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Comment on Dynamical Systems Theory: a Framework for Performance-Oriented Sports Biomechanics Research

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In their article Glazier, Davids and Bartlett discuss implications of dynamical systems theory to performance-oriented sports biomechanical research. They provide a summary of important theoretical concepts in dynamical systems theory. They emphasize the significance of reducing the potential degrees of freedom of the human movement system, and how this leads to the self-organization of coordination and control. They then review briefly the existing literature on fast cricket bowling to exemplify current limitations with sports biomechanics research and the need for an alternative approaches.

The authors provide a convincing account of key concerns with the previous work. First, they suggest that it is limited by its focus on discrete measures of performance that offer little in the way of describing how the coordination between body segments is organized over time. Second, they suggest that the emphasis on single trial analysis to represent generalized performance outcomes does not take account of the intra- and inter-subject variability that is inherent in performances requiring skill. The authors go on to suggest that dynamical systems theory is not based on the existence of common optimal movement patterns that many sports biomechanics researchers have strived to establish. Therefore, they propose more research is required using multiple single-subject designs that focus on the processes of coordination and control in the human motor system. In support of their position, the authors provide a summary of various qualitative and quantitative analysis tools suitable for use with multiple single-subject research designs. Their discussion of the potential benefits and costs of such tools is particularly welcome.

A concern with the paper is that the authors do not clearly distinguish between the concepts of "common optimal movement patterns" that probably do not exist and "common coordination patterns" that have been observed and can distinguish between skilled and less skilled performers (Temprado et al., 1997; Zanone and Kelso, 1992). While there is certainly intra and inter-subject variability in many measures of performance, there is often an underlying coordination pattern that is remarkably consistent within different skill groups and that probably needs to be assembled (or disassembled) before the individual can progress to the next level of skill.

The paper's focus on skilled athletes leaves me wondering about the implications of dynamical systems theory for skill acquisition. There is some reference to work that has commented on this issue, but still the authors do not substantiate their conclusion that the use of alternative research designs and analysis techniques will enhance our understanding of the processes of coordination and control, leading to improved motor performance. Therefore, although not explicitly stated, perhaps a key message is that there is a lack of empirical research confirming the benefits of general concepts proposed by dynamical systems theorists to skill acquisition. Like the authors, I hope that by highlighting some of the weaknesses with the current dominant approach, this paper will stimulate more research interest in this area.

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