Introduction

Speech Interpretation and Recognition Interface, Siri®, is an artificial intelligent speech recognition software developed by Apple Inc. It is pre-loaded on any Apple device succeeding iPhone 5 and serves as a personal assistant. Some of its functions include setting the alarm, giving directions, recognizing music, defining words, determining calorie content in foods, locating contacts, reading and sending texts or emails, and pointing out the closest restaurants, Wi-Fi hotspots, or local businesses assorted by rating (Moore, 2014). Although Siri was developed in order to equip Apple's customers with a personal assistant, it can also be used for the purpose to practice pronunciation. In order to carry out its users' requests, it is critical for Siri to understand its interlocutor's utterances. Thus, Siri can be used to teach almost any oral language feature with respect to intelligibility through negotiation for meaning (but limited by what languages are available through Apple).

When it comes to pronunciation intelligibility, it is important to keep in mind Celce-Murcia, Brinton, and Goodwin's (2010) point that even if a speaker incorporates perfect vocabulary and grammar usage, a certain pronunciation threshold has to be reached in order to avoid communication breakdowns. At the same time, Jenkins (2000) pointed out how mutual intelligibility, not perfect pronunciation, should be the ultimate goal of language teaching in general, given that English has become a global phenomenon and the number of speakers of English as a Lingua Franca has far exceeded the number of speakers of English as a native language.

Figure 1 illustrates how Siri relates to Jenkins's statement. First, speech is evaluated on whether it is comprehensible or not. If Siri understands what the speaker is trying to say, it will carry out the requested function. However, if Siri does not understand, it will either execute another function, state it does not understand, or search the web for answers. This means that comprehensible output does not always equal perfect pronunciation. Siri is context-aware, just as human interlocutors are, and knows how to interpret small errors that do not interfere greatly with meaning.

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Figure 1.

Japanese language learners to acquire and retain. In order to observe the software in action, the researchers had the participants read minimal pairs containing the target vowel duration. The software was based on experiments on native Japanese speakers' perception of confusability i

feedback on how to get closer to the phoneme duration benchmark in point. These benchmarks – 120 and 250 milliseconds – came to be as a result of testing native Japanese speakers' perception of speech samples of varying phoneme durations.

Dalby and Kewley-Port's (1999) and Kawai and Hirose's (2000) studies gave much appreciated insight into how these speech recognition software work. However, while decontextualized minimal pair drills may have served its purpose for research purposes, it may not be as efficient in language learning. The attention that is drawn to the target phoneme may indeed help the student produce it, but in naturally occurring speech, this attention is spent on content and negotiating of meaning as well as sound production. Therefore, in order to develop phoneme pronunciation skills that are applicable to the outside world, research has to be done on how language learners can negotiate for meaning using speech recognition software in a contextualized and communicative manner.

Apple's Siri may be a suitable tool for pronunciation in tasks that are similar to real-life communication because, as Boyle (2013) stated, Siri is both context aware and interprets and corrects small grammar errors automatically. This feedback, however, is of less quality than both Kawai and Hirose's (2000) and Dalby and Kewley-

that Arabic speakers were likely to find challenging. These were determined based on a contrastive analysis of the Arabic and the North American English phoneme inventories as well as phonotactics. After narrowing these difficulties down, / / and / / stood out as the most difficult phoneme pair, due to the absence of / / in Arabic vowel inven

one breakdown. I used my training in linguistics and language teaching to determine whether a communication breakdown was due to a pronunciation deficit or technology limitation. If an utterance contains pronunciation that differ from standard English, I logged the breakdown as being due to pronunciation deficit. On the other hand, if an utterance sounds native-like but there was a communication breakdown, I categorized the cause as technology limitations. Finally, those errors that could be accredited both pronunciation deficits and technology limitations would only count as one breakdown and classified as either one of these depending on which one was the most prominent.

Findings

Forms of Feedback Provided by Siri

Siri does not provide feedback when the learner mispronounces a sound but there is enough intelligibility in context. An example of how Siri provides corrective feedback is when P1 asked Siri if it could tell him a joke. A native speaker would pronounce the phrase as /tɛl miy ə dʒowk/ while P1 produced /tɛl miy ə dʒk/. P1 had a slight pronunciation error here: as was expected from the contrastive analysis between English and Arabic (see above), P1 had problems differentiating /ɑ/ and /ʌ/, in addition to not producing the off-glide after /ʌ/. However, he also provided Siri with sufficient

P2's Intended phrase: Find a good restaurant nearby
Production: /faynd   god r st rant n yrbey/
Siri's transcription: Find a good restaurant near me
Siri's reaction: Carried out the intended request

In these examples, Siri pointed out the errors by transcribing a word or phrase that was not intended. Notice, however, that only the words that may limit intelligibility got corrected. No native speaker would say /god/ or /r st rant/ for *good* and *restaurant*, but they are perfectly understandable in context; thus, they did not get corrected by Siri. Note also how these words are pronounced very

with, so there is no wonder that P1 keeps making these mistakes. After substituting / / with / / three times without Siri carrying out the intended function, however, P1 modified his speech slightly by replacing / / with / / and gets the result he wanted. Even though this negotiation of meaning could lead to improvements in pronunciation, it is neither mutual, nor always based in pronunciation deficits.

