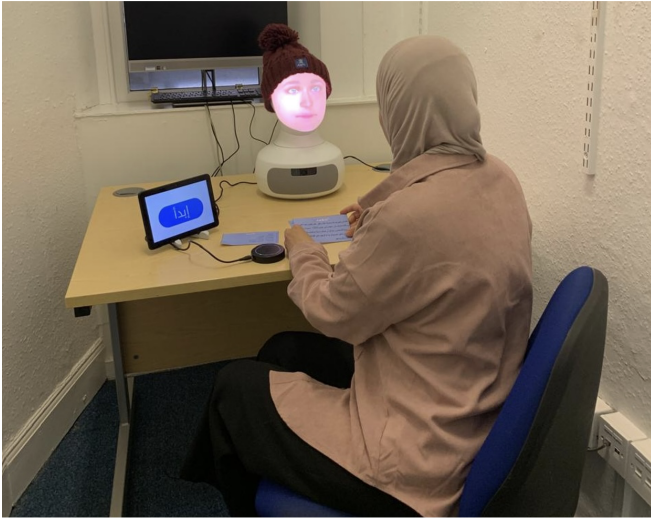


Fig. 2. A participant interacting with the robot in the lab

be. Recently, a few bilingual or multilingual robots have been developed: for example, there has been an Arabic-English speaking robot exploring speech across Arabic and Western cultures [15], Hala the receptionist speaking Arabic and English [16], and a Nao robot that could read out Wikipedia entries in Japanese and English [17]. However, these robots were not generally developed for a particular purpose beyond pure interaction. Another area where robots may speak more than one language is Robot-assisted Language Learning [18]–[20], but this is distinct from a robot explicitly designed to interact in multiple languages.

Social robots are being increasingly deployed in public spaces, where the technical challenges are significant, but the application areas and evaluations are more authentic and realistic [21], [22]. For example, the Furhat robot can be found acting as a receptionist [23], a museum guide [24], and a barista [25], while Pepper has been deployed in a wide range of contexts including shopping malls [26], restaurants [27], libraries [28], university buildings [29], and train stations [30]. User responses to these robots have generally been positive, although technical limitations on audiovisual sensing in public spaces sometimes have an impact, and many studies suffer from the novelty effect [31].

III. STUDY DETAILS

A. Robot System

For this lab study, we use the multilingual student support robot system described in [32]. At a hardware level, the robot incorporates the Furhat robot [33] and a Kindle Fire tablet, along with a microphone (Figure 1). The user initiates an interaction with the system by using the tablet, where they can choose their preferred language: English, Mandarin Chinese, or Modern Standard Arabic. After the user chooses a language, the system begins the interaction in that language, using a language-specific synthetic voice from Amazon Polly [34]. Each session ends with a QR code that the user can scan, which will lead to further information, again, in their

preferred language. All the information provided by the robot was verified by the University’s student support team and translated into Mandarin and Standard Arabic by native-speaking volunteers.

We evaluated the robot in a controlled setting in the lab, where participants were asked to carry out four predefined tasks with the robot (Figure 2). The goal of this study was to explore user performance when using either their native language or English, as well as their preferences between the two language options when given the choice.

B. Hypotheses

Based on previous literature on second-language interaction (“*Service providers in psychology and social work report that clients prefer to communicate in their mother tongue, as they can better express their emotions, feelings, and problems, and can analyze situations in more depth.*” [35]), we had the following hypotheses for this study:

- H1** Students will choose to perform the tasks in their native language more often than in English.
- H2** Students choosing to use the robot in their native language will perform better than when using it in English.
- H3** Students choosing to use the robot in their native language will rate the interactions more positively than when using it in English.
- H4** Students using the multilingual robot will report low cognitive demands.
- H5** Students using the multilingual robot will report high habitability.
- H6** Students using the multilingual robot will report high likeability.

