

First Notes

PASS 3

PRIMARY SOURCES

1. Coping Skills and Self-Efficacy as Predictors of Gymnastic Performance

- 1.1. According to Fitzpatrick (4) the most commonly reported attributes distinguishing between high and low levels of gymnastic performance were psychological factors, in contrast with the general belief that successful performance is mainly influenced by ability (29). Thus, the psychological skills of gymnasts can influence their capability to perform successfully in a competition. These coping skills refer to the cognitive and behavioral efforts to overcome, reduce or tolerate internal and/or external demands caused by a stressful situation. Coping with stress is not directly related to the final outcome of the effort. This means that coping is defined by the efforts to control the challenge of a situation, regardless of an athlete's success (5) (p. 1).
- 1.2. It has been also demonstrated that, in relation to young athletes, the support offered by their coaches and fellow athletes plays a very important role in coping effectively with stress (16). In this respect the ways in which children and teenagers deal with stress are influenced by the feedback and the behavior of parents, trainers and others. When a child enters puberty the importance placed on "wins" increases substantially. This in turn amplifies the feeling of being "pressured to perform", a feeling which is carried over into puberty and adulthood (p. 2).
- 1.3. Bandura's theory of self-efficacy (1) examines the influence of personal belief on the actual capability to perform, with final performance being affected by two parameters: a) the strength of a person's belief in his or her ability to perform a certain task; and b) the presence of an accepting and responsive environment (14). The effect of self-efficacy [...] has been used to predict to a significant degree the actual performance in football (17), serving in tennis (25), darts (11), basketball free-throws (9), and gymnastics (13). According to Lee (13) the performance of female artistic gymnasts has been shown to vary according to self-efficacy expectations. Weiss, Wiese and Klint (30) have demonstrated that artistic gymnasts with higher expectations of final achievement before a tournament tended to be more successful than gymnasts with low expectations of success (p. 2).

2. Self-belief does make a difference: A reciprocal effects model of the causal ordering of physical self-concept and gymnastics performance

- 2.1. As is the case in many disciplines, in sport/exercise settings self-concept is frequently posited as a mediating variable that facilitates the attainment of other desired outcomes such as physical skills, health-related physical fitness, physical activity, and exercise adherence (Marsh, 1997, 2002). The rationale behind this research is that individuals who feel positively about themselves in a particular domain—in this study the physical domain—are more likely to pursue and achieve desirable outcomes in that domain than individuals who do not feel positively about themselves (p. 3).
 - 2.2. In a recent meta-analysis of relevant research, Valentine (2002; Valentine, Dubois & Cooper, 2004) concluded that there was clear support for predictions based on the reciprocal effects model over those derived from self-enhancement and skill development models. Whereas the effect of prior self-concept on subsequent achievement after controlling for the effects of prior achievement was modest (mean standardized regression coefficient = .1), the effect was highly significant overall and positive in 90% of the studies in this meta-analysis. In support of the multidimensional perspective that is so important to the reciprocal effects model, the effects of prior self-beliefs were significantly stronger when the measure of self-belief was based on a domain-specific measure rather than on global measures such as self-esteem, and when self-concept and achievement measures were matched in terms of subject area (e.g. mathematics achievement and math self-concept) (p. 4-5).
 - 2.3. More recently, [...] there has been a stronger emphasis on a multidimensional perspective of self-concept with physical self-concept measures designed specifically for physical education, sport and exercise settings (Fox & Corbin, 1989; Marsh, 1997, 2002). They show that physical self-concept is distinct from other areas of self-concept (e.g. academic). This growing body of research also provides clear support for convergent and discriminant validity of physical self-concept responses in relation to a wide variety of sport/exercise outcome measures (p. 5).
- 3. Are there specific conditions for which expertise in gymnastics could have an effect on postural control and performance?**
- 3.1. In [gymnastics], and specifically in the floor exercise for male gymnasts, maintaining postures is needed and required by the international codification [1]. The “legmount”, the scale (two postures on one leg with the other leg fully extended in a front, side or rear split position in the first one or lifted backward in line with the trunk bended forward parallel to the floor for the second one) or the handstand on the floor are such examples. Before attempting or learning these specific and difficult postures, gymnasts are first trained to maintain less specific ones, such as the unipedal; a posture that any healthy human could perform (p. 76).