   In short, Siri's feedback, then, is based on intelligibility through its context-dependency and can help improve its users' pronunciation in instances where negotiation of meaning occurs. Siri also points out the error and, to some extent, the severity of it, but fails to provide explanations on how to treat it.

Communication Breakdowns and Pronunciation Errors
As was mentioned earlier, Jenkins (2000) proposed that all language teaching should be based on mutual intelligibility. She does not address speech recognition software particularly, but her proposal is built upon having two interlocutors arrive at a common understanding. With Siri, this process is not mutual; even though speakers may change their pronunciation in order to negotiate meaning, Siri does not seem to negotiate with them. Besides, the communication breakdowns that occur do not always originate in pronunciation deficits. My analysis of P1's and P2's communication breakdowns was based on whether they were due to pronunciation deficits or technology limitations.

   Based on these data, technology seems to be the cause of less than half of the communication breakdowns, but the rate can vary greatly from participant to participant. P1's breakdowns were caused by technology limitations in only 11% of the cases, compared to 43% for P2. One possible reason for this could be that P2 generally had a clearer pronunciation, especially in distinguishing / / from / /. In any case, more extensive research is needed in order to determine why the technology interference varies this greatly.

   The above analysis was made on the assumption that even native speakers of English encounter communication breakdowns when using Siri, and there are even more frequent communication breakdowns for a non-native speaker. The participants in this study, however, seemed to come across relatively few communication breakdowns caused by technology limitations, which may indicate that

	Total number of breakdowns	Breakdowns due to pronunciation deficits	Breakdowns due to technology limitations
Participant #1	9	8	1
Participant #2	7	4	3

this is not such a prevalent issue as previously assumed.

Table 1
Communication Breakdowns Sorted by Cause
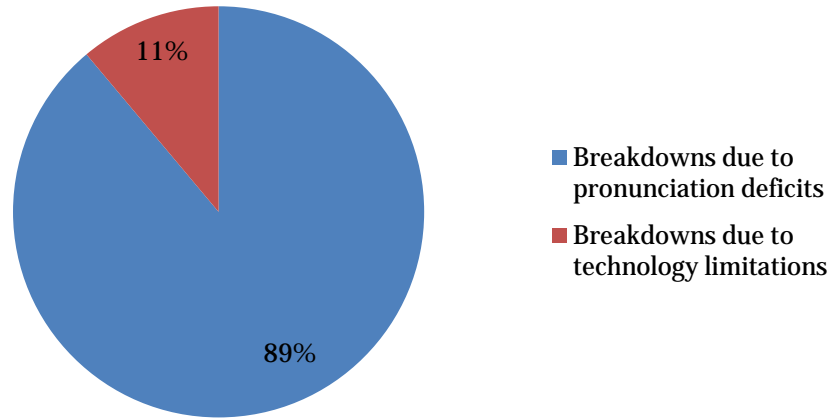
Communication breakdowns with Participant #1

11%

89%

- Breakdowns due to pronunciation deficits
- Breakdowns due to technology limitations

Figure 4. Causes of communication breakdowns with Participant #1

Communication breakdowns with Participant #2

43%

57%

- Breakdowns due to pronunciation deficits
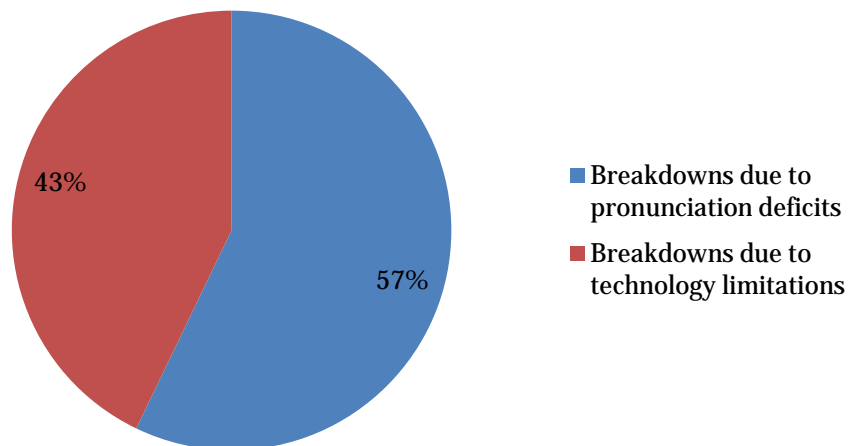- Breakdowns due to technology limitations

Figure 5. Causes of communication breakdowns with Participant #2

In sum, this preliminary study indicates that pronunciation deficits are the main cause of communication breakdowns when second language learners interact with Siri. More extensive research is called for in order to confirm this preliminary finding.

