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LETTER TO THE EDITOR

The role of representative design in talent development: a comment on "Talent identification and promotion programmes of Olympic athletes"

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A recent comment in the *Journal of Sports Sciences* (MacNamara & Collins, 2011) highlighted some major concerns with the current structure of talent identification and development (TID) programmes of Olympic athletes (e.g. Gulbin, 2008; Vaeyens, Gullich, Warr, & Philippaerts, 2009). In a cogent commentary, MacNamara and Collins (2011) provided a short review of the extant literature, which was both timely and insightful. Specifically, they criticised the ubiquitous one-dimensional 'physically-biased' attempts to produce world class performers, emphasising the need to consider a number of key environmental variables in a more multi-disciplinary perspective. They also lamented the wastage of talent, and alluded to the operational and opportunistic nature of current talent transfer programmes. A particularly compelling aspect of the comment was their allusion to high profile athletes who had 'failed' performance evaluation tests and then proceeded to succeed in that sport. This issue identifies a problem with current protocols for evaluating performance and is a line of research that is sorely needed in the area of talent development. To understand the nature of talent wastage that might be occurring in high performance programmes in sport, future empirical work should seek to follow the career paths of 'successful' and 'unsuccessful' products of TID programmes, in comparative analyses. Pertinent to the insights of MacNamara and Collins (2011), it remains clear that a number of questions have not received enough attention from sport scientists interested in talent development, including: (i) why is there so much wastage of talent in such programmes? And (ii), why are there so few reported examples of successful talent transfer programmes? These questions highlight critical areas for future investigation. The aim of this short correspondence is to discuss these and other issues researchers and practitioners might consider, and to propose how an ecological dynamics underpinning to such investigations may help the development of existing protocols.

In their comment, MacNamara and Collins (2011) argued that a large number of potentially talented performers may have been excluded from talent identification and transfer programmes due to "inappropriate identification measures". These measures may have become prevalent because current identification of talent is based on structured and mechanistic attempts to maximise limited resources (e.g. physical, logistical, operational and financial). However, given the prevalence of these 'snapshot' approaches, which are based on minimal factors, allied to an absence of a principled theoretical framework for understanding expertise and talent development (see Phillips, Davids, Renshaw, & Portus, 2010), it is unsurprising that there are such large numbers of performers being unsuccessful in transfer or de-selected during identification (a view supported in the extant literature: e.g. Abbott, Button, Pepping, & Collins, 2005).

From an ecological dynamics perspective, the volume of wasted talent and inefficiency of talent identification programmes may be partly explained as being due to a lack of awareness of the relevance of the concept of 'representative design' for performance evaluation tests, and the inability of current talent identification tests to adequately assess all requisite

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aspects of competitive performance. Currently, there is a reductionist tendency to profile discrete physical abilities putatively required by athletes to become experts in a specific sport or performance discipline. As argued by MacNamara and Collins (2011), typically these discrete abilities have a physiological or anthropometric characteristic deemed to be required for success in specific sports, usually those with a performance orientation towards physical power. Traditional talent identification models tend to be operationalised by assessment of a small number of heavily weighted variables typically measured in isolation from the performance context. These isolated performance evaluation tasks are reductionist and lack representative design. Another glaring weakness in the practice of sport scientists interested in talent identification is task decomposition. Typically, practitioners break tasks down into small performance sub-phases, which provide ease of control during measurement and evaluation, when they attempt to correlate performance on one specific sub-phase of a sport or activity with overall performance outcomes to predict future success. For example, 30 m sprint times have been used to select 'talent' and predict success in some winter sports (e.g. Bullock et al., 2009). It is worth acknowledging that such variables are moderately correlated with performance outcomes, and are therefore somewhat important for success, and indeed that the observed reductionism is understandable as part of an operational approach to talent identification. However, such an economically rationalised approach needs first and foremost to be based on a principled theoretical model of the relationship between expertise and talent development (Phillips et al., 2010). Crucially, this operational approach could benefit from an ecological dynamics rationale that captures the continuous interactions of athletes with their performance environment, as well as the need to ensure the presence of specifying information in performance evaluation tests, which performers use to regulate their actions (Jacobs & Michaels, 2002). Moreover, the current approach does not acknowledge the complex and dynamic nature of sport performance, especially the inherent 'degeneracy' of the athlete-environment system (e.g. the ability of elements that are structurally different to perform a similar function or yield a similar output; essentially there is more than one way to achieve the same performance goal: Edelman & Gally, 2001). The failure to consider the functional role of degeneracy in human movement systems, therefore, is perhaps most keenly felt in the systematic testing with a limited physiological and anthropometric bias. Ecological dynamics research has challenged the existence of 'common optimal strategies' for successful performance in sport as a pathway to expertise (Davids & Araújo, 2010). Traditional reductionist approaches to talent identification fail to consider that individual athletes can make up for deficits in one aspect of performance (e.g. a slow start) with superior skills in others (e.g. better attunement to environmental conditions resulting in better running/driving lines being taken). Properties of a complex neurobiological system (e.g. characteristics of an expert performer) cannot be truly observed if the parts of the system are broken down and analysed individually (Ovens, Hopper, & Butler, in press), nor can future success be predicted if the epigenetic nature of talent development and the nonlinear emergence of new behaviours is not considered (Renshaw, Davids, Phillips, & Kerhervé, 2011).

MacNamara and Collins (2011) rightly discuss the important role of psychological and environmental factors; however, caution should be taken in emphasising some sub-disciplines over others. For example, attempts to target isolated psychological characteristics in talent identification programmes have led to psychologists repeating the same errors as their physiology contemporaries (e.g. Weissensteiner, Abernethy, Farrow, & Gross, 2012). This issue is only exacerbated by the adoption of mono-disciplinary approaches to sport science support work – and strengthens the need for a multidisciplinary and holistic approach (Renshaw, Oldham, Glazier, & Davids, 2004).

