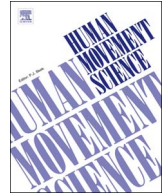


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Full Length Article

## Towards a Grand Unified Theory of sports performance: A response to the commentaries

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### 1. Introduction

In this response article, I consider and react to some of the main issues and remarks made in the commentaries to my target article, *'Towards a Grand Unified Theory of sports performance'*. It was both reassuring and satisfying to receive two highly favourable reviews from the anonymous reviewers during the peer-review process. Although some of the commentators were somewhat less enthusiastic and supportive of my ideas, I am satisfied that the target article has broadly fulfilled its goal of stimulating critical discussion and provoking scholarly debate on what is an important contemporary topic. I hope this collection of articles will provide a useful resource for high-performance practitioners seeking to gain a more holistic understanding of sports performance and for academics aspiring to increase the impact and reach of their sports performance research. I thank the commentators, both for their considered contributions and for their patience whilst I prepared this response, and also the Editor, Peter Beek, for commissioning and coordinating this Special Issue of *Human Movement Science*.

### 2. Aim, motivation, and intention of the target article

*Cobley, Sanders, Halaki, and O'Dwyer*, in particular, were seemingly somewhat bewildered about what I was trying to achieve in the target article. From the outset, I would like to point out that the target article was only intended to be a proposal to the sports science community, hence why I purposefully entitled it *"Towards a Grand Unified Theory ..."*. I am by no means claiming that the target article contains all the answers to the problems that continue to afflict contemporary applied sports science or that the theoretical approach described is some kind of panacea for the field that has regularly been criticised—as *Williams* and *Ward* did—for being descriptive, fragmented, and lacking theoretical rationale. As evidenced by previous target articles published in *Human Movement Science* (e.g., [van Ingen Schenau, 1989](#)), this format of article provides an excellent forum for open dialogue and I had hoped that the commentaries would collectively contribute to the development of the Grand Unified Theory (GUT) given the varied backgrounds and expertise of the commentators, and, together, consensus could be achieved or, at least, worked towards. Regrettably, however, it appears that I have only been partially successful at achieving this aim. Nevertheless, moving forwards, I hope the target article continues to stimulate discussion, both among and between academics and applied practitioners in high-performance sport—especially those who *Cardinale* insists are already engaging in interdisciplinary support work—and, in conjunction with the commentaries, will provide strategic direction to the field.

### 3. Originality of ideas – beyond [Newell \(1986\)](#)?

Despite acknowledging in the target article that many of the principles and concepts of the proposed GUT are not new, a number of commentaries criticised the ideas being conveyed for lacking originality. *Cobley, Sanders, Halaki, and O'Dwyer* contended that the

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proposed GUT was little more than [Newell's \(1986\)](#) model of constraints reframed as a theory that contained no new theoretical concepts or provided any further explanations. [Williams](#) and [Ward](#) also remarked that the arguments made in the target article do not advance the field much further than those presented in previous decades, citing [Davids, Handford, and Williams \(1994\)](#) as a specific example. Before discussing these respective issues, it needs emphasising that the basis of the proposed GUT is just as much the formation and self-organisation of coordinative structures—as [Lopez-Felip](#) and [Turvey](#) correctly asserted—as it is [Newell's](#) constraints framework.

There are, at least, two main advancements in the target article that appear to have gone unnoticed by these, and other, commentators. The first advancement is the extension of [Newell's \(1986\)](#) model of constraints to the inter-individual level of analysis. Originally, this tripartite model was formulated to explain motor coordination in children performing both phylogenetic ('natural') and ontogenetic ('cultural') activities, which had previously required separate theoretical explanations (see [Newell, 1989](#)). As acknowledged in the introductory section of the target article, it has since been applied to various aspects of sport, including sports performance, but predominantly at the intra-individual level of analysis. The recent extrapolation of the coordinative structure concept to the inter-individual level of analysis (see [Riley, Richardson, Shockley, & Ramenzoni, 2011](#); [Araújo & Davids, 2016](#)) has afforded the opportunity to broaden the scope of the constraints model and has enabled it to be applied to all levels of analysis—a key feature in fulfilling the requirements of a GUT.

