Exploring Voice Assistants and Their Impact on International Student's Productivity

Justin Baumann
Rochester Institute of Technology
Rochester, USA
jb5788@rit.edu

Matt Panebianco
Rochester Institute of Technology
Rochester, USA
mp5292@rit.edu

Archana Ramesh
Rochester Institute of Technology
Rochester, USA
ar2693@rit.edu

Songlin Wu
Rochester Institute of Technology
Rochester, USA
sw4593@rit.edu

Chuqi Zeng
Rochester Institute of Technology
Rochester, USA
cz7661@rit.edu

ABSTRACT

This paper builds off the results of our previous research, in which we sought to determine the impact that voice assistants (VA's) had on the academic productivity of students at the Rochester Institute of Technology (RIT). For this paper, we will pivot slightly, and quantitatively determine whether VAs limit the everyday production of non-Native english speaking RIT students. Our research entailed distributing relevant survey questions to RIT students, followed by quantitative analyses on these responses. Our results concluded that the productivity of RIT international students is affected more by the language they choose to communicate with their VA's, and not their international status. Additionally, our results indicated several deficiencies that persist with VA accent and language recognition, specifically for non-native English speakers.

Author Keywords

Artificial Intelligence, Voice Assistant Technology, Productivity, Non-Native English

INTRODUCTION

Over the last several years, voice assistants have become more pervasive in nearly all aspects of technology. From appliances, to automobiles, VA's have developed into incredibly intelligent and useful tools, for many everyday users [4]. This development can be best seen in mobile phones, where the most sophisticated VA's on the market, year after year, carefully iterate with new features and improvements, delivering more valuable and accurate performances for consumers [3].

Despite this improved progression, the purpose and value of VA's, since their inception, ultimately boils down to their ability to aide in the productivity of the user. From this standpoint, our research team previously attempted to uncover whether VAs improved the academic productivity of RIT students, using qualitative research methods. We were unfortunately unsuccessful providing definitive results toward this inquiry; however, in our research, we were fortunate to receive honest and valuable responses from students, who shared their frustrations.

In particular, we were alerted to a high percentage of international, non-Native english speaking students, responded with similar problems regarding the recognition capabilities of these systems. Specifically, non-Native english speaking students were more likely to re-speak voice inputs, as their VAs' frequently could not discern either non-English languages, or English spoken with an accent.

Although VA's are touted as robust and increasingly more useful resources, our previous research suggested that international students on RIT's campus, were continuously and unnecessarily wasting time attempting to get accurate responses from their VA's [4]. From this, our research team posed a logical follow-up question: are non-Native English speaking RIT students limited, production-wise, when utilizing their VA's?

To answer this question, we will generate an online survey, with extractable quantitative and qualitative questions, and distribute them amongst international and domestic RIT students. Ideally, our prefered sample size of respondents will be 20 international students, and 20 domestic students (40 total). We will then provide response percentages from our survey, as well as perform correlation analyses to extrapolate relevant statistical measurements of this issue [2].

Fundamentally, our goal is to better understand whether international students are disadvantaged when utilizing VA's, and whether their everyday production with their mobile devices is hindered.

METHODS

From inception, our plan to measure and answer our posed question, was to develop an online survey and distribute it to a sizable sample of RIT student-participants. Given the specificity of our research question, and our limited geographic reach, we believed 40 responses (20 international and 20 domestic students), would be a sufficient sample size to accurately benchmark VA's limitations for non-Native english speaking students at RIT. For our survey, we wanted to design a concise and streamlined report, which would pose a select amount of quantitative and qualitative, VA-related questions. Additionally, our team 'dry-ran' this survey multiple times before distribution, gauging ease of use, as well as ensuring any potential participant would not spend more than a few minutes responding.

Our survey questions were broken down into four unique sections, so as to better organize our results. The first section was comprised of multiple-choice background questions, which would give us an idea of our participants,

as well as provide information that would eliminate irrelevant entries. The sections and multiple-choice questions were as follows:

Background

1. Do you own a mobile device with a voice assistant?
2. Which voice assistant do you have in your phone?
3. Are you an international student at RIT?

