POSTER

Late Breaker

N. MANA, G. SCHIAVO, M. FERRON, O. MICH. Investigating redundancy in multimodal interaction with tablet devices for older adults. Gerontechnology 2018;17(Suppl):183s; https://doi.org/10.4017/gt.2018.17.s.178.00
Purpose   With the advance in mobile and sensor technology, multimodal systems that combine multiple interaction modalities have been sought to provide not only more compelling interactive experiences, but also more accessible interfaces to mobile devices. Research has shown that typical mobile gestures, such as swiping and tapping, might be difficult for many older adults to perform[1]. The adoption of multiple interaction channels can mitigate the interaction difficulties encountered by older adults when using touchscreen mobile devices[2]. When designing multimodal interfaces, complementarity and redundancy are two crucial aspects to consider[2,3]. Many studies have shown the importance of complementarity as an organizational theme in multimodal interaction[2], while others have highlighted the benefits of redundancy in the interaction[3], especially when an interaction channel becomes indistinct or noisy. Indeed, a multimodal system can receive redundant information from more than one modality, for instance when a command is given by moving a hand from right to left plus saying "go ahead" in order to select the next item in a horizontal list. This redundancy can support the successful interpretation of the input message, since one stream of information can be used to compensate for the other during times of distortion or of poor quality. But how do older adults perform redundant multimodal commands? And how do they experience the interaction compared to younger users?
Methods   The study used a Wizard-of-Oz approach for emulating a tablet device that recognizes mid-air gestures and voice commands. Ten participants from 3 age groups – older (M_{age}= 68, *SD*= 3.6), middle-aged (*M*= 51, *SD*= 2.9) and young (*M*= 30, *SD*= 3.7) adults – were asked to use 8 redundant commands for interacting with the augmented tablet while it was operated by the "wizard." Information on the interaction experience was collected using semi-structured interviews after completing the task. Recordings of the observed interactions (1h 35′ video footage) were annotated considering interaction type (*multimodal* if both gesture and speech input were performed, *gesture-only*, and *speech-only*), temporal occurrence[4] (the interaction was labeled as *in parallel* if the two modalities were performed with less than 2 sec delay, otherwise it was considered *in sequence*) and first modality used (*gesture-first* or *voice-first*).   **Results & Discussion**   The predominant interaction type was multimodal commands (Friedman test: χ^2= 53, *p*<.01) and no differences between age groups were observed. Within the multimodal interactions, mid-air gestures and speech were frequently performed in parallel (χ^2= 46, *p*<.01). However, older adults performed more commands in sequence (*H*(2)= 11, *p*<.01) with gesture-first interactions (*H*(2)= 16, *p*<.01). Despite this, older adults were also less concerned about the redundancy of repeating the same command using both mid-air gesture and voice, while younger and middle-aged users were more annoyed. This result opens opportunities in the design space of multimodal interaction for older adults, indicating that redundancy might not negatively influence acceptability. However, potential limits related to the social context in which the interaction is performed should be carefully considered when designing multimodal interfaces. This is in line with previous findings[5] on acceptability of multimodal interaction in public places, and it seems to be particularly relevant for older users.

References
1. Neves BB, Franz RL, Munteanu C, Baecker R, Ngo M. My Hand Doesn't Listen to Me!: Adoption and Evaluation of a Communication Technology for the 'Oldest Old'. In CHI 2015; 1593-1602
2. Oviatt S, Cohen P. Perceptual user interfaces: multimodal interfaces that process what comes naturally. Communications of the ACM. 2000; 43(3):45-53
3. Mills KM, Alty JL. Investigating the role of redundancy in multimodal input systems. Gesture and Sign Language in Human-Computer Interaction. 1997;159-171
4. Turk M. Multimodal interaction: A review. Pattern Recognition Letters. 2014; 36:189-195
5. Rico J, Brewster S. Gesture and voice prototyping for early evaluations of social acceptability in multimodal interfaces. In ICMI 2010