Chapter 13
Signing Avatars

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ABSTRACT

The chapter focuses on signing avatars and their potential to improve deaf education. In sections 1 and 2, the authors give an overview of what signing avatars are and the benefits of using animated characters for deaf education. In section 3, they explain how signing avatars are created. In particular, in subsection 3.1, they describe different types of 3D models and skeletal deformation systems, and in subsection 3.2 the authors discuss a variety of methods used to animate manual and non-manual signs. In section 4 they report the state of the art in signing avatars’ research and development and we discuss existing limitations and future trends. Section 5 includes a case study on the production of the signing avatars for SMILE™ and Mathsigner™. Conclusive remarks are presented in section 6.

INTRODUCTION

Deaf education, especially in science, technology, engineering, and math (STEM), is a pressing national problem. Unfortunately, current and past statistics show that too many deaf students do not reach their potential. Despite years of trials with different teaching and communication methodologies, little progress has been made. Less than 10% of deaf children have both deaf parents fluent in ASL, so the overwhelming majority suffers from inadequate communication with one or both parents. Deaf individuals face barriers in school, workplace, and social venues which prevent them from having equal opportunity for success. The underlying cause that needs to be addressed is that deaf students are unable to access and interact with grade-level curriculum materials because of their historically low literacy levels. Less than 12% of deaf students at age 16 can read at a 4th grade reading level or higher (Hoffmeister 2000; Padden & Ramsey 2000; Prinz 2002; Strong & Prinz 1997, 2000). Other barriers to successful STEM education for the
Deaf: (a) *Lack of adequate early interactive communication*. The challenge facing deaf children is not acquisition of speech, as many assume, but acquisition of language skills that underlie successful use of speech, signing, reading, and writing. Significantly, there is a strong correlation between ASL fluency and English literacy (Strong & Prinz 1997, 2000). English literacy improves as ASL skills improve and knowledge of ASL as a first language is beneficial because it taps normal capacities at appropriate developmental stages (Wilbur 2000). (b) *Inaccessibility to incidental learning*, i.e. exposure to media and other sources of information in which math/science concepts are present. Research literature refers to this as ‘the limited input problem’ (Johnson et al. 1989; Wilbur 2000).

Signing avatars have the potential to overcome all these barriers. A signing avatar is a three-dimensional (3D) animated character that can communicate in sign language, i.e. through hand gestures, facial expressions and upper body motions. Computer animated signing characters can teach young deaf children and their hearing parents how to sign and can make digital content completely accessible to deaf students who do not know how to read yet. They provide a low-cost and effective means for adding sign language translation to any type of media such as educational games and Virtual Learning Environments (VLE).

**BENEFITS AND USES OF SIGNING AVATARS**

Like videos of live signers, signing avatars allow for direct presentation of ASL in its dynamic visual form, eliminating the need for closed-captioned text, awkward representations of signs, or static sign images. Compared to video, animation technology has the following fundamental advantages.

(a) 3-D animation offers great control over the visualization of the signs; the point of view of the virtual camera that renders the signing character and the location of the character in relation to the background can be optimized to enhance clarity. (b) The speed of the signing motion can be adjusted to the ASL proficiency of the user, of great importance for children who are learning ASL. (c) Individual animated signs can be linked together smoothly to form sentences, without abrupt jumps or collisions as would happen when concatenating video clips. (d) 3D animation allows for user programmability; unlike videotapes and CD-ROMs of video clips for which programmability is very limited (clips can be composed but with great difficulty and discontinuous results). Programmability can be utilized for: generating infinite number of drills; unlimited text encoding; real time translation; limitless combinations of signs. For example, manual signs and facial expressions can be combined in any desired manner under program control. (e) Animations can be stored and transmitted remotely using only a small fraction of the storage and bandwidth costs of comparable video representations.

Moreover, some recent findings support the value of computer animation of ASL. The pioneering work in applying computer animation to ASL was carried out by Vcom3D (Vcom3D, 2007) Vcom3D products, now in use in over 30 school systems, have demonstrated the advantages of using three-dimensional animated characters that can communicate in ASL (and other variant sign languages) to provide multimedia access and increase English literacy for the Deaf. Data show improved reading comprehension as a result of using these products. In one evaluation, comprehension scores of young learners reading below grade level increased from 17% to 67%; in another evaluation, scores increased from 40% to 80% (Sims, 2000).