User Interface Design Options for Creation Tool for Animated si5s (CTAS)

Kianna Bagdon[1] Richard Ladner[2] Danielle Bragg[3]

[1]University of Washington Undergraduate Studies- Seattle, WA USA kiannabagdon@gmail.com
[2]University of Washington, Seattle, WA, USA ladner@cs.washington.edu
[3] Microsoft Research- Cambridge, MA USA Danielle.Bragg@microsoft.com

ABSTRACT

Currently, there are various American Sign Language (ASL) written character systems available, but each of these written systems can be difficult to learn. Previous work by Bragg, Kushalnagar, and Ladner presented an animated character system design using si5s, a character system that allows ASL to be in written form. Their study's opportunity evaluation demonstrated that 86% of Deaf/Hard of Hearing participants desired the ability to access written text in ASL and felt that an animated character system could potentially make it easier to learn a written ASL character system. With this demonstrated desire for an animated written ASL system we examined design options for the Creation Tool for Animated si5s (CTAS) to determine the best ways this application could be accessed to be most useful. We implemented an entry system that utilized a drop-down menu to choose si5s ASL static symbols, adjust the size of each symbol, and present symbols horizontally across the page.

Author Keywords

American Sign Language (ASL); Animated Character Systems; Creation Tool for Animated si5s (CTAS); Deaf/Hard of Hearing; si5s

INTRODUCTION

Individuals whose primary language is ASL should have access to a written text that more closely resembles their own language. The use of a two-dimensional character system is a barrier to accessing a written text form for many Deaf and Hard of Hearing individuals. With technological progress and increased written language usage for communication and access to almost all aspects of society, particularly with the pandemic crisis that our world is currently facing, where face-to-face interactions are a rarity, an animated character system should be further explored.

Not only is there a desire and need for an animated character system, but, moreover, a written text with animations that closely resembles actual ASL signs is preferable. Currently, writing character systems can resemble physical ASL signs but are limited by two-dimensional line drawings, some of which describe handshape, orientation, location, or actions, while others describe symbols, letters, subscripts, and superscripts [1]. The first animated character system prototype for a sign language utilizes the si5s character system where shape symbols are similar to hand and body parts with movement symbols designating movement. These two symbols together help create a written text

that resembles physical ASL signs. Animation of the si5s system will use animation to replace the movement symbols designation used in this system [2,3]. The ubiquitous use of animation in today's virtual world makes animation a more accessible option.

As with any web application, the user interface is extremely important. People choose to use an application based on whether it meets their needs or if there are any potential access barriers [4]. In general, user interfaces need to be engaging, satisfy an identified need, be easy to use (preferably with little to no instruction), work efficiently, provide the user with choices, and include built-in universal information when applicable so that a user does not have to create or enter all information [5,6,7,8,9,10].

BACKGROUND AND RELATED WORK

Cultural sensitivity is necessary in any field of research. The Deaf population has dealt with audism and has fought for their rights to use sign language as a means of communication. It is imperative that this history not be forgotten while working on communication technology. The Deaf community needs to be involved in all stages of development to ensure that their needs are met and to increase the likelihood that the technology created will be utilized [4].

Sign Language is very diverse and each particular sign language depends on many factors including geographic location, ethnicity, age, gender, education, and hearing status [4]. For example, Hawaiian ASL has a number of differences from other ASL. This diversity could potentially be challenging in the final CTAS design. Additionally, many Deaf individuals' parents are not deaf, so ASL is learned at an older age, which can result in lower fluency rates [4]. Previous work on an animated character system for ASL suggested the use of animation may make it easier to learn a written ASL text and potentially improve fluency rates [2].

ASL-Flash is a learning tool for ASL students. This tool has the user identify different hand features before the English translation is presented. This tool and its features have been shown to be effective. The different features of the ASL sign include hand shape, location, orientation, movement, and relative position and so the categorization of these features of ASL signs could be incorporated into the CTAS design [5].