IV. MATERIALS AND METHODS

A. Participants

60 international students currently studying in the University of Glasgow were recruited through the university’s participant pool, word-of-mouth, and posters. Native Language was represented by 43 native speakers of Mandarin Chinese (hereafter ‘Mandarin’) and 17 native speakers of Modern Standard Arabic (hereafter ‘Arabic’). Ages ranged from 21 to 35 for Mandarin (67.4% women, mean age = 24.67, $SD=3.27$) and 22 to 41 for Arabic (82.4% women, mean age = 32.94, $SD = 4.98$). All participants were compensated for their participation with a £5 shopping voucher.

B. Procedure

The study took place in a lab, under controlled conditions. We first presented the robot to the user and explained how to use it, and then asked them to perform four information-seeking tasks, in the order described in Figure 3. Cards were provided showing details of each task to be performed, along with the language to be used. For example, task 4 (Figure 4) guides the student to ask the robot about printing an official letter from the university. Figure 5 shows an interaction between a student and the robot concerning this task.

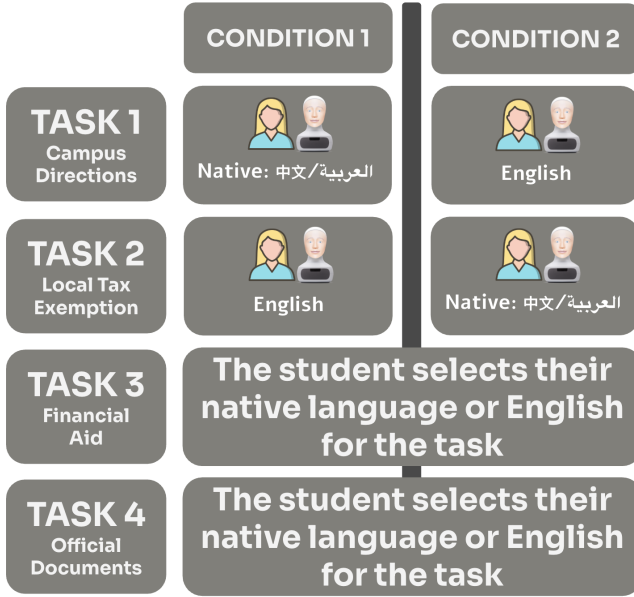


Fig. 3. Tasks, Conditions, and Language Choice in the Lab Study

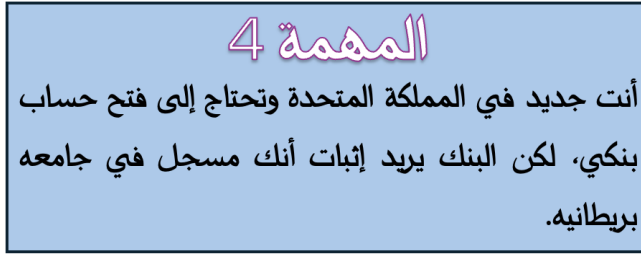


Fig. 4. Task 4 in Arabic. Translation: You're new to the UK, and you need to open a bank account, but the bank wants proof that you're enrolled in a UK university.

STUDENT: [The user clicks on "English" on the tablet]
 SYSTEM: *Hi, I'm a student support robot. You can ask me about campus directions, official documents, local tax exemption and financial aid. How can I help you today?*
 STUDENT: *uh hi um I'm just wanted to uh open a bank account*
 SYSTEM: *Which official document do you need? Certify letter or bank letter?*
 STUDENT: *yes a bank letter*
 SYSTEM: *For information concerning the bank letter, please scan the QR Code below. [after 5 seconds] Have you scanned the QR code?*
 STUDENT: *uh yes*
 SYSTEM: *Can I help you with anything else?*
 STUDENT: *uh no thank you thank you so much*
 SYSTEM: *I would appreciate it if you'd rate our conversation by clicking on the tablet. Thank you and have a lovely day.*
 STUDENT: [The user clicks on a happy emoji on the tablet]

Fig. 5. Example interaction with the robot for Task 4 (Participant 18).

The participants were randomly divided into two conditions, as shown in Figure 3: in Condition 1 they completed the first task in their native language (Arabic or Mandarin) and the second in English, while in Condition 2 they completed the first task in English and the second in their native language. In both conditions, the participants were free to choose the language for the third and fourth tasks.

