Perceptual-cognitive monitoring in real world and virtual reality

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To date, little is known about perceptual-cognitive adaptations in novices learning a motor action. Even less attention has been directed toward perceptual-cognitive monitoring of the learning process, both in real world and virtual reality. To shed further light on the perceptual-cognitive background of performance changes during skill acquisition, we examined the influence of physical and mental practice on novices' performance, mental representation, and quiet eye during golf putting. Novice golfers (N = 45) were assigned to one of three groups: physical practice (PP), combined mental and physical practice (CP), and no practice (NP). Prior to and after practice, as well as after three days of retention, participants' putting performance was assessed using 3D motion capture analysis. Mental representation and quiet eye were assessed employing structural-dimensional-analysis (SDA-M) and eye-tracking. Results indicated that practice groups performed more accurately and consistently during retention-test compared to the NP group (both $p < .01$). Interestingly, the CP group revealed most elaborate representations (ARI = .50) and longest quiet eye durations (M = 2475 ms, SD = 2132 ms) compared to the PP (ARI = .12; M = 1357 ms, SD = 1139 ms) and NP group (ARI = 0; M = 871 ms, SD = 588 ms). From this, and further related experimental investigations (e.g., Frank, Land, Popp, & Schack, 2014), learning a motor action is associated with both motor and perceptual-cognitive adaptations within the motor action system, and seems to depend on practice type. Based on these findings, the idea of perceptual-cognitive monitoring in real world and virtual reality will be discussed. Monitoring from within, by assessing the athlete's representation and gaze behavior, and by tailoring instructions accordingly may significantly fasten the learning process. Particularly, as virtual reality provides an ideal environment for various kinds of perceptual-cognitive diagnostics and interventions (e.g., representation-based or visually-guided learning and coaching), preliminary insights into the realization of intelligent coaching in a virtual reality environment will be given.