Dimension preferences from a design probe workshop with ASL users and the first animated character system prototype for a sign language provided direction for further application development. The participants provided feedback on this system and the ASL participants wanted the written ASL animated text to utilize 3D movements that are seen in live signing. This preference data is taken into consideration in the design options for CTAS. For movement direction of ASL animated images, preferences were to have horizontal translation, vertical translation, and size changes. The horizontal translation shows a hand moving left to right, while vertical translation shows a hand moving up and down. Movement towards and away from face was utilized for size changes. Preferences for hand orientation were rotation and reflection with a hand rotating or flipping and horizontal stretching, which could be presented as an angled hand with one part closer (larger) than the rest. There was

less agreement from ASL users on the following: when to start the movement, the number of repetitions, and whether or not to display a single sign versus a full page of animated designs [2]. The CTAS design needs to incorporate these types of movement, rotations, flipping, and size changes. Additionally, the display and access of the information needs to be user-friendly and provide the user with choices to display single words or multiple words with animation. Finally, instruction on how to navigate the text must be provided [2].

DESIGN

The CTAS design was approached in 3 phases. In phase 1, assessment of the user interface and arrangement on the display while taking into account the large si5s symbol library as well as the ease to make available choices had to be considered. Phase 2 will focus on the ability to drag symbols on the page to create characters and phase 3 will be the addition of symbol movement. All decisions needed to keep in mind that ultimately the user interface would have to support animation.

Phase 1

An entry system for si5s ASL character signs needed to be created. Currently this written ASL text is handwritten. Initially, there was discussion on whether a keyboard would be a practical user interface. A sign writing website was studied [11]. Symbols could be selected, but it was difficult to compose multiple symbols on a single page. An advantage was the ability to manipulate characters on an xy-axis, which allowed for easier location manipulation. Also, it was easy to find the characters on the keyboard. However, with a keyboard, there would be too many keys, which would make it more difficult to use and possibly overwhelming for the user. A drop-down menu that users would be familiar with and could present more options to access static symbols was selected. Advantages to a drop-down menu are that either a single symbol or multiple symbols can be selected and that there is the ability to add the additional parameters such as size and movement.

The si5s library contains many symbols and these static si5s symbols are stored as transparent images. si5s electronic images were integrated into CTAS. These symbols are the pieces of the written text used in si5s. A symbol can be selected from the following categories: diacritic marks, digibet, endpoints, eyebrow marks, locative marks, motion marks, mouth marks, movement lines, nose marks, person people marks, possessive pronoun marks, or wh questions. ‘Mouth mark’ subcategories will include an open, flat mouth, smile or puffed cheeks and a nose mark would include a crinkled or normal nose. ‘Person people marks’ are 1st, 2nd or third person and ‘wh questions’ include who, what, where, and when. An ‘endpoint’ is where the movement ends. There are different types of diacritic marks indicating type of motion such as sideway motion, rotation, wiggling, pulling or shaking. Essentially, modifications of symbols can be completed to indicate diacritic marks [12]. CTAS will compose these si5s symbols into characters with the addition of motion symbols being replaced by animated symbol motions, for example the hands. In si5s, the ASL word for “understand” is a face, an s or fist hand shape that moves upward while the fist turns in a pointed index finger moving upward with a movement line that is vertical and at the top of the line is an ending point dot. So a

user would have to pick each symbol necessary to make up the complete character that represents the word “understand” (see Figure 1). A drop-down menu allows this to occur more quickly.