- 3.2. Expertise represents 'a high level of knowledge and skills gained from training and experience' (Oxford English Dictionary). Thus, it can be argued that this general effect which included gymnasts' experience, competition level, number of hours of training, etc. can be regrouped as one notion: the effect of expertise. Then, to test such [an] effect of expertise, one could compare elite gymnasts to other athletes who are not trained to stand still (p. 77).
- 3.3. The visual system is a complex system but mainly it can be separated into two essential components. The first one, called foveal vision, is largely concerned with objects' recognition and identification, textures or colours. The second one, called peripheral vision, detects movements occurring in the environment. These components, neurophysiologically distinguished, are linked by their role in the control of posture [10]. For example, in bipedal posture, any modification of the surroundings (objects position or brightness) affects postural sway [10]. This effect is more pronounced in more challenging balance tasks such as standing with the feet close together [11] or standing on one leg [9]. Closing the eyes is another and simpler way to analyse the impact of this sensory system (p. 77).

4. Exploring Visual Patterns and Judgments Predicated on Role Specificity: Case Studies of Expertise in Gymnastics

- 4.1. The contextual approach suggests that cognitive processes (e.g., perception) are dependent on interactions with the environment, indicating that perceptual mistakes could be influenced by memory (Jacoby et al. 2001; Ste-Marie et al. 2001). For example, the decisions of referees may be mediated by their current and previous behaviors (i.e., sequential effects) or by their visual perspective when viewing a sport sequence (i.e., a positioning effect). In contrast, the embodied approach focuses on the relationship between cognitive processes, the body and movement (Goldman and de Vignemont 2009). Errors in perception emerge when people misinterpret the actions of other individuals from their own motor representations (Jeannerod 2001) (p. 935).
- 4.2. Empirical evidence shows that previous motor experiences could improve the accuracy of perceptual judgments (Hecht et al. 2001; Pizzera 2012), decision-making process (Poplu et al. 2003), and the sensitivity to perceived actions (Hodges et al. 2007). For example, Aglioti et al. (2008) showed that neural activation in brains of expert basketball players increased during observation of video action sequences, suggesting that motor experience is used to predict movements of their opponents (Rizzolatti and Craighero 2004) (p. 935).
- 4.3. The objective of this study was to determine, using an embodied cognition approach, whether the perceptual judgments of participants with expertise in gymnastics may have been influenced by previous domain-specific visual and motor experiences. As the sample had extensive experience in the task, the method of verbal reporting was also introduced to analyze how expert

participants used their previous sport-specific experiences gained during years of training and practice to make perceptual judgments (p. 939).

5. Gymnastic judges benefit from their own motor experience as gymnasts

- 5.1. Fast and complex movements characterize several gymnastic skills; therefore, judges have a highly challenging and difficult mission. Research on gymnastic judges has shown they also have to cope with imperfect positioning (Plessner & Schallies, 2005), sequential effects influenced by previously judged performances (Damisch, Mussweiler, & Plessner, 2006), and conformity bias (Boen, Van Hoye, Auweele, Feys, & Smits, 2008). The question arises concerning the information sources judges use to overcome these obstacles. Researchers have examined different factors, such as gaze behavior (Bard, Fleury, Carriere, & Halle, 1980; Ste-Marie, 2000), anticipation (Ste-Marie, 1999), and judging experience (Plessner & Schallies, 2005; Ste-Marie & Lee, 1991) (p. 603).
- 5.2. Studies have shown that observers' motor and visual experiences positively influence their visual perception of other people's movements (Loula, Prasad, Harper, & Shifrar, 2005). These authors asked participants to identify and discriminate point-light videos of themselves, friends, and strangers performing various actions. Performance was best for their own actions, indicating a positive influence of motor experience on visual perception, as people do not usually have visual experience of their own movements. Participants performed second best for friend trials, which the authors attributed to visual experience as the determining factor. In a study on action identification and discrimination, Casile and Giese (2006) showed that pure motor learning can enhance visual perception. Participants had to learn a novel coordinated upper-body movement, characterized by arm movements that matched a gait pattern with a phase difference of 270° , while blindfolded. Although visual experience during the training was absent, there was a selective improvement of the visual recognition performance for the learned movement (p. 603).
- 5.3. During a gymnast's routine, judges repeatedly identify, discriminate, categorize, and assess different skills. They must be capable of judging joint angles correctly. Studies have shown that people accurately estimate body part angles or geometric angles visually (Genaidy, Simmons, Guo, & Hidalgo, 1993; Kennedy, Orbach, Gordon, & Loffler, 2008). Judges must also detect movement and form errors and give credits or deductions accordingly. In high-level competitions, judges are divided into two panels (IFG, 2009). Panel D is in charge of identifying and determining the difficulty of the routine, while Panel E judges deduct for general, execution, and artistry faults. In low-level competitions, one panel performs both tasks. Judges must also be alert to intentional deceptions of gymnasts who try to cover up errors to get fewer deductions (MacMahon & Plessner, 2008) (p. 603-604).

