

Sound Selection for Gesture Sonification and Manipulation of Virtual Objects

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Abstract : New sensors and technologies – such as microphones, touchscreens or infrared sensors – are currently making their appearance in the automotive sector, introducing new kinds of Human-Machine Interfaces (HMIs). The interactions with such tools might be cognitively expensive, thus unsuitable for driving tasks. It could for instance be dangerous to use touchscreens with a visual feedback while driving, as it distracts the driver's visual attention away from the road. Furthermore, new technologies in car cockpits modify the interactions of the users with the central system. In particular, touchscreens are preferred to arrays of buttons for space improvement and design purposes. However, the buttons' tactile feedback is no more available to the driver, which makes such interfaces more difficult to manipulate while driving. Gestures combined with an auditory feedback might therefore constitute an interesting alternative to interact with the HMI. Indeed, gestures can be performed without vision, which means that the driver's visual attention can be totally dedicated to the driving task. In fact, the auditory feedback can both inform the driver with respect to the task performed on the interface and on the performed gesture, which might constitute a possible solution to the lack of tactile information. As audition is a relatively unused sense in automotive contexts, gesture sonification can contribute to reducing the cognitive load thanks to the proposed multisensory exploitation. Our approach consists in using a virtual object (VO) to sonify the consequences of the gesture rather than the gesture itself. This approach is motivated by an ecological point of view: Gestures do not make sound, but their consequences do. In this experiment, the aim was to identify efficient sound strategies, to transmit dynamic information of VOs to users through sound. The swipe gesture was chosen for this purpose, as it is commonly used in current and new interfaces. We chose two VO parameters to sonify, the hand-VO distance and the VO velocity. Two kinds of sound parameters can be chosen to sonify the VO behavior: Spectral or temporal parameters. Pitch and brightness were tested as spectral parameters, and amplitude modulation as a temporal parameter. Performances showed a positive effect of sound compared to a no-sound situation, revealing the usefulness of sounds to accomplish the task.

Keywords : auditory feedback, gesture sonification, sound perception, virtual object

Conference Title : ICASV 2017 : International Conference on Acoustics, Sound and Vibration

Conference Location : Sydney, Australia

Conference Dates : January 26-27, 2017