The second advancement in the target article is the promotion of the constraints model as a basis for increasing interdisciplinary collaboration within and among high-performance practitioners and researchers conducting applied sports science studies, and the explicit identification of key physiological and psychological variables affecting sports performance within the constraints framework. Following a comprehensive review of the 'natural-physical' approach to motor behaviour, [Davids et al. \(1994\)](#) made a similar recommendation to the sports science community about the opportunity for interdisciplinary research, but their proposals only made fleeting reference to [Newell's \(1986\)](#) model of constraints. Additionally, they tended to focus on potential links between biomechanics and motor learning/control—as others have before (e.g., [Dillman, 1989](#); [Gregor, Broker, & Ryan, 1992](#)) and since (e.g., [Bartlett, 1997](#); [Glazier, Wheat, Pease, & Bartlett, 2006](#)), albeit not necessarily with the same rationale—whereas the GUT outlined in the target article aspires to incorporate all subdisciplines. Although [Sands](#) has argued to the contrary (see Section 8), very few, if any, previous attempts have been made in the literature over the past few decades to unite and unify the subdisciplines of sports science using such rigorous underpinning science.

#### 4. Characteristics, criteria, and application of GUTs

There was some conjecture in the commentaries about what constitutes a GUT and whether the approach outlined in the target article fulfilled the qualifying criteria. It was this difference of opinion and/or interpretation that perhaps led [Williams](#) and [Ward](#) to proclaim that they had "... *no great confidence that a unifying theory of sports performance is something that is even achievable*" (p. XXX)—a viewpoint shared by [Hackfort](#). [Williams](#) and [Ward](#) had earlier claimed that "... *while the approach may have some utility as a descriptive and illustrative framework, ultimately, it falls considerably short of the type of unifying theory proposed by Glazier (2017)*". It does not satisfy some of the basic criteria required by the scientific community to constitute a theory" (p. XXX). [Cobley, Sanders, Halaki, and O'Dwyer](#) also argued that the GUT "... *does not adhere to criteria for being grand or unified*" (p. XXX).

Although there were some inconsistencies, the commentators identified several key deficiencies with the proposed approach that they believed prevented it from fulfilling the requirements of a GUT. First, it was argued that the proposed approach does not enable testable hypotheses to be postulated ([Williams](#) and [Ward](#); [Rein, Perl, and Memmert](#)) and, therefore, is not falsifiable ([Williams](#) and [Ward](#)). Second, it was claimed that the proposed approach does not provide any information about underlying causal mechanisms ([Williams](#) and [Ward](#); [Rein, Perl, and Memmert](#)), has no explanatory power ([Williams](#) and [Ward](#)), and cannot be used to make predictions about future behaviours ([Williams](#) and [Ward](#)). Finally, it was asserted that the proposed approach does not incorporate multiple theories from other disciplines to make a bigger collective ([Cobley, Sanders, Halaki, and O'Dwyer](#)).

Taken at face value, these concerns appear to be legitimate and may be perceived to represent significant impediments to the proposed approach attaining GUT status. However, on closer inspection of the generally accepted characteristics and criteria of a GUT (e.g., [Fawcett, 2005](#); [Ayres, 2008](#); [Davidoff, Dixon-Woods, Leviton, & Michie, 2015](#))—many of which were covered in Footnote 1 of the target article—most of these putatively disqualifying issues are actually commensurate with those required for a GUT. To recap, GUTs are not designed with the express purpose of generating hypotheses nor are they meant to be falsifiable. Rather, GUTs are intended to provide a broad, overarching explanation for a discipline or body of knowledge and a foundation on which to develop mid-range and micro theories, which display many of the hallmark features that some of the commentaries incorrectly associate with a GUT.

To be clear, the GUT label is not extravagant or pretentious as [Hackfort](#) implied and, just because GUTs do not lead directly to the generation of hypotheses or experimentation, it does not mean they are merely a "... *sophisticated form of storytelling*" (p. XXX) as [Sands](#) insinuated. I somewhat agree with the proposal of [Rein, Perl, and Memmert](#) that the constraints model—and, by elaboration, the proposed GUT—should be regarded more as a phenomenological framework. Indeed, GUTs by their nature are phenomenological, rather than structural, in that they deal in abstract laws and principles rather than dedicated structures and mechanisms (see [Beek, Peper, & Stegeman, 1995](#), for further discussion of the key distinctions between phenomenological and structural approaches). Criticism has been directed previously at the phenomenology of dynamical systems and constraints-based approaches (e.g., [Carson & Riek, 1998](#); [Rosenbaum, 1998](#)), and [Summers \(1998\)](#), in particular, raised concerns regarding the apparent lack of clarity about where constraints come from, which ones are relevant, and how they interact. However, whilst these are clearly important and valid issues, they become less conspicuous if expressed in the context of a GUT.

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