

CSE 490V Final Project Proposal

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1 ELEVATOR PITCH

We will create a VR app that supports letter animation to enhance the learning of vocabulary. This app will incorporate optical character recognition in computer vision, and character animation in computer graphics. Starting from using the camera input to read the word on the user's laptop screen, the app constructs a 3D model version of this word and presents it in the VR display. After the model is constructed, the user is able to now see the word in the VR display, and the screen where this word originally displayed will be filled with the background color. The result word will be viewed in the VR headset, and "disappeared" from the laptop screen. As the first goal, we will have the user choose the letter in this word that he or she tends to misspell. As the second goal, we will let the user manipulate the letters around to enhance memorization. As a stretch goal, we hope to implement the manipulation with non-Latin and non-Greek root languages, such as characters.

2 EXTENDED OVERVIEW

Learning language and expanding vocabularies have always been a challenge for people of all ages. Either in learning a new language to learn about basic lexicon, or in learning professional vocabulary for one's job, memorizing new words can be hard because the best way of memorization for each person is different. People's brains have different levels of sensitivity of the five senses: the faculties of sight, smell, hearing, taste, and touch. For example, some people memorize words easier by sounding the words out, while the others are able to memorize them just by staring at the words; however, touch isn't always available to the learners when it comes to memorizing words. Richard Lowe [2004] proposed that interactive animations provide opportunities for learners to deal with available information selectively and so avoid excessive processing demands. Therefore, an animation VR app can be very supportive for the learners who are more sensitive to the touch sense.

Learning with the touch sense is possible in multiple ways in the VR headset. One of them can be a combination with the hearing sense. The webcam on the VR headset can read the words into the VR headset, and perform OCR to convert the word into a 3D model. Thus, the user is able to "touch" the letters. By touching a letter in the word's 3D model, the user can hear the pronunciation of this syllable. Along with making the pronunciation, the letter also jumps or performs an animation to make more information

available to the user. This can be very helpful when the learner tends to misspell words. By touching the misspelled syllabus or letter, the learning process happens in multiple senses and helps the learner to memorize the word better.

Words from Latin and Greek roots are composed by root, prefix, and suffix. As a result, manipulating these words can be helpful to understand the words better. For example, in Latin, a verb can have its time, person, and place determined by prefix and suffix. In this case decomposing the word into sections by hands on operations can help the learner obtain a more comprehensive understanding of the words. In order to let the user manipulate the words, the VR headset should be able to recognize the user's hand and its movement.

2.1 Technical Challenges

This project involves addressing the following key technical challenges:

- We will construct a word capturing system consisting of a head-mounted webcam (or on the VR headset) to read the word that the user is memorizing using OCR.
- We will implement a VR application to allow the user to interact with the words through touching and moving letters.
- We will implement a word selection and letter selection operation in the VR application, allowing the user to interact with the words on the paper, and the 3D model of the converted word.
- Optionally, we will implement interaction with non-Latin and non-Greek root languages, such as characters.

2.2 Key Risks and Mitigations

We identify the following key risks and potential implementation alternatives:

- Incorporating the camera and OCR algorithm can be challenging, and a webcam might not be available. A potential mitigation is to embed vocabulary flashcards in the VR headset, instead of reading from the webcam.
- Recognizing hand movements can be a hard algorithm, and might not work due to the webcam resolution / availability. A potential mitigation is to stimulate the hand movement by operating through a laptop, and observe the manipulation in the VR headset.

3 HARDWARE AND SOFTWARE

- **[Personal]** Desktop PC: This will be provided by the student team.
- **[Requested]** Oculus Rift S: Prefer this specific model, but open to suggestions.

- **[Personal]** Unity: This will be provided by the student team.
- **[Personal]** Quizlet: This will be provided by the student team.

4 TEAM RESPONSIBILITIES

This is a 3-person project, with the primary responsibilities being divided as follows:

- **Daniel Lyu:** (1) Implement the letter selection operation. (2) Implement the touch operation. (3) Corporate OCR algorithm into the VR application. (4) Optional: Implement selection with non-Latin rooted languages.
- **Lily Zhao:** (1) Implement the word selection operation. (2) Implement the move operation. (3) Embed vocabulary flashcard into the VR application. (4) Optional: Implement move operation with non-Latin rooted languages.

5 DEVELOPMENT PLAN

- **February 21:** Embed vocabulary flashcard into the VR application.
- **February 26:** Corporate OCR algorithm into the VR application.
- **February 29:** Implement hand recognition into the VR application.
- **March 3:** Implement the word & letter selection operation.
- **March 9:** Implement the touch & move operation.
- **March 12:** Make improvements on UI. (Optional) Support the non-Latin rooted language.

REFERENCES

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