Proposal:
Learning the APCO Phonetic Alphabet: An Alternative Approach using the Virtual Assistant Alexa as an Educational Tutor

Leonard Johnson
Georgia Institute of Technology
Frisco, Texas
Ljohnson305@gatech.edu

1 INTRODUCTION

The phonetic alphabet [3] is one of the most important languages that law enforcement officers, public safety officials, aviation personnel, and military personnel can ever learn. Most common and current method of learning this alphabet is through flashcards and memorization. It has been shown [1] that learning through digital flashcards is faster and more efficient than traditional methods.

Using Alexa, the educational possibilities could include pronunciation training and conversational role-play, which are vital learning paradigms and far exceed the capabilities of flashcards based learning [2].

My proposal would include creating an Alexa voice-assisted skill, which would help educate learners in the Association of Public Safety Communications Officials – International (APCO) version of the phonetic alphabet [4]. The APCO version of the phonetic alphabet has been adopted by law enforcement and public safety departments for standardize radio traffic.

The value of the creating such a skill would create a standardized learning medium for law enforcement and public safety. Alexa can also be used on mobile devices, which has been shown when used, as a vocabulary-learning tool can be more effective than traditional vocabulary learning methods [5]. Errors translating the phonetic alphabet could put law enforcement officials in danger and jeopardize their safety and ultimately could lead to death. Voice assisted technology used in the course of learning has been proven to help workers reduce errors by providing immediate feedback unlike the traditional methods such as memorization or flashcards [6].

1.1 Existing tools

Currently, there are over 70,000 Alexa skills. Out of those 70,000 skills, there are only five skills that deal with the phonetic alphabet and only three that could be classified as an educational type skill.

Table 1—Phonetic Alphabet Skills available on Alexa.

Name	Rating	Type
Phonetic Alphabet Trainer	3	Flash Card-Based / Quiz
My Phonetic Alphabet	n/a	Flash Card Based / Quiz
NATO Alphabet	4	Word Repeater
Alpha Bravo Charlie	4	Word Repeater
Alfa Bravo Charlie	3.6	Flash Card-Based / Game

There are no skills that deal with the APCO standard phonetic alphabet. Out of the three skills, I had to eliminate the *My Phonetic Alphabet* from the list. The reason why is that *Phonetic Alphabet Trainer* and *My Phonetic Alphabet* would confused the Alexa device. My assumption is because both skills share *Phonetic Alphabet* so the first skill in the ranking list is always loaded. This could explain why *My Phonetic Alphabet* has no ratings. The same issue plagued *Alpha Bravo Charlie* vs *Alfa Bravo Charlie*.

1.2 Existing tools – other forms

Mobile versions of the NATO phonetic alphabet trainers exists. These applications were not voice-related and only dealt with the inputting of text and the application would translate. While, it is a trainer in the realm of my proposal, since it's not voice-assisted – just texted based, I decided to exclude these from my comparisons.

2 RELATED WORK

In Table 1, only two Alexa skills were comparable to the need-finding research I conducted. Further investigation led to the breaking down of educational training options that would best benefits the learning experience for users.

Table two—Phonetic Alphabet Skills and Parametric Options.

Phonetic Alphabet Trainer	**Alfa Bravo Charlie**	**Option**
No	Yes	Gamification (point-based)
Yes	No	Quiz Based
No	No	Heuristics
No	No	Pronunciation Refinement
No	No	Spelling Check
No	No	Multi-char Words
No	No	Reserved Words
No	No	Two-Way Training

2.1 Parametric Options

Several importing learning abilities should be present in a phonetic trainer.

- ***Heuristics*** – to limit repeatable words/phrases and ensure the whole alphabet is covered in any type of quiz or game function.
- ***Two-Way Training*** – the alphabet is used for construction and deconstruction of a word or phrase. Example: A law enforcement officers reads a tag (HGD-1V2) over the radio and constructs *Henry-George-David-1-Victor-2.* Dispatchers receive the communications and de-construct the message back to HGD-1V2.
- ***Multi-Character words*** – The tool would need the ability to use multi-character words like *HGD-1V2*.