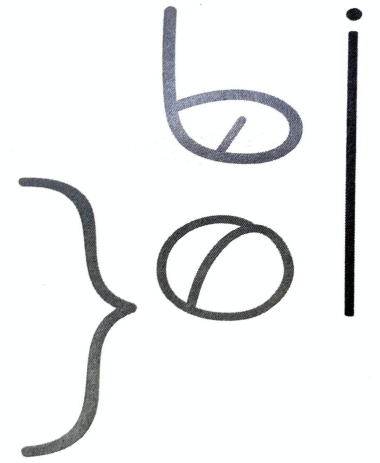

Figure 1: UNDERSTAND in si5s

A user can use the drop-down menu and choose a handshape or body part or any symbol found in the si5s library under the tab marked ‘location.’ Currently, CTAS has 11 static symbols to select from (see Figure 2). Once the symbol is chosen, then the size of the symbol can then be adjusted and selected (see Figure 3). The symbol then appears on the page (see Figure 4). One or more symbols can be selected to compose a character. These symbols will then need to be moved on the page. Each symbol appears horizontal on the page.

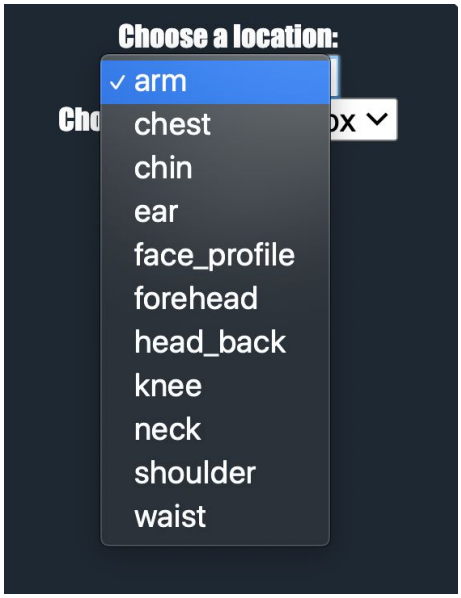

Figure 2: Drop-down menu symbol selection

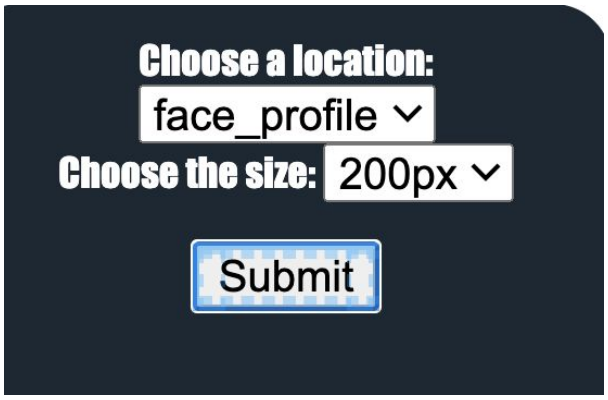

Figure 3: Drop-down menu size selection

Figure 4: Drop-down menu symbol output

Phase 2

Phase 2 will need to address moving the symbols on the page to allow overlay or different proximities to each symbol. A library of completed si5s character signs should begin.

Phase 3

Adding animations or movement to any symbol requiring movement will be the final phase. Incorporating animation or movement into motion symbols and having an interface that is relatively easy to navigate will be challenging. Microsoft Powerpoint's animation system is a very detailed system and is an example of how we could proceed with creating animated character signs. Lastly, we will continue to build a library of completed ASL signs with animation and create an easy retrieval system.

FUTURE WORK

This project examined CTAS design options to determine the best ways the application could be accessed to be most useful. An entry system for beginning implementation of animated ASL characters was created. Additional preference data such as speed or repetition should be considered. User studies to better understand the tool, CTAS, will need to be completed to evaluate the application's effectiveness and identify any functional problems or barriers. Additional methods of building a functional keyboard should be explored. Chinese and Japanese keyboards may provide insight into possibilities for functional ASL keyboards so should be evaluated further. Similarly, information on building custom keyboards should be explored, as it may be beneficial in allowing for easier access.

CONCLUSION

This study designed a user interface with a drop-down menu that allows selections of static symbols with the ability to adjust the size and presents symbols horizontally on the page. Further work will include positioning of symbols to create characters, adding animation, and creating a database with completed characters and animation. Subsequently, CTAS will need further evaluation to help dictate any further user preferences or identify accessibility barriers. A long-term future goal would be the development of a CTAS mobile application.