6. Expressiveness of gestural communication through body actions

- 6.1. The human body is, through its structure and mobility, a mirror of the infinite psychics hue that animate the individual. Receptive to everything that happens inside and outside, the dancer/athlete conveys and transpose[s] his psychic and infinite fluctuations, into a multitude of possibilities and expressions to those around him or her. His body becomes a micro-universe in which the muscular tensions, his own breathing and his sensory channels instruments, the nonverbal communication individual instruments, [represent] a present reality, of which the performer is not always aware of. The gesture is, most often, a voluntarily controlled movement that carries the semantic load of the message (p. 53).
- 6.2. The instrument with which the dancer/athlete expresses himself is his body. He must master the expressions technique means so as to instantly respond to the imposed commands of the choreographer/coach conceptions. In order to achieve the impulse and action simultaneity, it is necessary for the performer to develop the parallel development of both thinking and self-control, as well as the body's physical qualities that will act. In order to obtain a special artistic effect, the dancer/athlete becomes conditioned by the movement plasticity and expressiveness (p. 53).
- 6.3. Understanding the gesture in terms of its expressiveness, represents an outside projected expression essentiality that reflects a pre-existing psychic content through the body which can be transmitted to a present audience. "The gesture can become [the] body`s expression when we want to convey the emotional nature of a situation by capitalizing the original function which consists in the artistic act [of] beauty". Thus, the gesture can be the intermediary of two distinct planes: the mental (inner) and the physical body (outer). The viewer/spectator can be guided towards the inner message understanding through gestures with expressive value *developed in the outer space by the body`s dancer/athlete* (p. 54-55).

7. Affordances in Interaction: The Case of Aikido

- 7.1. Scholarship inspired by J. J. Gibson is showing considerable interest in multiagent environments and interactive behavioral dynamics (Warren, 2006), which underlie everyday social activities (Fusaroli, Rączaszek-Leonardi, & Tylén, 2014; Marsh, 2015) but also decision making in domains such as soccer, basketball, boxing, social dances (Araujo, Davids, & Hristovski, 2006; Bourbousson, Seve, & McGarry, 2010a, 2010b; Esteves, de Oliveira, & Araujo, 2011; Hristovski, Davids, & Arujo, 2006; Kimmel, 2012; Kimmel & Preuschl, 2015; Passos, Davids, & Chow, 2016; Torrents, Hristovski, Coteron, & Ric, 2016; Travassos et al., 2012), and robotics (Horton, Chakraborty, & St. Amant, 2012; Ibanez-Gijon, Diaz, Lobo, & Jacobs, 2013). In behavioral dynamics, due to real-time coupling between bodies, a new decision opportunity presents itself

frequently. In dance and high-paced sports this can be up to several times a second. To succeed with this, agents must source cues from other agents whom they supply with cues in return. Typically, the behavioral dynamics are not scripted (p. 195-196).

- 7.2. Agents shape and are shaped by smoothly adapting to each other's ongoing actions and the environment. As this embodied dialogue unfolds, a stream of transient perceptual configurations offers guidance. That is, actions are selected, modulated, switched, and terminated based on evolving interactional contingencies (McGann & De Jaegher, 2009), which are drawn from spatio-temporal information such as geometry between the bodies or relative timing (p. 196).
- 7.3. The associated empirical challenge is that such coregulated perception–action streams (a) are tightly interwoven and difficult to dissect, (b) involve highly task- and phase-specific sensorimotor skills, and (c) generate myriad alternative interpersonal dynamics. To address these challenges we report on selected data from a wider project tapping into first-person practitioner know-how. We applied special dialogic interviewing techniques, which allow both learners and seasoned experts to verbalize what usually remains implicit about their sensorimotor and strategic skills. (p. 196).

