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AN IMPROVED TOOL FOR PRACTICING

FINGERSPELLING RECOGNITION

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Abstract

Our new fingerspelling practice software displays realistic animations of fingerspelling, including naturalistic transitions between letters that were previously impossible.

Introduction

Fingerspelling is an important component of American Sign Language (ASL) and is a necessary skill for complete communication in sign [BATTISON 78]. Padden found that fingerspelling makes up 7 to 10 percent of the signs produced in everyday ASL conversations [Mulrooney 02]. Fingerspelling is useful for spelling proper nouns, technical terms, acronyms, initialized signs, loan signs and words from foreign languages. When fingerspelling, people use their dominant hand to create a series of manual symbols, one corresponding to each letter of the word.   A person fluent in ASL can produce fingerspelled words at a rate of four characters per second.

In contrast, the fingerspelling recognition rate for people learning sign language is far lower. Acquisition of fingerspelling recognition skills typically lags far behind other sign

language skills [GRUSHKIN 98] [SCHLEPER 03]. Wilcox surveyed sign language students, who reported that recognizing fingerspelled words was the toughest part of learning ASL [WILCOX 92]. "Fingerspelling is the first skill learned and the last skill mastered" [LAKE 04]. Patrie found that experienced interpreters were significantly more likely than novices to correctly identify fingerspelled pseudowords words [PATRIE 92]. All 31 Baccalaureate degree programs in ASL/English Interpreter Training devote significant portions of several classes to fingerspelling and over half offer an entire course in developing fingerspelling skills [REGISTRY 04].

Achieving fingerspelling fluency requires the visual comprehension of the manual representation of letters. One reason students experience difficulty in fingerspelling recognition is its high rate of symbol presentation. Most signs in ASL use no more than two hand symbols [BATTISON 78], but fingerspelling uses as many symbols as there are letters in a word.

An additional barrier to improving fingerspelling comprehension is the lack of resources for self-study. Several interactive programs do exist that are capable of showing a series of static images of the manual alphabet [VISION 93] [ASL 05] [GAY 01] [INSTITUTE 03], but none show the motion between letters. These motionss are essential in fingerspelling recognition. When interviewed, fluent signers mention that they look not for individual letters, but for the "shape" of a word [GROODE 92]. Watching a series of static images in sequence will not help.

To solve the problem of realistically displaying fingerspelling, we have developed an approach that displays the transitions between letters. We have developed new software which implements this technique as part of an interactive learning tool for practicing fingerspelling recognition. As Figure 1 demonstrates, this new technology displays the transitions that naturally arise when a person produces each letter in succession.

Static images only

Natural transitions

Figure 1: T-U-N-A: comparing the previous and improved approaches to fingerspelling display

Design Criteria

Three major user-centered design criteria guided the software development:

1.   Simple navigation and visual appeal

The most challenging aspect for the user should be the recognition of fingerspelling, not negotiating the interface. To cater to a variety of users, many of whom are not computer-proficient, the interface layout should be consistent. The controls for basic options should be visible at all times, so the user will know where they have been and where they can go. An interface that is visually appealing and easy to use encourages users to spend more time with the software.

2.   Multiple levels of challenge

The software should accommodate all skill levels and give users the opportunity to experience a variety of recognition challenges. Skills improve with practice, so users should be able to start at their current comfort level and progress to more challenging options. Each level should include an adjustable speed control. By adjusting the content and presentation in accordance with individual skills, the learning process is facilitated and this can in turn improve user confidence by offering realistic goals [PALMER 03].

3. *Review and self-quiz*

Users need opportunities to test their recognition skills. The design should offer multiple-choice and fill-in-the-blank practice sessions and quizzes, each unique to the level of difficulty. The software should provide a summary of the number of correctly and incorrectly identified words. Giving the user relevant information during practice sessions and quizzes will allow them to analyze their own progress and identify areas of improvement [IKEDA 99].