Representative design in sport

So what are the alternatives? An Ecological Dynamics perspective emphasises the interactions of the individual and environment as the relevant scale of analysis for understanding talent development and excellence in sport (see Araujo et al., 2010; Phillips et al., 2010). This theoretical framework, based on ideas and empirical findings of ecological psychology and dynamical systems theory, proposes that movement behaviours emerge from the interaction of neurobiological movement systems (e.g. the performer) and direct contact with their performance environment (Davids, Button, & Bennett, 2008; Newell, 1986). From this perspective, the concept of 'representative design' has recently been advocated to ensure that learning tasks are a representative simulation of the performance environment (Araújo, Davids, & Passos, 2007; Pinder, Davids, Renshaw, & Araújo, 2011b) and may provide some insights of relevance for the talent identification and development specialists. Representative learning design is a functional framework for assessing the fidelity of various practice and learning tasks in sport (see Pinder et al., 2011b). The interaction between the constraints of the environment, the task and the individual performer results in the emergence of

patterns of movement behaviours that become stabilised through learning. The assessment of representative learning design is critical in allowing sports scientists to understand the functionality and limitations of specific training tasks. The association between practice and performance contexts should be analysed by considering the fidelity of the performers' actions. The ideas proposed in this conceptual framework are synonymous with current concerns over the representativeness of performance evaluation tests for talent identification. Current test designs generally do not allow performers to use information that is faithfully simulated from a competitive performance context in regulating their actions, failing to include key task constraints reflective of the performance environment (for a review see Pinder et al., 2011b; also see Vilar, Araujo, Davids, & Renshaw, in press). For example, differences in the coupling of perception and action have been observed under differing ecological constraints of practice and performance contexts in cricket batting (Pinder, Davids, Renshaw, & Araújo, 2011a), soccer goalkeeping (Dicks, Button, & Davids, 2010), and 1v1 attacker-defender interactions in football (Headrick et al., 2011). Ecological dynamics emphasises the role of information for regulating actions, and it is counterintuitive to remove key perception-action couplings by decomposition of evaluation tests in performance sub-phases. There is a need to re-evaluate the design of performance evaluation tests in talent programmes to ensure that they faithfully simulate the continuous interactions of athletes with their performance environments (Vilar et al., in press). Here, we propose that the assessment of *representative design* in talent development programmes in sport should be based on principles of Ecological Dynamics (see Pinder et al., 2011b) to allow talent sport scientists to capture the information in the environment that performers use to regulate their actions, rather than basing tests on discrete sub-phase performance measures being correlated with performance outcomes. In reconsidering approaches to talent development, tasks should embrace variability, sample functional information sources from the performance environment, ensure decisions are context dependent, provide representative affordances for action, and consider individual differences (for a comprehensive discussion of these recommendations see Davids, Araújo, Vilar, Renshaw, & Pinder, in press).

Within an ecological dynamics framework, consideration of the cultural environment is as important as the physical environment (as identified by MacNamara & Collins, 2011). This wider view emphasises that it is often an athlete's ability to cope with the ancillary demands of being an elite athlete above and beyond simply 'performing' that determine the ultimate success of an individual. For example, elite athletes described organisational stresses within sport organisations as being more demanding than stresses associated with competitive performance (see Hanton, Fletcher, & Coughlan, 2005). Hence, for talent scientists, predicting how an individual copes with factors such as "environmental issues", "personal issues", "leadership issues" and "team issues" may well be as significant in determining ultimate potential as is an isolated physiological component of performance. A multi-disciplinary framework would consider the psychosocial interactions, for example by taking into consideration how an individual co-adapts to solve problems when working with team mates (Fajen, Riley, & Turvey, 2009). Furthermore, given emotions change cognitive functions, such as attention, attempts to re-create the emotional states that are experienced in performance should be carefully considered in performance evaluation test designs (see Lewis, 2004), suggesting that "testing" should be over a longer period, rather than a one-off snapshot approach (Abbott & Collins, 2004).

By using a principled theoretical framework in performance evaluation to develop the concept of representative design in sport applied to learning design and performance evaluation test design, sports scientists may reduce the amount of wastage in talent transfer and development programmes, allowing testing protocols to more faithfully simulate aspects of performance environments in sport. This principled approach would entail a move away from snapshot TID methods towards structured talent development (TD) programmes (supporting the views of MacNamara & Collins, 2011) based on empirical evidence and representative learning and testing environments. For example, in expert athletes, preferred coordination tendencies form basins of attraction (stable states of organisation) which reveal an individual's intrinsic dynamics (inherent coordination dispositions) in specific contexts. Expertise in sport is predicated on the ability of an athlete to adapt these intrinsic system dynamics to cooperate with those of a particular task; the transfer of expertise is therefore defined by the amount of cooperation or competition between the two. When the gap between the pre-existing movement pattern repertoire of an athlete and the task demands is low, a convergence between the two might be expected, facilitating the transfer of skills. Talent development programmes should be based on mapping of the intrinsic dynamics of a performer and the demands of the task or environmental constraints (Davids, Araújo, Hristovski, Passos, & Chow, 2012). This mapping process is highly dependent on representative design in performance evaluation tests.

In conclusion, a key challenge for sport scientists interested in talent identification is to consider

environmental constraints and accurately predict the performance environment of the future. Such an advance in methodology may prevent talented individuals from being de-selected from programmes.

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