8. Performance and Health Concepts in Artistic Gymnastics

- 8.1. The extreme forces placed on the gymnasts' body in combination with the repetitive movements and high training hours are more than likely a major factor behind the reportedly high incidence of injuries (Lilley, 2006). Although the types of injuries sustained in gymnastics are comparable with many other sports, gymnastics is unique in that the gymnasts receive the majority of their training during their childhood years (Sands, 2000) (p. 52).
- 8.2. During training, a preferred leg and hand often develops when aiming to achieve performance consistency and reliability of a skill. This can lead to a potential functional imbalance between the limbs. In non-elite competitive gymnasts (National Levels 4-6), Lilley et al. (2007) identified only two gymnasts out of 15 who had functionally symmetrical landings (less than 10% difference between limbs; Grace, 1985) with one gymnast having a staggering 73% of asymmetry ($X = 18.14 + 20.46\%$). Recent unpublished results of 25 international development stream (elite) gymnasts performing drop landings from heights of 70 and 95 cm revealed a more favourable result, with 11 of the 25 gymnasts displaying functionally symmetrical landings ($X = 6.85 + 14.59\%$, $Max = 32.74\%$) and much lower overall levels of asymmetry (p. 52).
- 8.3. Often the most important test of biomechanical research is whether it eventually improves performance and/or influences coaching (and training) practice through

increased knowledge. One study that achieved success in Australia was that on target-directed running in vaulting (Bradshaw, 2004). It revealed that gymnasts who want to perform more advanced vaults need to be able to target and adjust their strides early in the approach in order to hit the beat board with high velocity (p. 53).

SECONDARY SOURCES

1. **Embodied Cognition With and Without Mental Representations: The Case of Embodied Choices in Sports**

- 1.1. We argue that when embodied choices in complex environments such as sports are considered, taking two recently discussed theoretical approaches into account can be useful. One of them assumes that there is mediation between a person and the environment through mental representation, and the other assumes direct contact between a person and the environment and thus no need for mental representation. Both approaches will be used to contrast interpretations of embodied cognition in sports (p. 2).
- 1.2. Radical embodied cognition approaches assume that the functioning human body itself constitutes a cognitive process (Chemero, 2011; Jacob, 2016). According to Jacob (2016), there are at least two approaches. The “basal radical” approach principally denies the existence of representations and challenges computational approaches to cognition. We refer to this as taking a direct contact approach. The “constructive radical” approach describes bodily processes with regard to their functionality and as a component of cognition. In some cases, a constructive radical approach accepts that there can be a mediating role of mental representation (see Newen et al., 2018, for a range of positions). In sports, this discussion can be traced back to the motor-action controversy (Beek and Meijer, 1988), in which a rather representational approach based on motor program theory (Schmidt, 1988) and an ecological approach to movements (Reed, 1988; Warren, 1988) that excludes representations from its explanations were pitted against each other (p. 2).
- 1.3. The conceptual basis of this paper is that empirical findings indicating effects of sensorimotor processes on cognitive processes cannot be ignored (Goldinger et al., 2016) or explained as an “epiphenomenon” (Topolinski, 2010). Further, following the frequently cited review “Six views of embodied cognition” (Wilson, 2002), we agree on Wilson’s major assumption of cognitive processes being situated, dynamic, and functional and serving actions or being expressed by actions. The mental representation and direct contact approaches differ in whether they see a strict separation of the environment and the person (p. 2).

2. Optimizing Performative Skills in Social Interaction: Insights From Embodied Cognition, Music Education, and Sport Psychology

2.1. Expert musicians and skilled athletes often display the stunning ability to adapt to, and coherently engage with, the shifting demands of their contingent milieu. A sudden change in the tempo of a music performance or the emergence of a particular spatial configuration of players in team sports requires the immediate generation of appropriate novel actions to keep the music “alive” or the sport performance possible. Traditionally, this process is described as a largely automatic mechanism, where little or no attention is dedicated to the generation and enactment of the new actions (see Dreyfus and Dreyfus, 1986; Schmidt and Wrisberg, 2008) (p. 2).

2.2. It has been argued that the automaticity of such mechanisms develops through a progressive shift from an initial phase where skills are acquired to a final performative stage where the task (e.g., repeating and elaborating an “error” to make it sound intentional in improvised music or dribbling the opponent in ball games) can be achieved without any explicit “cognitive” involvement (c.f., Papineau, 2013). By this view, musicians and athletes do not follow pre-defined rules as they become experts; it is only at the beginning of the process, when skills are acquired and developed, that these schemas need to be examined and discussed (p. 2).

2.3. In this article, we aim to provide additional grounding for this line of research by comparing and further developing original themes concerning how performative skills are acquired and optimized by novices in the context of music and sport. In particular, we will draw on recent research in embodied cognitive science (ECS) with the aim of developing a more integrated view of how action and thought shape each other dynamically. Scholars inspired by ECS emphasize the deep continuity between perception, action, biological organization, reflection, and intersubjectivity (Di Paolo et al., 2017). By this view, talking about the physical location of the mind becomes meaningless. Instead, “mind” is here conceived as an emerging property of the interplay between a brain–body system and the contingent (social, cultural, physical) environment in which the organism is situated (Thompson, 2007) (p. 3).

