

Too Much or Too Little Control? Investigating Optimal Sense of Agency for Assistive Technology

Jacopo Elettari^{1:2}, Agnieszka Wykowska^{1:3}

1. Social Cognition in Human-Robot Interaction Unit, Italian Institute of Technology, Via Enrico Melen 83, 16152 Genoa, Italy
2. University of Ferrara, Department of Neurosciences and Rehabilitation, Via Ludovico Ariosto 35, 44121 Ferrara, Italy
3. Hans-Fischer Senior Fellow, Institute for Advanced Study, Technical University of Munich, Lichtenbergstrasse 2 a, D-85748 Garching, Germany

Abstract

Sense of Agency (SoA) is defined as “the experience of controlling one’s own motor acts and, through them, the course of external events” (Haggard, 2017). Sense of agency is one of the most fundamental mechanisms of human functioning in the environment and has also been shown to be motivating and rewarding (Deci & Ryan, 1980; Leotti & Delgado, 2011).

The current use of automation can blur or heavily deteriorate subjective feelings of agency. This seems to be particularly concerning for assistive technologies (e.g. robotic arms employed in factories or surgical robots). The potential attenuation of SoA can impact users’ performance, for example intervening in case of system failure may become harder, like it happened during the Air France flight 447 crash in 2009 (Ueda et al., 2021). SoA degradation may also affect users’ satisfaction. Bhattacharjee and colleagues (Bhattacharjee et al., 2020) found that people with mobility impairments may sometimes prefer less autonomous robot-assisted feeding.

Since both excessive and very low levels of automated assistance seem to be harmful, it seems plausible that an intermediate level of control is optimal capable for users’ motivation. We refer to this optimal level as the ‘sweet spot’ of sense of agency.

To support the idea of the ‘sweet spot’ of SoA, we designed an empirical study that will test whether different levels of SoA would result in different degree of motivation. Data collection is currently underway. In our study, participants’ task is to remember a string of letters, look for them in a search array and move a cursor towards the single letters in the remembered sequence. Sense of agency is manipulated by introducing perturbations to the cursor trajectories (similar to Wen Wen et al., 2018). In particular, the trajectories could be distorted at various levels, varying from high to no distortion. Motivation is operationalized as the number of times participants accept to engage in highly demanding trials compared to low-demanding trials. Indeed, each time, the participant accepts or refuses to engage in the task based on the combination of effort (number of letters to remember) and agency (level of control over the cursor). We predict that participants will engage in effortful versions of the task when SoA is at

the medium level. Results of this study will cast a light on the relationship between SoA and motivation, with particular focus on the “sweet spot” of SoA.

References

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