- ***Reserved Words*** – Uses have the ability to rename their Alexa device. Need to investigate what happens when the device is renamed to one of the phonetic alphabets reserved words.
- ***Pronunciation Refinement*** – Enforce the use of proper pronunciation of the alphabet.

A proposed new phonetic trainer would try to incorporate to the best of its abilities the options listed.

3 PROPOSED WORK

My proposal is to create an Alexa enable skill to help educate and learn the APCO phonetic alphabet. This skill would be accessible through any Alexa enable device. There are multiple JDK's for developing Alexa skills; I plan to focus on using the NodeJS library. Instead of hosting it on Amazon's lambda server, I will pass through to my own private server so I can do data evaluation. My deliverables and proposed work go hand-in-hand.

3.1 Server setup

There are several steps before actually working with the Alexa skill. This includes SSL set up, registering with Amazon, and setting up your environment.

3.2 Unit Testing - Locally

I have identified possible word combinations that could be mistaken for other words. For example, if a user would like to know how HCN-123 is deciphered in the phonetic alphabet – the ***C*** could be mistaken for ***Sea***. There will be a need to capture different variations of spoken alphabet so I can apply some machine learning that will associate these letters with the proper phonetic spellings. The application will run locally and capture user-spoken words.

3.3 Unit Testing – Select Group

Because of different spoken accents, there is a need to selectively have a group of individuals repeat my tests and verify that the skill can understand them. This will ensure I can build a library of associated words that match proper spellings.

3.4 Building the application

At this point in the design, the main options for the application will be fleshed out. Due to time constraints and this being an individual project it will have a direct impact on what functionality can be implemented in the final solution. At a minimal, the ability to cipher and decipher the phonetic alphabet and associated words is a core functionality. As time permits further functionality such as quizzes, gamification, spelling check, and pronunciation enforcement will be included.

4 DELIVERABLES

4.1 Intermediate Milestone I – 10/28/2019

Server setup complete with a rudimentary Amazon Alexa skill running in development mode locally. While this sounds simple, it is not. It will include getting NodeJS installed on a hosting computer. Setting up Amazons SSL cert and verifying connectivity. Installing the Alexa SDK, setup, and configuration. Registering with Amazon and getting a pass-through for Alexa API to my server and round-robin it back. Connecting to a MySQL instance for data capture and analysis.

At this point, the bottom layer architure should be completed (depending on complexity and any roadblocks that might have been encountered). Class submissions for this assignment will include:

- Submission of a high-level design overview document.
    - Instructions and screen shots of setting up existing URL.
    - Installing Node and NVM.
    - Registering with Amazon Developer Services
    - Setting up MySQL
    - Working Alexa Skill
- Will also create a video that will include
    - Basic trouble shooting and debugging.
    - Demostration of actually working with a super basic Alexa Skill.

4.2 Intermediate Milestone II – 11/18/2019

A fleshed-out basic version of the phonetic trainer with at least the basic functionality mentioned in section 3.4

At this point, there should be a basic working modal of the trainer. Class submissions for this assignment will include:

- Submission of a high-level design overview document.
    - Working on further development of the Alexa Skill
    - What issues encountered and fixed.
    - Testing plans.
    - Future work needed to polish finished product.
- Will also create a video that will include
    - Demostration the an actual working skill.

4.3 Final Project – 12/09/2019

The final project will include APCO phonetic alphabet trainer as an Alexa skill available to the general population. I will include:

- The complete code used to create and operate the skill. This will be mostly NodeJS and MySQL stored procedures. There will be the possibility of PHP.
- MySQL database design, tables, and data collected for use in the Alexa Skill (no user information will be supplied).
- Final Paper on the Project.
- Presentation for the Project.

