

Importance of the Sign Language Components for Intelligibility of Sign Language in Human-Computer Communication

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Sign language is the main communication means of deaf people. Since they cannot receive acoustic information, they rely on the visual component of communication. This limits them in the human-human and human-computer communication. Thus, modern human-computer interaction systems that are based on speech communication are not accessible by deaf people. When designing a communication system based on sign language (Železný, 2008), we need to be aware of the importance of the two main components of sign language, the manual one and the non-manual one.

The hardware setup of the information kiosk is proposed as presented in Figure 1. System will use 3 cameras, a touch screen display, and a big screen. Cameras 1 and 2 aim at the upper half of the body. They are used for 3D processing of data of manual gestures of sign language. Camera 3 is aimed at facial detail and is used for non-manual gestures (articulation and facial expression) detection. The big screen is an LCD TV set that is rotated to vertical position. It is used to present sign language synthesis—the avatar. Touch screen display is used for displaying state of the dialog, important status information and intermediate results. It can be used for alternative input in case of choice from several options. System allows distributed architecture, so either all cameras and displays can be connected to one computer or the processing load can be divided among several computers.

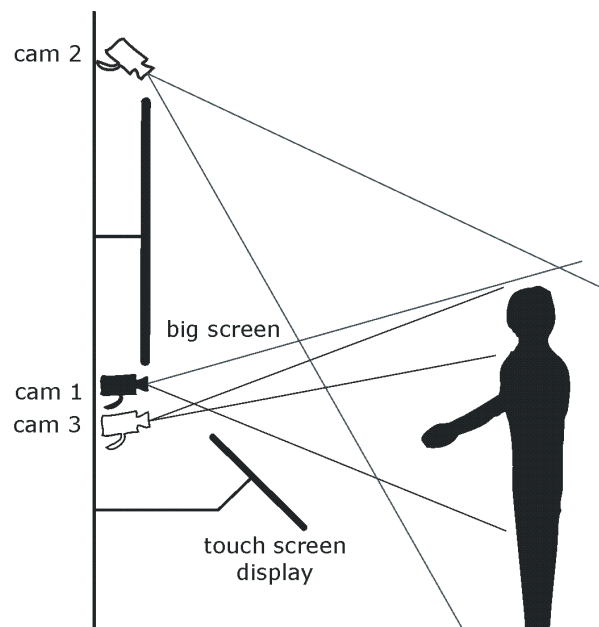


Figure 1 – The hardware setup of the human-computer communication system based on sign language.

Previous research was carried out on audio-visual speech synthesis. It was then extended to model whole (or upper half of) body and to be able to perform sign language synthesis. For this purpose, the avatar was developed, at the beginning without the articulation of lips. First evaluations

that were done with deaf people, showed very low intelligibility especially for profoundly deaf people, that were confused by missing articulation and did not understand only the manual component of sign language. It shows that manual component itself is not enough for good intelligibility of sign language synthesis system.

On the other hand, in the framework of the co-operation with the Primary School for Deaf Children in Plzen, a perception test was done with both manual and non-manual components of sign language and with audio-visual speech synthesis only. The test showed that lip-reading from audio-visual speech synthesis is difficult for deaf children without knowing context, using only perception test at the word level. Intelligibility of the full avatar test was better but it was dependent on the individual conditions and capabilities of each children.

These results lead to the conclusion that both manual and non-manual components are important for good intelligibility of sign language synthesis. At the same time, this knowledge is used for the sign language recognition system that will combine features from both hand motion data and lip-tracking results. Further perception tests will be carried out to analyse the role of other components as eye brow movements, gaze interaction or emotion expression.

The whole human-computer communication system based on sign language can be used for providing various types of data to the users, such as train or bus connections. Or it can be used for tasks, when deaf people communicate with authorities, such as issuing of ID, passport, etc. It can help to increase life quality of deaf people.

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