Hand movement tracking reveals similar processing of human-like and non-human-like cues during attention guiding

Virtual agents enable the design of anthropomorphic interfaces that exhibit nonverbal behaviors such as gaze and head orientation. Those behaviors can be used to create shared attention [1]. In order for the user to understand and correctly respond to such cues it should be ensured that the decoding happens quick and automatically. However, there appears to be a trade-off when considering the decoding efficiency of faces in certain scenarios. On the one hand, humans automatically attend to faces [2] and following another person's gaze happens rapidly and automatically [3]. These aspects should promote easy decoding. On the other hand, faces could also bind too much attention because they carry a wealth of social information, thus slowing down responses.

Our goal was to elucidate the efficiency of responding to virtual agent gaze and head orientation. In a within-subject experiment ($N = 17$) we asked subjects to respond as quickly as possible to a directional cue by dragging the mouse in the corresponding direction. The cue type was either a still picture of a virtual agent or an arrow. For validation purposes of the setting subjects were also pre-cued by a congruent or incongruent spoken word ("left" or "right"), occurring 500 ms before the picture appeared. We recorded subjects' mouse trajectories, permitting us to analyze the online cognitive processes after cue onset. It is known from various experiments that cognitive processes are manifested in motor movement in real-time (see [4] for a review). Unsurprisingly, pre-cuing had a clear effect on the motor responses. In incongruent trials trajectories were significantly attracted to the incorrect response and response times were longer. Cue type on the other hand had no significant effect. With respect to attention orienting, it does not make a difference whether the cue is a human-like face or not. Implications for the use of virtual agents in realistic applications are discussed.

References

[1] Peters, C., Asteriadis, S., & Karpouzis, K. (2010). Investigating shared attention with a virtual agent using a gaze-based interface. *Journal on Multimodal User Interfaces*, *3*(1-2), 119–130.

[2] Bindemann, M., Burton, A. M., Langton, S. R. H., Schweinberger, S. R., & Doherty, M. J. (2007). The control of attention to faces. *Journal of Vision, 7*(10), 15.

[3] Langton, S. R., Watt, R. J., & Bruce, V. (2000). Do the eyes have it? Cues to the direction of social attention. *Trends in Cognitive Sciences*, *4*(2), 50–59.

[4] Song, J.-H., & Nakayama, K. (2009). Hidden cognitive states revealed in choice reaching tasks. *Trends in Cognitive Sciences*, 13(8), 360–366.