5 REFERENCES

1. Dizon, G., & Tang, D. (2017). Comparing the efficacy of digital flashcards versus paper flashcards to improve receptive and productive L2 vocabulary. *The EuroCALL Review*, *25*(1), 3. DOI: 10.4995/eurocall.2017.6964
2. Skidmore, L., & Moore, R. K. (2019). Using Alexa for Flashcard-Based Learning. *Interspeech 2019*. doi: 10.21437/interspeech.2019-2893
3. NATO phonetic alphabet. (2019, September 14). Retrieved from https://en.wikipedia.org/wiki/NATO_phonetic_alphabet.
4. The police alphabet: an important 'language' for LEOs. (2016, September 20). Retrieved from https://www.policeone.com/communications/articles/the-police-alphabet-an-important-language-for-leos-YEwuPNi2NsYGlvVh
5. Basoglu, Baki | Akdemir, E., & Omur. (2010, June 30). A Comparison of Undergraduate Students' English Vocabulary Learning: Using Mobile Phones and Flash Cards. Retrieved from https://eric.ed.gov/?id=EJ898010.
6. Reducing Warehouse Employee Errors Using Voice-Assisted Technology That Provided Immediate Feedback. (n.d.). Retrieved from https://www.tandfonline.com/doi/abs/10.1300/J075v27n01_01.

Week #	Task #	Task Description	Estimated Time (Hours)	Member Responsible
8	1	Clean off existing URL	1	Leo
8	2	Install NodeJS	0.25	Leo
8	3	Register With Amazon	1	Leo
8	4	Figure out Amazon SSL	1	Leo
8	5	Figure out Amazon SSL	1	
8	6	Connect MySQL to NodeJS	0.5	Leo
8	7	Redirect NodeJS port	0.5	Leo
8	8	Use Postman to Test Posts	1	Leo
9	9	Install Alexa Emulator	2	Leo
9	10	Experiment with Alexa Emulator	2	Leo
9	11	Create Hello World Alexa Skill	3	Leo
9	12	Offical Start of Alexa Skill	2	Leo
9	13	Work on Alexa Voice Capture	2	Leo
9		Work on Alexa Voice Capture	2	Leo
10		Work on Alexa Voice Capture	3	Leo
10	14	Train and Capture Word Varations	3	Leo
10		Train and Capture Word Varations	3	Leo
10	15	Create Video Presentation	3	Leo
10		Create Video Presentation	3	Leo
		INTERMEDIATE MILESTONE 1 DUE		
11	16	Have Select Users do Voice Capture	2	Leo
11		Have Select Users do Voice Capture	2	Leo
11		Have Select Users do Voice Capture	2	Leo
11	17	Start work on base functionality	3	Leo
11		Continue work on base functionality	2	Leo
12		Continue work on base functionality	3	Leo
12		Continue work on base functionality	3	Leo
12		Continue work on base functionality	3	Leo
12		Continue work on base functionality	3	Leo
13	18	Start work on enhancements	3	Leo
13		Continue enhancement work	2	Leo
13	19	Create Video Presentation	2	Leo
13		Create Video Presentation	2	Leo
13		Create Video Presentation	2	Leo
		INTERMEDIATE MILESTONE 2 DUE		
14	20	Continue enhancement work	2	Leo
14		Continue enhancement work	2	Leo
14	21	UAT (Beta testing with users)	3	Leo
14		UAT (Beta testing with users)	3	Leo
14		UAT (Beta testing with users)	3	Leo
15	22	Fix Bugs from Testing	2	Leo
15		Fix Bugs from Testing	2	Leo
15	23	Producation Release	2	Leo
15	24	Work on Final Paper & Presentation	2	Leo
15		Work on Final Paper & Presentation	2	Leo

16	Work on Final Paper & Presentation	2	Leo
16	Work on Final Paper & Presentation	2	Leo
16	Work on Final Paper & Presentation	2	Leo
16	Work on Final Paper & Presentation	2	Leo
16	Work on Final Paper & Presentation	2	Leo
FINAL PROJECT DUE			

Total Hours	**101.25**
Leo	100.25