3. Introduction: when embodied cognition and sport psychology team-up

3.1. [...] excellence in sporting skills inspires embodied cognition by exhibiting tangible evidence that the details of our bodily constitution are not accidental to our mental powers, but define them in various inherent ways: not only because the informational processes that realize our intelligent functions are specifically regulated, distributed, filtered, or scaffolded by the physical and biological compound that implements them (Shapiro 2011); but also because the modes and the efficacy of our practical intelligence primarily depend on the originary

unprincipled engagement with a perceptual environment that can only be discovered by and become meaningful to an embodied agent (p. 213).

- 3.2. [...] it is not just metaphorically that we speak of “good feet” and “quick hands” as making a difference in the way a professional football player or a Formula One pilot perceive the world and skillfully cope with it, because the athlete’s conceptual understanding and decision-making capabilities build first of all on her situated expertise, i.e., on the development of a direct responsiveness to the surroundings, a readiness to anticipate and take advantage of the opportunities of action that the others cannot see. Maurice Merleau-Ponty (1945) used to characterize this practical, relational know-how as a sort of “tacit knowledge” or “knowledge in the hands”, a kind of proficiency that—as opposed to the conceptual knowledge based on explicit instructions, stored heuristics, and amodal representations—relies on the concrete familiarity with practical contexts and personal or interpersonal experience situated in the contingencies of individual or collective performance (p. 213-214).
- 3.3. The theory of embodied cognition resonates at least in part with some of the psychological doctrines situated at the root of the sport sciences, e.g., both the cognitive-computational approach by Fitts and Posner (1967) (which stresses how bodily engagement with the environment provides specific tools for perceiving, remembering, thinking, and acting that can hardly be replaced by “intellectual” skills on their own) and the cognitive-ecological approach by Gibson (1979) (maintaining that the physical constitution of our body carries out a significant portion of the information-processing traditionally attributed to mentation). These psychological doctrines are deeply implanted in the everyday research practice of the sport sciences; that is why it is not surprising that the most influential theories of embodied cognition begin to be seriously addressed (though not universal[ly] accepted at all) by many researchers in sport psychology (p. 214).

4. Moving Wisdom: Explaining Cognition Through Movement

- 4.1. Starting with the notion of activities for which performance, movement, and the pursuit of excellence are central, the two driving questions are: 1) what may be fruitful ways to modify existing research mores and theoretical assumptions in cognitive studies? In this regard, this study is an overture to expand the cognitive canon. And, 2) how do we integrate the cognitive sciences with the normative? Uniquely, the normative weight to excel is derived not only from conceptual requirements from the ethical sphere, but also from work in the mind sciences and skillful coping that is connected to standards inherent to and resulting from the active pursuits central to this examination—sports, performing and martial arts, and crafts. Animate bodies, in particular as incorporated into active pursuits, best show the connection between the normative and the cognitive, and how

these correlate with bodies, their kinetic capabilities, and the context of a community (p. 59).

- 4.2. To effect this, I propose to expand the current research in congruent ways to Shaun Gallagher and Dan Zahavi's proposal in *The Phenomenological Mind*, where they write, "If real progress is to be made in the study of the mind, it requires a collaborative effort that draws on all the available resources and that integrates a variety of theoretical and empirical disciplines and methods." (2008: 221. My emphasis) My goal is to make a case for active pursuits, highly demanding in an intelligently kinetic and tactile fashion, to legitimize them as activities themselves, objects of study, and cognitive modes. In particular, I wish to go beyond vision, normality and the pathological to also incorporate much more explicitly the kinetic-tactile and the exceptional under a framework that re-conceptualizes matters (p. 60).

- 4.3. A more inclusive view of what counts as cognition is in order. Robert P. Crease's points out that of the two ways we have of knowing the world, one theoretical and linguistic, endorsed by science, and the other experiential, subjective and practical, we feel as if we must prioritize and favor the former. After convincingly arguing that athletes do not 'know' the laws of physics but rather know the laws of 'physics,' Crease concludes that, "Conflating the senses of knowing – and giving priority to the theoretical sense over the practical – simply reflects our adherence to the ancient myth that true knowledge is theoretical." (2012a: 19) Indeed, both are complementary and serve our varied needs and interests. As a matter of fact, most of our every day lives' interactions take place in the realm of the practical as Edmund Husserl points out (Gallagher and Zahavi, 2008:136) (p. 60-61).