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The dynamics of expertise acquisition in sport: The role of affective learning design

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A B S T R A C T

Objectives: The aim of this position paper is to discuss the role of affect in designing learning experiences to enhance expertise acquisition in sport. The design of learning environments and athlete development programmes are predicated on the successful sampling and simulation of competitive performance conditions during practice. This premise is captured by the concept of representative learning design, founded on an ecological dynamics approach to developing skill in sport, and based on the individual-environment relationship. In this paper we discuss how the effective development of expertise in sport could be enhanced by the consideration of affective constraints in the representative design of learning experiences.
Conclusions: Based on previous theoretical modelling and practical examples we delineate two key principles of *Affective Learning Design*: (i) the design of emotion-laden learning experiences that effectively simulate the constraints of performance environments in sport; (ii) recognising individualised emotional and coordination tendencies that are associated with different periods of learning. Considering the role of affect in learning environments has clear implications for how sport psychologists, athletes and coaches might collaborate to enhance the acquisition of expertise in sport.

Introduction

In sport, performers must adapt to the constraints of dynamic performance environments, with commensurate variable conditions and situations, while performing under different emotional states that constrain their cognitions, perceptions and actions (Jones, 2003; Lewis, 2004). Despite the documented presence of emotions[1] in sport performance, thus far (see Vallerand & Blanchard, 2000), limited attention has been paid to the role that emotions might play during the acquisition and development of expertise. Traditionally, emotions have generally been viewed as negative and detrimental constraints on behaviour, considered better to be removed from practice task contexts until a skill is well established (Hutto, 2012). This reductionist approach to learning design is in line with traditional thinking in the acquisition of skill in which practice tasks are decomposed to putatively reduce the cognitive loading on performers as they attempt to enhance expertise (Lewis & Granic, 2000). Here we raise questions on the reductionist approach to learning design and discuss an alternate principled approach suggesting how affective constraints on behaviour may be included during the acquisition of expertise in sport, drawing on the theoretical rationale of ecological dynamics.

In existing research on movement behaviours, ideas from dynamical systems theory have been integrated with concepts from Gibsonian ecological psychology, forming the ecological dynamics approach to understanding performance and learning (Araújo, Davids, & Hristovski, 2006; Davids, Williams, Button, &

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[1] The broad term of affect refers to a range of phenomena such as feelings, emotions, moods, and personality traits that interact over different time scales. Here affect will be used interchangeably with emotion to follow previous modelling of cognition, emotion and action (Lewis, 2000a; Vallerand & Blanchard, 2000).

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Court, 2001; Warren, 2006). An ecological dynamics approach to enhancing expertise recognises the need for individuals to form mutual functional relationships with specific performance environments during practice and training (Araújo & Davids, 2011; Davids, Araújo, Vilar, Renshaw, & Pinder, 2013; Seifert, Button, & Davids, 2013). In a functionalist approach to the study of perception and action, Gibson (1979) emphasised the role of the environment and proposed that an individual's movements bring about changes in informational variables from which affordances (invitations for action) are perceived to support behaviours (Withagen, de Poel, Araújo, & Pepping, 2012). As a result a cyclic process is created where action and perception underpin goal-directed behaviours in specific performance environments (Gibson, 1979).

Studying emergent behaviours and the acquisition of expertise at this individual-environment scale of analysis takes into account how perceptions, actions, intentions, feelings and thoughts continuously emerge under the constraints of information external and internal to the individual (Seifert & Davids, 2012; Warren, 2006). Humans, conceptualised as complex dynamic systems, exhibit self-organising, coordination tendencies during learning and performance to achieve specific task objectives (Kelso, 1995; Lewis, 2000b). The informational variables in a specific performance environment, along with associated goals and intentions, constrain how each individual behaves (Davids et al., 2001; Freeman, 2000; Juarrero, 2000). Coordination tendencies (e.g., behaviours in human movement systems) that are stable are described as attractors (Kelso, 1995; Zanone & Kelso, 1992). Stable attractors are states of system organisation that represent well learnt, stable patterns of behaviour (Kelso, 1995; Thelen & Smith, 1994). It is important to note that coordination tendencies may be functional or dysfunctional in terms of meeting the demands of a specific task, or during learning (Warren, 2006). Depending on the depth or stability of an attractor, changes in informational variables that act as control parameters have the potential to perturb (disrupt) coordination tendencies (e.g., Balagué, Hristovski, Aragonés, & Tenenbaum, 2012; Passos et al., 2008). Perturbations can lead to phase transitions in coordination tendencies, often producing changes in behaviour. Unstable system states correspond to a 'hill' above potential 'wells' where coordination tendencies may be variable and possibly less functional (Kelso, 1995; Vallacher & Nowak, 2009). Unstable system states are more open to influence by changes to informational variables both internal and external to an individual during performance (Davids et al., 2001). Through practice and experience in sport, athletes, considered as dynamic movement systems, can learn to enhance stability of performance behaviours and increase their resistance to perturbations, including negative thoughts, and emotions (e.g., differences in ice climbing performance between experts and novices, see Seifert, Button, et al., 2013; Seifert, Wattlebled, et al., 2013). An important question for sport psychologists and coaches concerns how practice programmes can be designed to provide athletes with learning experiences that help them to exploit functional coordination tendencies (i.e. system states which are stable yet adaptable) under the affective constraints of sport performance.