The Fingerspelling Tutor

We have implemented the interface shown in Figure 2, which displays naturalistic animations. The program runs on Intel-based PCs with Microsoft XP.
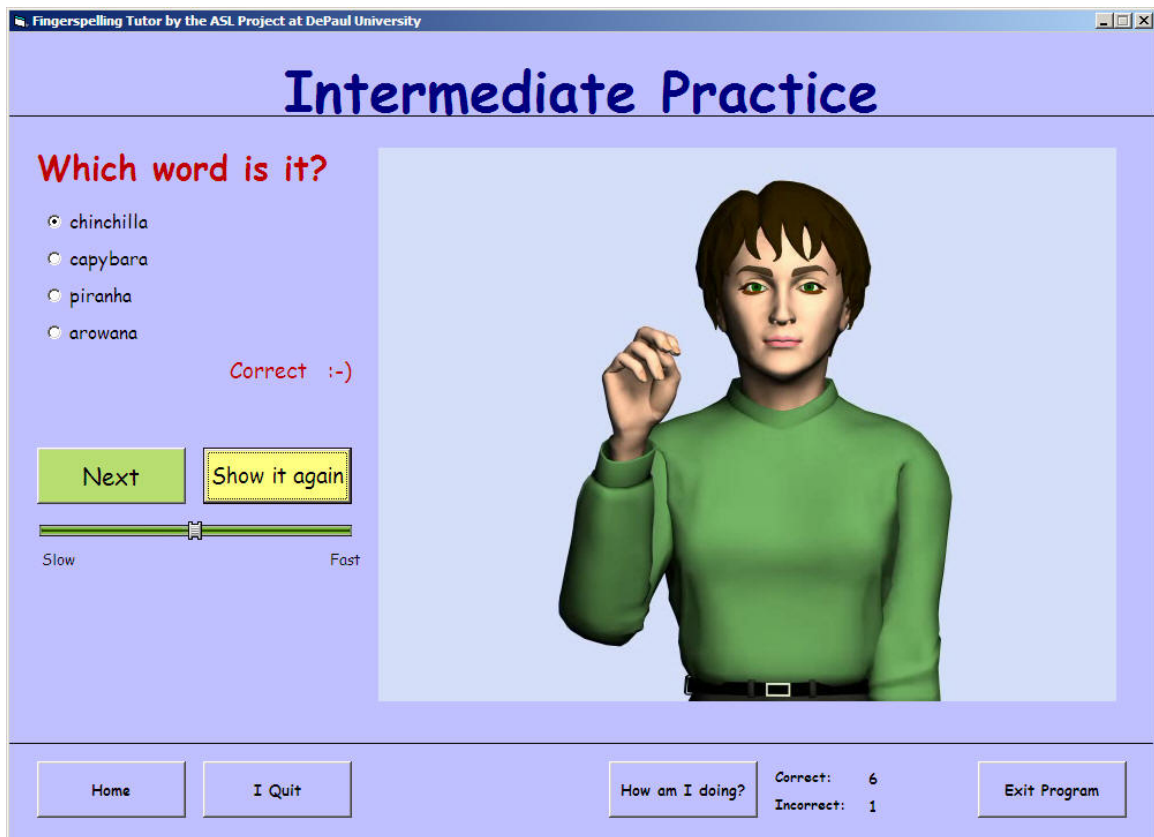

Figure 2: Interface of Fingerspelling Tutor

The software offers multiple levels of challenge:

1.   Alphabet

This level displays each symbol of the manual alphabet in a simple chart, with both front and back views. In the *practice* and *quiz* sessions, users guess the letter and receive feedback on their response. At all levels, there is an unlimited number of repetitions in practice sessions, but only one repetition in quiz sessions.

2.   My First Fingerspeller

This level introduces fingerspelling and presents words that are only two or three letters long. The practice and quiz sessions are multiple-choice. After the software fingerspells the word and the hand returns to a neutral position, a set of four possibilities appear on the screen. Users can choose an answer or click the "Repeat" button. After receiving feedback, users can click "Show it again", which is helpful when the word was incorrectly identified. These buttons are also available at the Intermediate and Advanced levels.

3.   Intermediate

At the intermediate level, users choose from a category (i.e. food, animals…), view a fingerspelled word, and select from four possible answers. To provide a realistic challenge, the possible answers presented are of similar length and contain the same first and/or last letter. The category gives a context to the fingerspelled word which assists the user in selecting the correct response.

4.   Advanced

In the advanced level, practice and quiz sessions use a "fill-in-the-blank" style of interaction.

At all levels, users can access the "How Am I Doing?" button. This displays a summary of a user's responses, including feedback on the number of words correctly identified as well as a list of incorrect responses and the corresponding correct answer.

Testing the Software

After developing the software, we tested its usability with 19 users, who were ASL students, tutors or teachers in an accredited baccalaureate ASL-English Interpretation program. In the test sessions, users were asked to pick the option that corresponded with their current skill level (Alphabet, My First Fingerspeller, Intermediate, Advanced), and to explore the software. All 19 users began practicing fingerspelling recognition within one minute with no assistance from the test facilitator. This is a strong indication that the interface is intuitive and easy to use.

On the post-test questionnaire, 17 of 19 users responded "Agree" or "Strongly Agree" to the statement, "I would like to user the Fingerspelling Tutor frequently." To the statement, "The Fingerspelling Tutor can help me increase my fingerspelling skills," 17 of 19 users responded, "Agree" or "Strongly Agree." These are good indicators that people not yet fully fluent in signing will find the tool useful.

Future Work

We will test the user opinion that the software would help improve fingerspelling skills. We will do this by evaluating the software in a classroom setting.

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