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Real-time feedback use during goal-directed movements

One pervasive terminology in the human movement literature is the open-loop vs. closed-loop dichotomy. Such terminology can be associated with Woodworth's (1899) dual-component model. However, is there such thing as an open-loop movement? In this presentation, various studies using a goal-directed movement as the main task and manipulating visual information will be contrasted. First, how sensory information from trial n-1 can influence online control on trial n will be discussed (Cheng et al., 2008). This first study showed that vision on trial n-1 significantly influences endpoint accuracy and online trajectory amendments regardless of vision on trial n. Second, evidence that vision is used as a function of limb velocity, will be presented (Tremblay & Hansen, in preparation). This second study shows that not having vision during the high velocity stages of the limb trajectory is not different from having vision throughout the movement. In addition, this study also shows that having vision during the low velocity stages of the limb trajectory is not different from not having vision at all. Third, how the influence of limb velocity on limb control extends to the perceptual experience will also be considered (Tremblay & Nguyen, submitted). Specifically, we showed that susceptibility to an audio-visual illusion (e.g., Shams et al., 2000) is linearly related to real-time limb velocity. Fourth, the idea that there is no such thing as a ballistic task in natural human movements will be entertained (Kennedy & Tremblay, in preparation). Indeed, the last study showed humans reaching a target location at maximum velocity (i.e., the optimal moment to release a ball in a throw) are significantly influenced by combined visual and proprioceptive manipulations. Altogether, sensory information seems to be used in a real-time fashion during goal-directed movements and the concept of open-loop control is virtually impossible in natural human movements.

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