A User Interface for Posing Signing Avatars

Session Information

Session ID       DHH-005
Date & Time      Wednesday, February 29, 2012 - 12:00 PM PST
Location         Mohsen AB, 3rd Floor

Session Description

Track/Topic: Deaf and Hard of Hearing

We describe a graphical user interface designed to allow non-expert users to pose characters to create American Sign Language (ASL) computer animation.

Author(s)

Nicoletta Adamo-Villani
Purdue University

Add to Outlook/iCal (How it works)

Interested? (How it works)

0

Back to Session List
A Novel User Interface for Posing Signing Avatars

Nicoletta Adamo-Villani, Department of Computer Graphics Technology, Purdue University (nadamovti@purdue.edu)

Voicu Popescu, Department of Computer Science, Purdue University (popescu@purdue.edu)

ABSTRACT
In this paper we describe a graphical user interface designed to allow non-expert users to pose characters to create American Sign Language (ASL) computer animation. A study indicates that users with no computer animation expertise can create ASL signs with our interface quickly and accurately.

Deaf education, especially in science, technology, engineering, and math (STEM), is a pressing national problem in the U.S. Deaf individuals are significantly underrepresented in STEM fields and historically have had difficulty entering higher education leading to STEM careers [1, 2]. An important underlying cause of the educational lag is that deaf students have limited access to grade-level curriculum materials. Computer animation of American Sign Language (ASL) has the potential to improve learning outcomes by making educational content deaf accessible, thus providing deaf children with the same learning opportunities as hearing students. Computer animation provides a low-cost and effective means for adding signed translation to any type of digital content.

However, ASL animation currently falls short of reaching its potential in deaf education. There is no easy-to-use public domain authoring system that allows educators to create learning materials annotated with animated ASL. An important piece of functionality that such a system has to provide is to allow educators to animate new ASL signs. This is important for several reasons. There are thousands of ASL signs and an initial database can realistically only cover basic signs; a given ASL sign might need to be animated in several ways to reflect stylistic preferences; like any other language, ASL evolves continually and new signs enter the language all the time; outsourcing the animation task to an expert animator every time a new sign is needed is a solution that does not scale (i.e. due to time and remuneration costs).

We are developing a software system for allowing educators to author deaf-accessible math and science digital learning materials for grades 1-3 (Figure 1). One major challenge is the interface for posing the signing character. A preliminary user study revealed that educators find interfaces similar to those used in commercial animation systems very difficult to use. Many users gave up, and those who succeeded took over 20 minutes for a single ASL sign [3].

In this paper we describe a novel interface that allows users knowledgeable in ASL but with only basic computer literacy and with no computer animation expertise to pose characters to create new signs (Figure 2, Figure 3). We also refer the reader to the accompanying video, which can be downloaded from http://idealab.tech.purdue.edu/ASL/CSUN2012/

We differentiate between non-expert users targeted by our work and novice users. Our users are expert educators and it is not intended that they ever become expert animators. Consequently the goal is to provide a near-zero learning curve interface that is rapidly adopted by a large number of educators, and not to train educators to become expert animators. The interface design incorporates the following principles.

First, the users’ knowledge of ASL is leveraged to make the interface more efficient. Instead of always starting from the neutral pose, the user has the option of loading a hand shape similar to the one targeted. The hand shapes available to the user are the digits and letters of the English alphabet. These hand shapes are well known to ASL users, they span the space of possible hand shapes, and they can be easily invoked by pressing the corresponding key.
Second, all selection operations are performed unambiguously in 2-D, which avoids problems with occlusion or poor separation between selection targets, without requiring view adjustments.

Third, the tens of degrees of freedom (DOFs) of the character are decomposed hierarchically such that the user manipulates only a single DOF at a time. Once the bottom of the hierarchy is reached, individual DOFs are selected using buttons labeled with an animation that previews the effect of manipulating that particular DOF. This way the user is more likely to select and manipulate the correct DOF, avoiding a time consuming and frustrating trial and error approach.

We have conducted a user study to evaluate the proposed interface. The pool of subjects included 8 hearing ASL signers and 2 deaf ASL signers, age 22-53 years, 2 males, 8 females. 5/10 participants were very fluent in ASL; the other 5 participants were students in an advanced ASL class and had a good knowledge of ASL, as they had taken 3 ASL courses prior to participating in the experiment. All participants had basic familiarity with computers; none of the participants had any prior experience with 2D or 3D animation software. Subjects were first given instructions (in ASL and spoken English) and a 15-minute demonstration on how to use the posing interface with mouse and keyboard. Then they were asked to pose the avatar to form the “I love you” (Figure 2) and “Apple” (Figure 3) ASL signs. Subjects worked alone at a personal computer. The task completion time was recorded by a key press which started and stopped the timer and video screen capture. The video recordings were later analyzed to determine the nature and number of mistakes and possible “bugs”. Subjects were instructed to create accurate and legible signs as quickly as possible; the signs were then evaluated for accuracy and legibility by two deaf ASL signers.

After completing the signs, participants were directed to fill out a web survey. The first part of the survey included demographics questions; the second part included rating questions on interface usability.

Figure 1. First-grade math learning activity annotated with ASL animation using our prototype system.
All subjects completed the tasks successfully. The average task completion times for the two signs (‘I love you’ and ‘Apple’) were 97 and 181 seconds, respectively, a substantial improvement over the 20 minutes or more needed with the conventional interface. The results of the survey show that subjects found the posing interface easy to use (MEAN=4, on a scale of 1 “not easy” to 5 “very easy”).

The analysis of the video screen recordings shows that all 10 subjects were able to identify and load the Y and X hand shapes as starting poses for the creation of the “I Love You” and “Apple” signs, respectively. This confirms the usefulness of a library of canonical ASL hand shapes that users are familiar with.

Participants did not experience any difficulty selecting the character components and manipulating the sliders. However, 3 out of 10 subjects did not seem to understand the effect of manipulating some of the sliders, as they repeatedly selected the incorrect ones. This finding suggests that the animated preview of the effect of manipulation of a specific DOF might not be clear to all users. Some users were able to use the interface extremely efficiently—for example to pose the “Apple” sign in 31 seconds.

One interesting finding is that the majority of the subjects spent 30-40% percent of the total time for making the sign posing the left arm, which does not actually sign, and only has to be brought down from the neutral elevated position to a resting position parallel to the body. The time for creating a sign could be significantly shortened by providing a library of commonly used ASL arm poses that the user can load as starting positions.

Lastly, subjects took much longer to make the “Apple” sign than the “I Love you” sign. Observation of the subjects’ screen interaction shows that many participants experienced difficulties in positioning the index finger such that it touches the character’s cheek (Figure 3). We believe that this difficulty is due to

---

**Figure 2.** Proposed interface for posing singing avatar. Here the user animates the “I love you” sign.

**Figure 3.** “Apple” ASL sign. The pose is challenging because the right index has to touch the cheek.
the subjects’ inexperience with 3D spatial representation and view manipulation. Assisted view changing, which we plan to implement in the future, might alleviate this problem.

Overall, results indicate that the proposed interface is usable by non-expert users and could remove one of the major barriers precluding ASL animation from becoming a widespread solution for making digital materials accessible to deaf learners.

Acknowledgement

This work was supported in part by the National Science Foundation (award # 0622900) and by the Dr. Scholl Foundation. We thank Jason and Jill Lestina for their help with the project, and all the subjects who participated in the study.

References