C. Dependent Measures

We gathered objective and subjective dependent measures from the participants. For objective measures, we recorded the language chosen (Language Choice) for Tasks 3 and 4 (note that the language for Tasks 1 and 2 was determined by the condition). We also measured the performance on each task (Task Performance) by noting whether the user received a QR code corresponding to the task they were supposed to complete. A failure was recorded if the conversation ended prematurely or a wrong QR code was given.

We also recorded two subjective measures. After each support interaction, the participant was prompted to give immediate feedback (Task Feedback) by clicking an emoji to indicate either "Happy", "Neutral", or "Sad" on the tablet, as shown in Figure 5. After all four tasks were completed, participants completed a survey using a subset of the SASSI questionnaire [36], which is a validated subjective questionnaire designed to measure user satisfaction with speech-based systems. Based on our hypotheses, we included items from three sub-scales of the SASSI questionnaire:

- Cognitive Demand: *the perceived amount of effort needed to interact with the system and the feelings resulting from this effort.*
- Habitability: *the extent to which the user knows what to do and knows what the system is doing.*
- Likeability: *the user's ratings of the system as useful, pleasant and friendly.*

Each item required the user to choose an item on a 7-point Likert scale, and the items were presented to each user in a random order. Items on the three sub-scales were averaged to give an overall score for each SASSI factor.

V. RESULTS

We present descriptive results for the categorical data, which show clear patterning, supported by a series of Chi-square tests for language choice, task performance and task feedback, and independent t-tests for the SASSI scores. To control for multiple comparisons, we applied the Bonferroni correction, adjusting the significance threshold for all tests to $\alpha = 0.0056$.

A. Language Choice

After applying the Bonferroni correction, only 4/9 comparisons remained statistically significant ($p < .0056$). Most participants preferred to use their native language over English confirming H1 (Figure 6): a) Task: English vs. Native in Task 3 ($\chi^2(1) = 38.4, p < .001$); b) Condition: English vs. Native in Condition 1 ($\chi^2(1) = 20.9, p < .001$) and in Condition 2 ($\chi^2(1) = 13.52, p < 0.0056$); c) Native

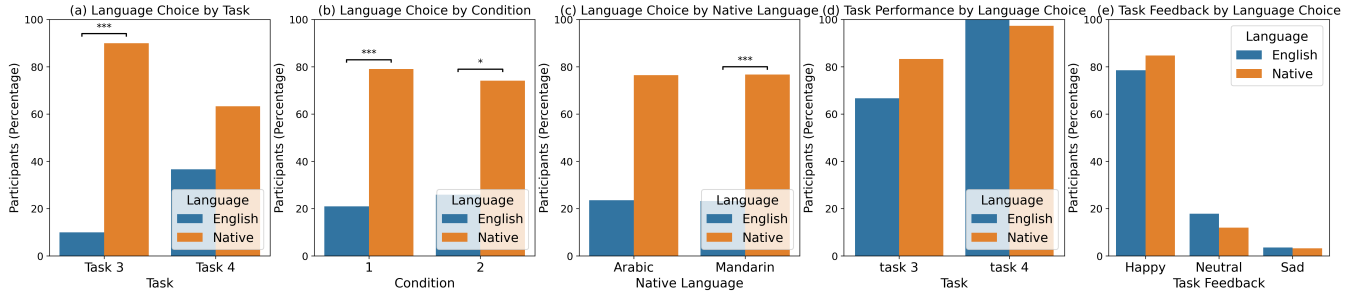


Fig. 6. Language Choice by Task, Condition, Native Language, Task Feedback and Task Performance ($\alpha = .0056$)

