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DIGITAL APPROACH TO STUDYING OF SIGN LANGUAGE MOVEMENTS IN ORDER TO IMPROVE CLOTHING DESIGN

Purpose. *Research of typical sign language poses was carried out to further use the obtained information in the processes of functional clothing design.*

Keywords: *clothing for deafs, sign language, gestures estimation.*

Objectives. About 15% of the world's population is estimated to experience disability and over 5% – or 430 million people – require rehabilitation to address their 'disabling' hearing loss. It is estimated that by 2050 over 700 million people – or one in every ten people – will have disabling hearing loss. Since disabled people's functional environment differs significantly from the generally accepted one, adaptive clothing use is important for providing conditions for physical and social rehabilitation. That is exactly why a large amount of applied scientific research is devoted to the development of adaptive clothing.

It is generally accepted that hearing loss people have no special clothing requirements, as they do not physiologically differ from other people. This statement is only partially correct, because it does not take into account that the preferred method of communication for such people is sign language. Active manual articulation involves stress on the hands, which is significantly increased by the use of uncomfortable clothing. This is especially true for sign language interpreters, for which one work cycle duration can reach 4 hours.

Our survey confirms that deaf individuals often get discomfort caused by too tight clothing. Therefore, accounting for the typical movements of this group of people at the stage of clothing design is an important background for ensuring wearing comfort.

All previously conducted research in the direction of analysis and classification of sign language gestures mainly concerns video image recognition and translation of received signals into written or audio form. At the same time,

examples of the classification of sign language gestures for the purpose of further clothing design were not found in the available literature sources. Therefore within the framework of this work, the research of typical sign language poses was carried out in order to further use the obtained information in the processes of functional clothing design.

Methodology. Modern digital technologies have been used for the realization of the set tasks. Typical gesture movements were scanned with a high-performance 4D scanner, the data was processed and interpreted using modern software for mathematical analysis and 3D image processing.

Research results. After approximating the data, extrema were identified manually by the nature of the change in the curves (Fig. 1).

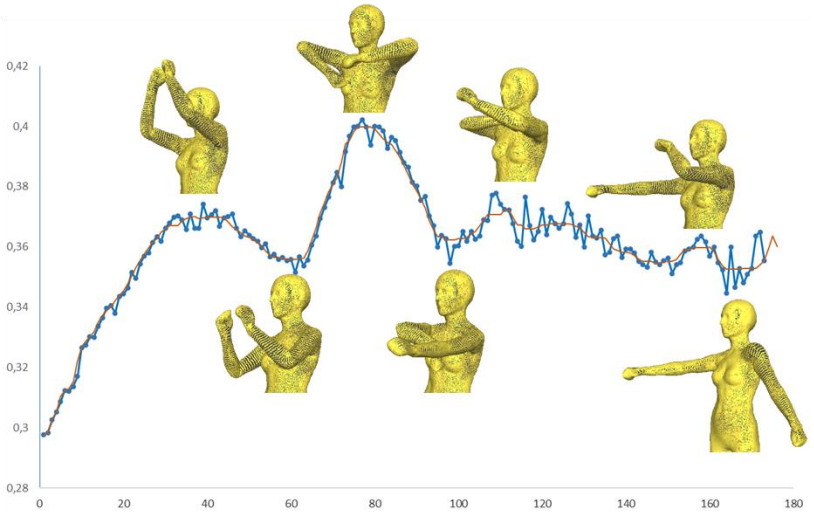

Fig. 1. **The frames, considered as extremes for the selected type of movement**

The points of the extrema on the Matlab diagrams correspond to the frames, which can be considered as extremes for the selected type of movement. It is clear that in order to ensure dynamic comfort in a constructive way only the maximums are important, while the minimums can have a negative impact on the esthetics of the external shape. For our future work, which involves the development of product designs for people who speak sign language, only maxima are considered. Based on the analysis, the most important poses, responsible which have to be considered during the development of clothing with better fit are detected and these are in the current case with numbers 46, 84, 116, and 165 (Fig. 1). For these

poses the length of the investigated segment is already known, so the garment developer can then decide if this length has to be reached by the elongation of the material; based on slipping between the body and the clothing, or by the combination of these. The results of the studies performed were anthropometric measurements corresponding to extreme gesture language postures. The use of the obtained data in the design of clothing for the hearing impaired will allow for optimizing the cut of clothing in accordance with the functional environment.

Conclusion. A method for automatic postprocessing of homologous meshes obtained from MOVE4D scans of deaf people is applied for analysis of the hand motion and the length of specific segments of the clothing during their communication. The application of the method allowed detection of the important poses within a very short time (few minutes), where the investigated segment has a longer length than the defined one as critical, based on the selected material. The obtained data provides a new engineering basis for clothing developers, which will allow the creation of clothing with significantly better comfort and less mechanical effort by communication of deaf people.

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