Language

1. What is your native or first language?
2. Please rank your English speaking proficiency?
3. What language do you primarily use to interact with your voice assistant?

Voice Assistants

1. To what degree do you use your phone's voice assistant?
2. What tasks do you typically utilize your voice assistant for?
3. How would you rate the accuracy of your phone's voice assistant using English?
4. How would you rate the accuracy of your phone's voice assistant, using your native language? (ignore if native English speaker)
5. For voice assistant tasks, what is the typical response time you experience?
6. Are you satisfied with the response time of your voice assistant?
7. If your voice assistant gives you an inaccurate response, what is your response?

The last section of our survey was an open-ended response section, with two straightforward questions: (1) What is your biggest issue, when dealing with your phone's voice assistant? (2) What are some improvements you would like to see going forward with voice assistants? These final qualitative questions were to provide our team additional points of interest for our research, as well as potential future topics of discussion.

In total, we received 37 responses out of 40 potential participants. It took our participants an average of 1.5 minutes to complete the survey with most people taking an average of 1-3 seconds per question.(See figure 3). This was well within our anticipated completion goal of 1 to 2 minutes.

RESULTS

As stated in the previous section, our research scope included 37 responses from an estimated survey group of 40 participants. Unfortunately we had several questions that were lacking the responses from our full respondent group, where respondents were given the option to skip or not answer questions. Fortunately, all 37 respondents indicated in the survey that they have a Voice Assistant on their mobile device. 27 of the 37 students were International Students at RIT (73%). 24 of the 37 (64.9%) had Siri (Apple) on their devices, while the remainder utilized Android variants such as Google Now (11 | 29.7%), Assistant for Android (6 | 16.2%), and Bixby (1 | 2.7%).

International students were asked specific questions regarding their native languages, english-proficiency, and the language they use to interact with their VA's. International students spoke a wide range of languages, with the overall majority being some variation of Chinese (11 | 47.8%). Several students also listed English as a native language (3 | 15.1%), but we discovered, while combing through the results, that some students can fluently utilized multiple languages for different circumstances, and that English is considered by some to be a native tongue. The remaining languages were different regional languages of India, including Hindi, Tamil, and others. 80% of our international respondents considered themselves to have an above average proficiency in speaking English, with 60% (15) stating that they were fluent. Only one individual listed themselves as below average in this regard. In line with these findings, 80% (19) of international users chose to use English as their primary VA language, with the rest being a variation of Chinese. Most respondents who listed themselves as being "Fluent" (11) or "Good/Natural" (1) in English were native speakers of an Indian dialect, while native speakers of a Chinese dialect listed themselves as being "Good/Natural" (4) or "Average" (3) more frequently than "Fluent" (1) or "Limited" (1).

25 of our 37 respondents (67.6%) stated that they "sometimes" use their VA's, with 32.4% (12) of respondents split evenly between "often" or "never" using their VA's. Out of the people who use their VA's, VA's were utilized 67.6% of the time for "General Searching", followed by "Scheduling" (38.2%), and "Communication" (29.4%). Other options utilized under 5% of the time were "Translation", "Fun Activities", and "Checking the Weather". Accuracy of English voice assistants was rated highly, with 32 of the 35 responses rating it a 3 (31.4%), 4 (48.6%), or 5 (11.4%). Native language usage, on the other hand, had mixed reviews; 21 of 27 respondents rated their usage at a 1 (25.9%), 2 (22.2%), or 3 (29.6%).