Learners' Perception about Siri as a Pronunciation Practice Tool
When asked whether they were familiar with Siri, both of the participants responded that they were. They both said they talked to it weekly and used it to perform a range of functions. P1 explained that he used Siri in order to determine the weather, write his texts for him, or show him the spelling of words he knew how to pronounce, but not to spell. P2, on the other hand, said she used Siri in order to search on Google or call contacts, while both of them stated that they used Siri for fun whenever they were bored. Most teenagers and young adults, like the language learners in this study, carry their smartphones around with them wherever they go, and may turn to them whenever they have a spare moment. Siri may, therefore, meet the students where they are and aid classroom pronunciation teaching outside the classroom in a way that students find fun and motivating. Regardless of the learners' purpose, Siri requires them to speak a lot while focusing on pronunciation and the meaning they are trying to convey in order to carry out these functions.

Besides, even though both of the participants in this study had capable devices and could access Siri with ease, there are those who do not have any up-to-date Apple devices. These language learners may have to resort to other software depending on their devices. Android users, for instance, may use Google Now, while Windows users may use Cortana, both of which are speech recognition software and not much different from Siri. Language learners who do not have any of these may have to pair up with somebody who does.

When the participants were asked what they liked about the software, they responded that they liked the range of functions that Siri could carry out for them, and that all of these are accessible in one application. On the other hand, they also thought Siri was a bit picky with their pronunciation and too quickly misinterpreted their requests instead of asking them what they meant to say. Both of them also pointed out that it is a shame that Siri does not speak Arabic even though Apple Insider (2014) and Cooper (2012) point out how Arabic among many other languages may be added in the not too distant future. When the participants were asked why they thought Siri sometimes misinterpreted them, they responded that it might be because they sometimes struggle with vowels, that they pronounce words like "Saudi Riyals" using an Arabic pronunciation, or that Siri is just very selective about pronunciation. Furthermore, when they were asked if they thought Siri could be used for language teaching, P1 responded that he thought Siri could be good for learning how to spell new words, while P2 thought Siri could be used to improve speaking only.

In brief, the participants thought that Siri was easily accessible and liked the number of functions it could carry out for them but disliked how picky it could be with their pronunciation and how it did not speak Arabic yet.

Discussion and Conclusion
Like any technology, Siri has its positive and negative affordances. It is popular and easily accessible, but can only be found on relatively recent Apple devices; it provides feedback based on intelligibility, but the quality of this feedback may be up for question; and, even though certain communication breakdowns seem to foster changes in pronunciation, these breakdowns may also originate from other factors than pronunciation deficits. It is important to keep in mind, however, that Siri was never intended to be used as a language learning tool; it was its need for comprehensible input that united the developers' and language learners' purpose.

With that being said, a teacher incorporating Siri in pronunciation teaching needs to consider if the students have compatible devices. If the number of students without compatible devices is minimal, these students can group up with those who do; if the number of students without

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Tasks with SIRI

Part 1: Say "Hey SIRI" to start. Then, ask SIRI the following questions/requests:
1. Tell me a joke
2. Do I need an umbrella today?
3. Call me Ben
4. My wife/husband is [name of somebody in your contact list]
5. What month is it?
6. How many days until Veterans Day?
7. What does "bet" mean?
8. What is 3 times 23?
9. What is the square root of 133?
10. How many ounces are there in one cup?
11. How much is $20 in Saudi Riyals?
12. What is the tip on $43?
13. How many calories are there in a melon?
14. How far away is Saudi Arabia?
15. What is the population of **Serbia**?

Part 2: Do the following using SIRI:
1. Send an email to somebody
2. Listen to a text
3. Send a text to somebody
4. Find a good restaurant nearby
5. Find out which movies are being released this month
6. Make a reminder

Appendix B

Communication Breakdown Charts

Total - Guided Practice		Total #
# of tokens		

SUM

technology   deficits in subject

Interview Questions

1. What did you like about SIRI?

2. What did you dislike about SIRI?