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Neuromyographic Tongue Activity Based Control: Ergonomics and Design

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The rise of wearable and mobile devices has prompted attention to the systems that apply tongue movements for human-computer interfaces. However, most of the developed systems require intrusions [1], which limit their applicability for daily use, while the comfort of the interaction has not been evaluated at all [2] or has only been tested for specialized medical equipment such as a wheelchair [4]. Altogether, the existing systems have not been tested for their applicability to interacting with a computer for non-clinical purposes. The aim of this study is to design a non-invasive and extraoral control interface based on the tongue movement detection and to evaluate the comfort of user interaction with the system through usability testing. The prototype realization will include the montage of extraoral electromyogram (EMG) electrodes, the online classification model of five tongue commands based on the processing of the EMG recordings, and the adaptive interface that will allow to compensate possible algorithm inaccuracies. In the preliminary research, the 13 potential locations of the electrodes were tested offline. The electrodes were placed on forehead, cheeks, chin and neck. High levels of movement classification accuracy were obtained from all of these points, but the best scores (0.92–0.95) were shown by two electrodes placed over the suprahyoid muscles. These findings confirm the feasibility of the design and indicate that the underside of the jaw is a suitable placement for the electrodes. After the prototype creation, the comparative usability test will be performed to support the implementation of the adaptive approach, introduced to improve the controllability of the system by adjusting the interface elements themselves [3]. In the future, the proposed design of the tongue control interface and its evaluation may be useful in the development of input systems for both healthy users and severely disabled individuals with tetraplegia who need self-supporting access to computers.

References

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