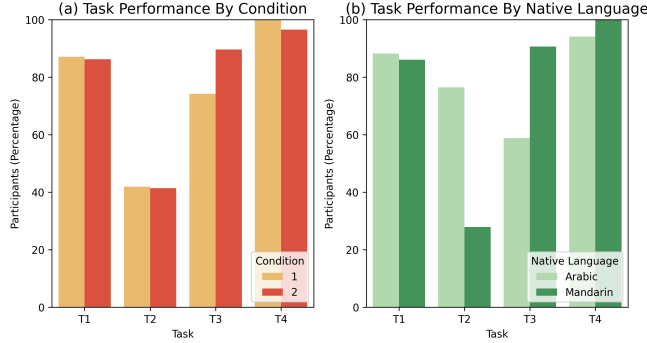


Fig. 7. Task Performance by Condition and Native Language

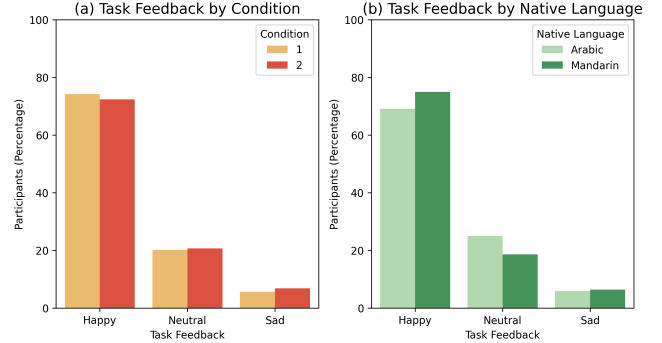


Fig. 8. Task Feedback by Condition and Native Language

Language Background: English vs. Native in Mandarin background ($\chi^2(1) = 24.6, p < .0056$). Language Choice also varied by Task, as Task 4, a relatively simple task relating to official documents, had more participants choosing to use English than in Task 3, though participants' native language was still preferred. Choosing to use their native language was not related to experimental Condition (Figure 6(b)), or native language of the participant (Figure 6(c)).

B. Task Performance

Contrary to H2, there was no significant difference when carrying out tasks in different languages (Figure 6(d)). Figure 7(a) shows that Task 2, obtaining information about local tax exemption was done least successfully, but this is largely because the Mandarin-speaking participants found it particularly difficult (Figure 7(b)) – this was potentially a less familiar concept for these participants. At the same time, the Arabic speakers did not complete Task 3 as well as the Mandarin speakers, showing that task performance is at least partly contingent on students' native language.

C. Task Feedback

Immediate feedback via the Happy/Neutral/Sad emoji responses showed that all participants were happy with the interactions, irrespective of Language Choice, i.e. whether they had chosen their native language to carry out Tasks 3 and/or 4 (Figure 6(e)), contra our expectations (H3). We also found that Task Feedback was not affected by experimental Condition (Figure 8(a)), or appreciably by students' native language, as a vast majority of students from both language

backgrounds responded Happy after each task was performed (Figure 8(b)).

D. SASSI results

Figure 9(a) shows that in general, the Cognitive Demand of the multilingual system was perceived to be relatively light (7 = lowest/1 highest), average is (5.14), its Habitability was above average (4.23), and its Likeability was generally high (5.81). These responses did not vary significantly by Condition, or by students' Native Language (Figure 9(b)), and so overall confirmed our expectations for H4 and H6, and partly for H5.

However, looking more closely, we found a difference in responses according to Native Language by Condition, namely whether the student had to start in their native language (Condition 1) or in English (Condition 2). Figure 10 shows that Arabic speakers reported significantly higher Habitability responses in Condition 1 than in Condition 2 ($t(15) = 2.15, p = .048, d = 1.04$), and also show a trend to higher Likeability responses for Condition 1. The Mandarin speakers did not show any significant differences by Condition, though their trend for Habitability is in the opposite direction, finding the system more tractable in Condition 1. These differential responses by native language according to Condition partly account for the lower average rating for Habitability found overall.