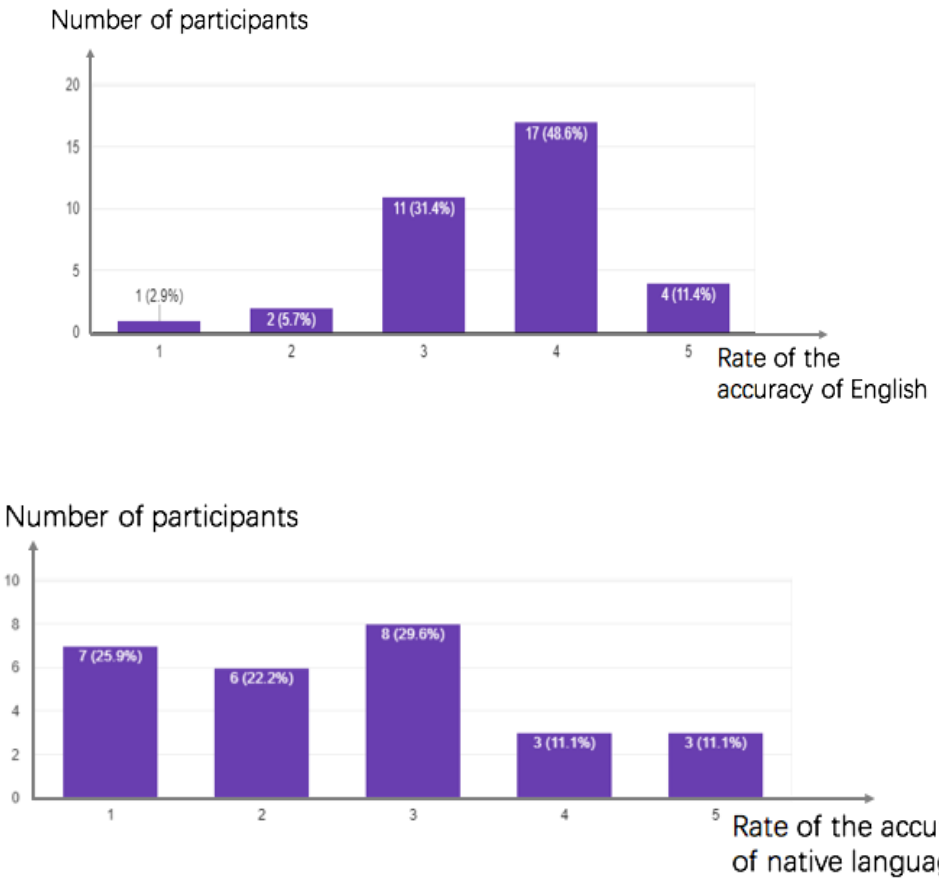

Figure 2: The accuracy of voice assistant using Native Language

Response times for VA's were viewed to be satisfactory for 72% of respondents; 66.7% of users listed their response times as being between 1-3 seconds, and 22.2% as being between 3-5 seconds for results to appear. Respondents were also persistent with their usage (see Figure 3); inaccurate responses were often met with repeated attempts to get the expected response (72.2%), otherwise users would give up or stop using the VA (44.4%).

Figure 3: The response time of voice assistant

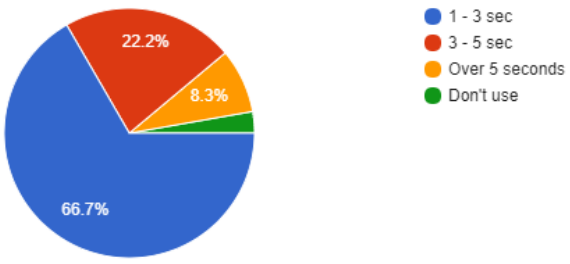

Figure 1: The accuracy of voice assistant using English

Correlations were found between several responses. While somewhat predictable, we noticed that a fluency in English had a strong correlation with a user's preference to which language their VA communicated in (.488); the more fluent the respondent was in English, the more likely it would be that they used English over their native language. There was also a significant negative correlation between VA language preference and the accuracy rating of VAs when using a non-English language (-.506); if the VA language preference was English, it was more likely that users would not consider their native language for VA use, as they anticipated comparatively poorer accuracy. Language preference also had a significant correlation with the

frequency of VA usage (.409); if the VA language preference was English, the users would be found to have a higher usage frequency for their VA. We also looked at correlations in VA language preference vs VA response time; because of our variable coding patterns the correlation is positive, but the slight correlation is actually that English VAs had faster response times than their native language counterparts.

