

On the Closure of Perceptual Gaps in Man-Machine Interaction: Virtual Immersion, Psychophysics and Electrophysiology

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ABSTRACT

Human behaviour in natural environments almost unconsciously relies on a stable and unified percept. The brain interprets perceptual inconsistencies as behavioural errors and tries to correct them. However, when humans are interacting with artificial environments the true error source might be based on imperfect implementations. Then, a behavioural change might be unwanted or even produce further errors. The problem arises from two issues: 1) since artificial environments often do not capture the required complexity, inconsistencies and errors are introduced that somehow distort the percept; 2) intended manipulations in the artificial environment (e.g., in man-machine interaction) seldom take the human's percept into account. Here, we present approaches to reduce such perceptual gaps and therefore enhance the immersion of the human. In our example scenario, the human interacts with an arm exoskeleton, while he is situated into a complex virtual scene. We show that psychophysics can be used to adjust parameter changes in the scenario or modifications in the machine according to intended perceptual changes. Furthermore, we use online classification of EEG data to create an intelligent interface that predicts the state of the operator. Finally, we present a short evaluation to illustrate how well subjects were embedded in the scenario.

Keywords: virtual immersion, human, psychophysics, EEG, Brain Reading, simulation-reality-gap, man-machine interaction