

Catching for Real and Catching for Fun in Ecological Psychology. Focus on “Internal Models of Target Motion: Expected Dynamics Overrides Measured Kinematics in Timing Manual Interceptions”

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The problem investigated in this article is at the heart of perceptual-motor control and is centered on the relevance and importance of taking dynamic (kinetic) variables of motion into consideration when intercepting moving targets. The take-home message is that the context of the situation makes all the world's difference: if you are trying to intercept a falling object, then you definitely rely on apparently internalized knowledge of gravity; but, when you play games with interception on a video screen using a mouse, you conveniently switch to a strategy based on the assumption of uniform motion, also a very appropriate knowledge in this case! This context-dependent dissociation brings to focus the notion of *selective tuning* (Shepard 1984) between two resonating systems consisting of the subject attempting the interception and the perception-action environment where the interception is taking place. In that sense, the subject's differential strategy, depending on the context, can be seen as a selective tuning to two different *affordances* (Gibson 1979), one made available by gravity (and most probably internalized through biological evolution), and the other made available by the video display (and most probably internalized through individual learning). This line of thought stems directly from Shepard's (1984) treatment and extension of Gibson's ideas (Gibson 1966, 1979). As put by Shepard, “We interpret and anticipate significant events by means of a system that has internalized the enduring constraints that govern such events in the world” (Shepard 1989). Although, over the years, Shepard has placed special emphasis on the constraints of kinematic geometry being reflected in mental transformations, he has also considered favorably the case for the internalization of kinetic aspects, as manifested, for example in the *representational momentum* (Freyd and Finke 1984), a mental analogue of the momentum of a moving physical object. It is interesting that Shepard's discussion of this issue has revolved around perception, not action. For example, he wrote that “Possibly some pervasive principles of physical dynamics (such as a principle of momentum), in addition to the more abstract principles of purely kinematic geometry, have been internalized *to the extent that they influence apparent motion*” [italics mine] (Shepard 1984). However, it is under real-life, perception-action conditions that representations of kinetic variables come to prominence, as this study by Zago and collaborators (this issue, p. 1620–1634) and previous work from the same group on Earth (Lacquaniti and Maioli 1989) and Outer Space (McIntyre et al.

2001) has demonstrated. Remarkably, a theoretical development regarding temporal aspects of action has come independently to positing a pervasive internal representation of kinetics (Georgopoulos 2002; Lee 1998).

The experimental design of the study by Zago and collaborators (2003) was clean and clever. It comprised both real punching as well as intercepting a virtual target. Although nice a priori, this design proved its importance by the fact that quite different results were obtained in the two cases, notably the employment of a uniform-motion model strategy in the virtual case and a gravity-incorporating model in the real punching case. I must say, I would not have predicted these results (I would have thought that the gravity model would have carried through to the virtual case) but, of course, the results underscored, once again, that the brain is smarter than our naïve predictions!

I would hazard the suggestion that Gibson would have loved these results on internalized gravity information. As the founder of ecological psychology, he promoted the idea that meaningful aspects of the environment to which organisms have been exposed over thousands of years are internalized and used routinely and necessarily to guide behavior; the evidence from the present study on internalized gravity would have been music to his ears.

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