VI. DISCUSSION

Overall, most of our hypotheses were confirmed for the lab study: the students did indeed choose their own language

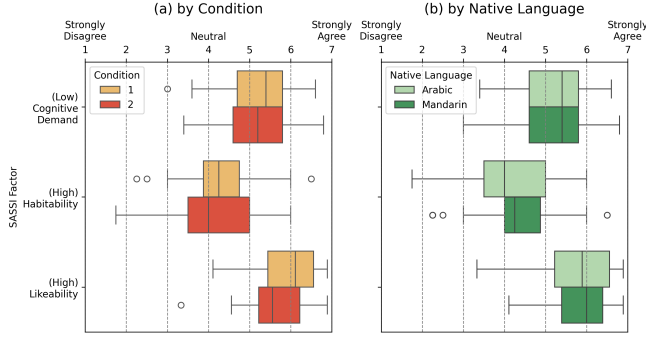


Fig. 9. SASSI Factor Scores by Condition and Native Language

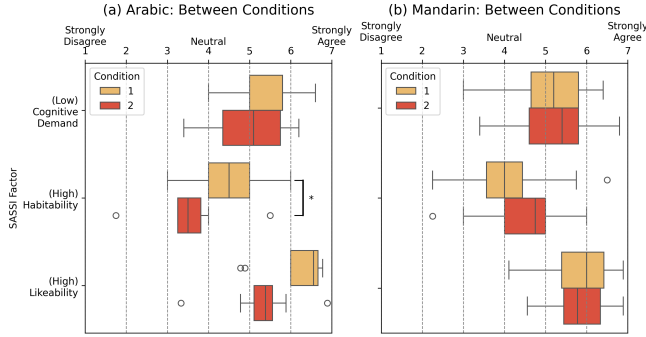


Fig. 10. SASSI Factor Scores by Condition within each Native Language

over English when given the option (H1), although there wasn't any significant difference in their performance when completing tasks in their own language (H2). The emoji responses did not show the expected pattern (H3), with all participants rating the robot equally highly regardless of the language and condition—this is likely to be due to a combination of the novelty effect and the social desirability bias [37], but is a welcome confirmation that the robot was generally liked. The SASSI results confirmed our remaining hypotheses regarding cognitive demand (H4), habitability (H5), and likeability (H6), although here the results were more nuanced and varied depending on the participant's native language: in particular, the Mandarin speakers seem to find the system easier to use when they started with their native language, while the Arabic speakers found it easier when they started with English first. It is not clear why this might have occurred, and further investigation with groups from other language backgrounds is definitely warranted.

VII. CONCLUSIONS AND FUTURE WORK

We have evaluated a multilingual student support robot through a controlled lab-based study. International student participants chose to interact with the robot in their native language, gave positive feedback about the multilingual robot, and also often performed better when given the chance to use their own language.

Based on these results, we intend to pursue two separate lines of work in the future: further development for the

behavior of the student support robot, and also another version of the robot that is able to provide similar support with bureaucratic navigation for another, more vulnerable group of target users: refugees and asylum seekers.

A. Further Development of the Student Support Robot

While the study presented here gives a positive indication about the student support robot, the system used here is still a prototype, supporting a limited set of languages and with a limited set of capabilities. Some universities are exploring different uses of technology for student support, such as a multilingual student support chatbot focusing on exam stress [38], a Nao robot helping with time management and role assignment [39], and a Pepper robot giving campus guidance and information [29]. We will work with the administration and staff of our university to further develop this prototype into something that can be deployed as part of the wider student support strategy.

B. Refugees and Asylum Seekers: The Robot Social Worker

The goal of this robot deployment was to support a specific group of new arrivals to the UK, international students, in navigating the necessary bureaucratic processes, reducing their stress and language anxiety by allowing them to communicate in their own languages. The positive results of these evaluations indicate that this sort of language-specific support was welcomed by its target users, and could also be useful in the context of other similar users.

Millions of people worldwide flee their countries due to reasons such as wars, climate change and hostile environments. Host countries such as the UK provide services and support for these refugees and asylum seekers, which includes helping them to navigate the necessary bureaucratic processes in the new country. In future work, we intend to explore the use of a similar robot to help refugees and asylum seekers to navigate these processes, working alongside human support workers—a “Robot Social Worker”.

We are currently engaging with local organizations that support refugees and asylum seekers, with the intent to develop the interaction style that will make them feel more at home and more welcome in their new host countries and to ensure that the robot is able to provide the information and support that is most useful.

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