Using Guessability Framework: Age-Related Differences In Hand Gesture Interaction

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ABSTRACT

Mid-air gestures have been heavily studied in HCI but with mostly younger adults (YAs). Older adults (OAs) can equally benefit from such a modality, but given their heterogeneous motor abilities, designing suitable gestures is challenging [2]. Our research specifically looks at age-related differences in hand gesture preferences between older and younger adults. This subject is important since it relates to the idea of a proper age-inclusive technological design and the means towards the successful adoption of technologies by all the layers of the population, including older adults [1].

CCS CONCEPTS

• **Human-centered computing**; • **Gestural input**;

KEYWORDS

Gesture Elicitation Study, Older Adults, Wearable Devices, EMG, IMU, Kinect, visualization, age-related differences

1 METHODS

Twelve younger (18<age<35) and older (65<age<75) adults were recruited to participate in the traditional gesture elicitation study [5, 6] where we extracted a set of gestures for ten common smart home interactions (e.g. turning on the TV, changing the channel, etc.). We then compared both, the extracted gesture set (vocabulary) and the agreement between participants in each of the ten interactions. The additional procedure included analysis of physical characteristics and properties of the elicited gesture motions collected using a Kinect depth[4] sensor and a commercial electromyography (EMG) band called Myo[3]. With Kinect we captured participants' spacial preferences by visualizing the movements of the joints in 3D for which we also calculated the average velocity and acceleration. With Myo Armband we extracted information related to the levels of exerted force generated by forearm muscles during the gesture motions. Lastly, a detailed motion segmentation analysis was conducted using the video-recordings of the experiment. The gesture motions in this step were split into sagittal, frontal and transverse planes.

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2 RESULTS

In general, the majority of the results yielded comparable performances while there were still a few differences. Both groups generated a similar gesture vocabulary (30% of difference). Examined physical gesture characteristics were also comparable for velocity (in cm/sec, YA: M=68.1, SD=8.43; OA: M=62.2, SD=19.65), acceleration (in cm/sec^2, YA: M=115, SD=26.6; OA: M=107, SD=27) and EMG-activity (as a.u.c., YA: M=0.316, SD= 0.79; OA: M=0.329, SD=0.74). Despite the similar gesture vocabulary, older adults demonstrated lower agreements in the proposed gestures (agreement rate: YA: M=19.5%, OA: M=10.9%; max-consensus metrics: YA: M=63.6%, OA: M=46.5%; consensus-distinct ratio: YA: M=54.3%, OA: M=69%). Likewise, the older adults reached less of the physical space with their hands rather keeping their ranges of motions smaller while gesturing and showed different spatial location preferences for the executed gestures (OA: hands closer to the body, YA: kept their hands both closer and further from the body). In contrast, younger adults did not show such an effect, and used both small and large motions. Finally, most of the results collected from the older adults generally showed higher standard deviations.

3 CONCLUSION

While there were a lot of similarities, there were also some differences along some of the examined dimensions. In particular, the amount of physical space and preferences in the spatial location of the gestures, the agreement in gesture suggestions, and standard deviations might validate a higher heterogeneity in physical capabilities of older adults. This may provide an interesting insight for further research since researchers and designers of hand gesture interaction interfaces should not make assumptions about the capabilities of a certain individual based on age by generalizing the results of the user studies by age. There is rather a greater need for exploring dimensions of the variability that comes with age and their effect size by capturing more age-groups in the experiments. While it is also possible that personalized interfaces for particular groups or individuals may need to take place in particular cases.

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