Ecological dynamics is an integrated theoretical rationale of human behaviour that can underpin a principled approach to learning design in clinical (Newell & Valvano, 1998) and sport performance environments (Araújo et al., 2006). The basis of behavioural change through learning involves the systematic identification and manipulation of system control parameters (informational constraints) to perturb stable states of organisation and facilitate transitions to more functional system states (Kelso, 1995, 2012). Attractors can take the form of intentions, and/or goals that a performer is 'attracted to' following changes in values of system control parameters (Davids et al., 2001; Davids et al., 2013; Warren, 2006). Stable system states often represent desired forms of organisation that are functional. Enhanced functionality, i.e. 'what works' (see Thelen & Smith, 1994), is achieved when an athlete establishes a successful relationship with a performance environment and task goals are achieved (e.g., through more accurate or faster performance outcomes). Simultaneously, functional coordination tendencies can satisfy the psychological needs (i.e. 'what feels good') of each individual performer in particular performance situations (Carver, Sutton, & Scheier, 2000; Hollis, Kloos, & Van Orden, 2009; Lewis, 2004). In order for a behavioural attractor to become stable through learning, the intrinsic dynamics (the predispositions and tendencies) of each performer and the task dynamics (e.g., specific performance requirements) must converge (Davids et al., 2001; Zanone & Kelso, 1992). The relative stability of behavioural attractors is important to facilitate achievement of successful performance at specific points in time. But, learning environments also need to be dynamic and variable to allow an individual to adapt to changing individual, task and environmental constraints over the short and long time timescales of development (Lewis, 2002; Newell, 1986). A key task for sport psychologists and practitioners is to understand how to effectively manipulate constraints to facilitate the development of new behavioural attractor patterns essential for expertise acquisition.

Sport psychologists have begun to identify control parameters to design effective learning environments that are carefully matched to each individual's intrinsic dynamics, or predispositional behavioural tendencies. Carefully designed learning environments can guide athletes towards *metastable* performance regions, in which a functional blend of coordination stability and adaptability can result in rich behavioural solutions emerging (Hristovski, Davids, Araújo, & Button, 2006; Pinder, Davids, & Renshaw, 2012). Metastability is a state of partial organisation where a system 'hovers' in a state of dynamic stability, switching between functional states of organisation in response to changing constraints, and displaying subsequent behavioural flexibility (variability, instability) (Fingelkurts & Fingelkurts, 2004; Phillips, Davids, Araújo, & Renshaw, 2014). Metastability allows a system to transit rapidly between co-existing functional states of organisation, essential for adaptive performance behaviours in dynamic environments (Chow, Davids, Hristovski, Araújo, & Passos, 2011; Kelso, 2012; Kelso & Tognoli, 2009). During learning events in specific performance environments, being in a state of metastability allows performers to discover and explore performance solutions (Kelso, 1995; Seifert, Button, et al., 2013). In sport, empirical data has revealed how locating samples of boxers and cricketers in metastable performance regions during practice helped them to explore and exploit rich and creative performance solutions to achieve their task goals (Hristovski et al., 2006; Pinder et al., 2012).

Adopting novel and potentially functional states of system organisation is a consequence of learning and/or development, as individuals transit from the 'known' to the 'unknown', i.e., moving from a familiar task or situation to one that is new or different. Of interest to sport psychologists is the fact that increases in movement variability during phases of learning are often accompanied by increased intensity and range of emotions (Lewis, 2004). These emotions can be attributed to: (i) the challenges of learning a new movement pattern; (ii) the perceived risk of failure to achieve specific performance outcomes; and (iii), the underlying uncertainty and/or excitement associated with performing in an unknown situation. Observable changes in behaviours and emotions of athletes are of importance since they can act as predictors for potential phase transitions in system behaviours, such as coordinated movement response characteristics (Chow et al., 2011; Kelso,