	Phone w/ VA	*VA Usage*	*English Accuracy*	*Native Accuracy*	*English Fluency*	*VA Satisfaction*	*Lang. Preference*
Phone w/ VA	1						
VA Usage	0.588563406	1					
English Accuracy	0.286769667	0.242681336	1				
Native Accuracy	-0.556902002	-0.4086002	0.066964953	1			
English Fluency	0.333837338	0.183449846	-0.037796447	-0.496083314	1		
VA Satisfaction	0.229415734	0.277350098	0.714285714	0.033482477	0.264575131	1	
Lang. Preference	0.423586871	0.409673245	0.276955855	-0.506933178	0.48850421	0.369274473	1
Response Time	0.084172562	-0.20351933	-0.209656967	-0.245694207	-0.02773501	-0.419313935	0.270973381

Table 1: Correlation matrix

DISCUSSION

From our results, international students generally considered their English proficiency and the accuracy of English to be above average. However, there are apparent differences in the VA language selection among the international students. When utilizing a modern VA, native English students always communicate with VA in English, while for international students, they are prompted to make a choice between their native language and English. According to our survey results, we found two key factors contributing to the decision of international students' VA language selection: English-proficiency and the expected recognition accuracy of their native language.

For the Indian student-respondents, their English-proficiency is as strong as their native language. However, the recognition accuracy of these language is much lower, compared with that of a more western accented English. Considering these two points, the majority of the Indian participants chose English as their prefered VA language. Comparatively, for the Chinese student-participants, more than half considered their English proficiency slightly above average, with English being a learned, not native, second-language. Additionally, most of the Chinese respondents rated their VA's accuracy, of their native language, to be above average, but indicated that the recognition accuracy was not as robust as the VA's for English recognition. Despite this, more than half of the Chinese participants responded with a preference toward Chinese as their VA language. Altogether, given the interview responses and results mentioned previously, the impact of productivity from VA usage was dependent on the user's' preferred VA language.

Additionally from our results, we see that language preference had a significant correlation with the frequency of VA usage (see Table 1). English VA users tended to use VA's in a productivity capacity more frequently than Chinese users. However, it is not that English VA users considered the recognition more accurate than Chinese VA users, as we initially predicted, but that the correlation between the final VA language selection and recognition accuracy of the prefered language is not statistically significant (see Table 1), translating to no direct relationship between them.—Similarly, VA language selection had no relation to the users' perception and satisfaction of response times.

VA language selection is not related to user satisfaction in accuracy and response time. Our findings reveal that both native English students and international students consider the accuracy level of their respective VA's, in their respective language selection, as above medium level, no matter how they communicate with their VA's. Nevertheless, from the qualitative portion of our responses, the majority of our survey participants indicated that accent and general language recognition was still their biggest concern and area of needed improvement.

Limitations of the Research

The responses and results of our quantitative research was entirely based on our online questionnaire of 37 participants. The results of which do not necessarily represent the usage preferences of all RIT students, or students in general. The limitations of the study include the sample size and diversity. Since it is was not feasible to reach students from various countries outside U.S., we focused on the largest communities of international RIT students, which happen to be from India and China. Additionally, our survey research was limited by the ethnographic composition of participants, which varied with age, gender, the VA's that users' mobile phones offered, the phones' performances and so on. Altogether, our research can be defined as non-definitive. We will continue to explore and expand our research in future work.

CONCLUSION

Our research concluded that the areas which ultimately impact the productivity of RIT international students is the language they choose to communicate with their VA's, and

not their international status. However, we have found that the majority of VA users view accents and general language recognition as the biggest issues of VA, regardless of their international status and prefered VA language.

Although we expected that different selections of prefered languages would lead to different user experiences, there are no substantial associations between language choices and dissatisfied response times and accuracy, specifically amongst RIT international students. From these results, our research team's future work will be comprised of testing VA-related tasks, with different user languages, and measuring user's' productivity performance levels. By continuing to explore observable limitations of VA's, as they relate to language, we can potentially showcase opportunities to for improvement in the field of VA technology and improved user design.

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