Optimization of Performance in Top-Level Athletes: An Action-Focused Coping Approach

A Commentary

Paul Glazier and Keith Davids
School of Human Movement Studies, Queensland University of Technology, Victoria Park Road, Kelvin Grove, QLD 4059, Australia
E-mail: pglazier@sky.com

INTRODUCTION

In their target article, Yuri Hanin and Muza Hanina outlined a novel multidisciplinary approach to performance optimisation for sport psychologists called the Identification-Control-Correction (ICC) programme. According to the authors, this empirically-verified, psycho-pedagogical strategy is designed to improve the quality of coaching and consistency of performance in highly skilled athletes and involves a number of steps including: (i) identifying and increasing self-awareness of 'optimal' and 'non-optimal' movement patterns for individual athletes; (ii) learning to deliberately control the process of task execution; and (iii), correcting habitual and random errors and managing radical changes of movement patterns. Although no specific examples were provided, the ICC programme has apparently been successful in enhancing the performance of Olympic-level athletes.

In this commentary, we address what we consider to be some important issues arising from the target article. We specifically focus attention on the contentious topic of optimization in neurobiological movement systems, the role of constraints in shaping emergent movement patterns and the functional role of movement variability in producing stable performance outcomes. In our view, the target article and, indeed, the proposed ICC programme, would benefit from a dynamical systems theoretical backdrop rather than the cognitive scientific approach that appears to be advocated. Although Hanin and Hanina made reference to, and attempted to integrate, constructs typically associated with dynamical systems theoretical accounts of motor control and learning (e.g., Bernstein's problem, movement variability, etc.), these ideas required more detailed elaboration, which we provide in this commentary.

IDENTIFYING INDIVIDUAL-SPECIFIC OPTIMAL MOVEMENT PATTERNS

The first stage of the ICC programme outlined by Hanin and Hanina was to identify and increase self-awareness of individual-specific optimal techniques[1]. The authors proposed an informal and somewhat unconvincing method of identifying optimal movement patterns for

[1]In the target article Hanin and Hanina actually used the terms 'technique' and 'performance' interchangeably throughout their target article. However, there is a distinct difference between the two as highlighted by Lees [1]. In this commentary, we use 'technique' to mean the underlying movement patterns and 'performance' to mean the product or outcome of these movement patterns.

specific individuals: that is, athletes would be required to recall retrospectively, usually with the aid of video, successful and unsuccessful performances in competition and their associated perceptions and subjective experiences. Several issues arise here that could jeopardise the effectiveness of this approach. First, it is important to dissociate good performance (in terms of outcomes) from what may be idealised as good technical performance. The most important relationship for athletes is between functional movement behaviours and successful performance outcomes [1]. Sometimes, the successful acquisition of a performance goal may require adaptive movement patterns which may not necessarily be deemed ‘optimal’. Second, because personal, environmental and task constraints coalesce to shape optimal patterns of coordination and control in neurobiological movement systems [2, 3], what is an optimal movement solution in one performance situation may not be optimal in another. Small changes, for example, in task constraints can lead to large changes in movement patterns which emerge to achieve consistent performance outcomes. Thus, attempts to identify a single ‘optimal’ movement pattern that is applicable in all performance contexts, may be futile and ill-advised [4]. The role of constraints in shaping functional movement patterns, however, appears not to have gone completely unnoticed in the target article since the authors seemed to have constructed arguments (perhaps unintentionally) against the ‘common optimal movement pattern’ concept, stating that “even in the same sport, the core components can be different in different athletes depending on their experiences and resources (anthropological, physical, coordinational, and psychological characteristics” (p. 5).

CONTROL AND MONITORING OF BODY SEGMENT MOTIONS

The second stage of the ICC programme is the control and monitoring stage, which involves the deliberate and step-wise practice of the individual motions of each body segment involved in the assembly of an optimal movement pattern. For the most part, the information presented in the target article about the second stage of the ICC program is at odds with current knowledge regarding emergent movement patterns in neurobiological movement systems. This discrepancy may have become apparent if the authors had considered outlining a dynamical systems theoretical account for their ideas on performance optimization. A central tenet of dynamical systems theoretical accounts of human motor control is that individual musculoskeletal components, or degrees of freedom, are temporarily linked together in functional synergies [5] or coordinative structures [6, 7] during goal-directed action. From this perspective, the degrees of freedom of neurobiological systems could be viewed as a resource to enhance adaptive movement behaviours during performance. It is important to note that there is no intelligent executive proposed to direct how these task-specific structural units are assembled during functional behaviour. Rather, their formation is shaped entirely by the internal and external constraints pressuring the system into change and intrinsic self-organising processes in neurobiological systems [8]. Once a decision to move has been made, musculoskeletal components that actually produce the movement pattern are softly assembled from whatever degrees of freedom are available that best fit the task [9]. Providing that the limb end-point trajectory is not compromised and that the performance goal of the task is attained, the brain “does not care” how the neurobiological degrees of freedom of the system interact during goal-directed action [10]. For this reason, combined with the potentially disruptive influence of passive reaction (inertial and centripetal) forces when the whole movement sequence is finally put together and executed, it makes little sense to attempt to consciously control, in isolation, the finite position of each body segment sequentially during practice.

CORRECTION OF HABITUAL PERFORMANCE ERRORS

The third and final stage of the ICC program is the overcoming of learned or habitual errors. Hanin and Hanina stated that one of the biggest problems facing high-level athletes attempting to make technical changes is the reversion towards a previous erroneous technique. The authors cited a theoretical construct from cognitive psychology called 'proactive inhibition' as the primary cause of this regression and argued that an alternative approach known as the 'Old Way-New Way' methodology may be superior at facilitating retention than traditional drill-based skill correction strategies. This criticism of traditional drill-based methods in motor learning is completely warranted in our view. However, a dynamical systems theoretical interpretation of this issue proposes that well-developed motor skills are supported by stable attractor regions in state space, so that when new or modified movement patterns are being learned, limb trajectories will be 'drawn' to these stable regions, converging on those of the erroneous technique. A more effective strategy that could encourage more persistent movement adaptations is to base practice on nonlinear pedagogy. The main principles of a nonlinear pedagogy have been outlined in detail elsewhere [11], but a most influential idea to note is that movement patterns emerge from the confluence of constraints impinging on the athlete and generic self-organising processes. According to nonlinear pedagogy, behavioural adaptations can be engendered by restructuring of practice environments and systematically manipulating organismic, environmental and task constraints [4]. By setting boundaries in the perceptuo-motor workspace, athletes can embark on a 'search and discovery' strategy for finding their own unique movement solutions for the ensuing constraints. Indeed, it is worth noting how these pedagogical ideas, advocating the benefits of emergent functional solutions under constraint, are harmonious with Bernstein's [5] conceptualisation of practice as a process of 'repetition without repetition'. This conceptualisation captures well the important role of functional variability in achieving successful performance in sport.

CONCLUSION

In this commentary, we have re-interpreted the target article and the ICC programme from a dynamical systems theoretical perspective. In general, applied sports psychologists have been slow to recognise the value of, and reticent to adopt, this alternative approach to motor control and learning in their sports science support programmes. However, this state of affairs need not be the case, as demonstrated in this commentary, since key dynamical systems theoretical constructs, such as adaptive movement patterns, self-organisation, constraints and functional variability, can be instrumental in explaining and enhancing sports performance. We hope that our commentary has provided the authors with 'food for thought' and that some of the principles and concepts from dynamical systems theory can be integrated into future iterations of the ICC programme.

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