REFERENCES

1. "Symbol Font for ASL." *ASL Font: Ways to Write ASL*, aslfont.github.io/Symbol-Font-For-ASL/ways-to-write.html.https://aslfont.github.io/Symbol-Font-For-ASL/ways-to-write.html
2. Danielle Bragg, Raja Kushalnagar, and Richard Ladner. "Designing an Animated Character System for American Sign Language." *Proceedings of the 20th International ACM SIGACCESS Conference on Computers and Accessibility*, 22 Oct. 2018, doi:10.1145/3234695.3236338.
3. Danielle Bragg, Raja Kushalnagar, and Richard Ladner. "The First Animated Character System Prototype for a Sign Language." *Animated Si5s*, danibragg.com/animated_si5s.html. https://danibragg.com/animated_si5s.html
4. Danielle Bragg, Oscar Koller, Mary Bellard, Larwan Berke, Patrick Boudreault, Annelies Braffort, Naomi Caselli, Matt Huenerfauth, Hernisa

Kacorri, Tessa Verhoef, Christian Vogler, and Meredith Ringel Morris. 2019. Sign Language Recognition, Generation, and Translation: An Interdisciplinary Perspective. In The 21st International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '19). Association for Computing Machinery, New York, NY, USA, 16–31. DOI:https://doi-org.offcampus.lib.washington.edu/10.1145/3308561.3353774

5. Danielle Bragg, Kyle Rector, and Richard E. Ladner. 2015. A User-Powered American Sign Language Dictionary. In Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing (CSCW '15). Association for Computing Machinery, New York, NY, USA, 1837–1848. DOI:https://doi-org.offcampus.lib.washington.edu/10.1145/2675133.2675226
6. Danielle Bragg, Nicholas Huynh, and Richard E. Ladner. 2016. A Personalizable Mobile Sound Detector App Design for Deaf and Hard-of-Hearing Users. In Proceedings of the 18th International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '16). Association for Computing Machinery, New York, NY, USA, 3–13. DOI:https://doi-org.offcampus.lib.washington.edu/10.1145/2982142.2982171
7. Bongjun Kim and Bryan Pardo. 2017. I-SED: An Interactive Sound Event Detector. In Proceedings of the 22nd International Conference on Intelligent User Interfaces (IUI '17). Association for Computing Machinery, New York, NY, USA, 553–557. DOI:https://doi-org.offcampus.lib.washington.edu/10.1145/3025171.3025231
8. Raja Kushalnaga**r.** 2019. A Classroom Accessibility Analysis App for Deaf Students. In The 21st International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '19). Association for Computing Machinery, New York, NY, USA, 569–571. DOI:https://doi-org.offcampus.lib.washington.edu/10.1145/3308561.3354640
9. Valerie Henderson, Seungyon Lee, Helene Brashear, Harley Hamilton, Thad Starner, and Steven Hamilton. 2005. Development of an American Sign Language game for deaf children. In Proceedings of the 2005 conference on Interaction design and children (IDC '05). Association for Computing Machinery, New York, NY, USA, 70–79. DOI:https://doi-org.offcampus.lib.washington.edu/10.1145/1109540.1109550
10. Zahoor Zafrulla, Helene Brashear, Thad Starner, Harley Hamilton, and Peter Presti. 2011. American sign language recognition with the kinect. In Proceedings of the 13th international conference on multimodal interfaces (ICMI '11). Association for Computing Machinery, New York, NY, USA, 279–286. DOI:https://doi-org.offcampus.lib.washington.edu/10.1145/2070481.2070532
11. *SignWriting Keyboard*, swkb-35431.firebaseapp.com/.
12. R.A. Augustus, E. Ritchie, and S. Stecker. 2013. The Official American Sign Language Writing Textbook. ASLized.