An Ecological Study of the Moderating Effect of Self-Efficacy on the Relationship between Personality and Biomechanical Consistency

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RUNNING HEAD : SELF-EFFICACY, NARCISSISM & MOTOR CONTROL

Title

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Abstract

Self-efficacy is a widely called upon theory in the domain of sport sciences. However, much debate surrounds the way precepts of self-efficacy are measured (Bandura, 2006) and how they relate to performance (Moritz, Feltz, Fahrbach & Mack, 2001). Following Bandura's (2006) guidelines, the present paper aims to make sense of the above criticism by testing the strength of a purpose-built self-efficacy questionnaire in predicting subjects' biomechanical performance in a dart-throwing task, against that of trait narcissism, as measured by the NPI (Raskin & Hall, 1979). Ten expert darts players took part in the present study. Data was collected using questionnaires and a 3D motion capture system during an international darts meet. Results suggest that increased levels of trait narcissism will lead to less biomechanically measurable effort into performance, and that this relationship is moderated by participants' precepts of self-efficacy. This moderation model posits that performance-related effort will increase as levels narcissism increase, provided that the subject perceives himself to be less competent in the task at-hand.

Key Words : Self-efficacy ; Narcissism ; Motion analysis ; Moderation ; Darts

Titre

Une Étude Écologique de la Modération de l'Auto-Efficacité dans la Relation entre Personnalité et Régularité Biomécanique

Résumé

La théorie de l'auto-efficacité est largement utilisée dans le domaine des sciences du sport. Cependant, tant les outils permettant la mesure de l'auto-efficacité (Bandura, 2006) que la relation qu'entretient ce construit avec la performance sportive (Moritz, Feltz, Fahrbach & Mack, 2001) sont sujets à débat. La présente recherche vise à répondre à ces critiques en évaluant la force prédictive d'une échelle d'auto-efficacité face à celle de la personnalité, ou, plus particulièrement, du trait du narcissisme, tel que mesuré par le NPI (Raskin & Hall, 1979). Dix individus ont participé à cette étude. Les données ont été recueillies, d'une part, via questionnaires, et d'autre part, via l'utilisation d'un système de capture du mouvement 3D. La régularité motrice est choisie comme variable de performance prédite. Selon les résultats, il semblerait que plus les niveaux de narcissisme sont élevés, moins l'effort investi dans la tâche sera grand. Cette relation est modérée par les sentiments d'auto-efficacité des participants. Ce modèle de modération postule donc que les efforts liés à la performance lors d'une tâche augmentent de consort avec les niveaux de narcissisme, à condition que le compétiteur se perçoive peu compétent à la tâche en question.

Mots-clé : Auto-efficacité ; Narcissisme ; Analyse du mouvement ; Modération ; Fléchettes

INTRODUCTION

Described as one's expectancy to deal with prospective situations (Bandura, 1977), self-efficacy is one of "the most extensively used [theories] for investigating self-confidence in motor and sport performance" (Feltz, 2007, p.279). Measures of self-efficacy can be found in research spanning across topics such as exercise behaviours (Papaioannou, Sagovits, Ampatzoglou, Kalogiannis & Skordala, 2011; Poag & McAuley, 1992; Welch, Hulley & Beauchamp, 2010), mental skills (Cumming, Nordin, Horton & Reynolds, 2006), leadership and coaching behaviours (Griffin, Parker & Mason, 2010; Jackson, Knapp & Beauchamp, 2009; Shipman & Mumford, 2011), risk-taking behaviours (Llewellyn, Sanchez, Asghar & Jones, 2008; Slanger & Rudestam, 1997), decision-making (Kane, Marks, Zaccaro & Blair, 1996; Vancouver, Thompson & Williams, 2001) and motivation (Bindarwish & Tenenbaum, 2006; Kuczka & Treasure, 2005). This construct is believed to be continuously influenced by an individual's experience of mastery, vicarious experience, verbal persuasion and arousal (Bandura, 1982), making it a highly dynamic aspect of the personal experience. Percepts of self-efficacy, in turn, have been argued to influence an individual's approach and coping mechanisms (Bandura, 1982) as well as one's goal-setting behaviours (Locke & Latham, 1990). Much debate, however, surrounds the use and interpretation of self-efficacy measures in research.

Indeed, in their meta-analysis, Moritz, Feltz, Fahrbach and Mack (2001) reported low overall correlation between self-efficacy scores and performance measures (r =.38). Feltz and Lirgg (2001) suggested that this lack of consistent results may be, in part, due to the lack of sensitivity of the instruments used. Furthermore, the authors impart a significant proportion of this relationship to concordance between self-efficacy measures and targeted performance. In line with this point of view, Bandura (2006) delineates some guidelines that researchers are suggested to follow when developing instruments to measure self-efficacy. These guidelines

aim to aid in the construction of more reliable self-efficacy questionnaires, underpinned by transparent rationales and methods.

Numerous performance-related outcomes may be predicted via the inclusion of self-efficacy ratings in research. For example, Feltz (2007) states that numerous performance outcomes may be predicted by self-efficacy. Such considerations may, in part, account for the lack of consistent correlations reported by Moritz *et al*. (2001). This in mind, the present research is an attempt to investigate a specific dimension of performance, namely motor performance, and how it relates to self-efficacy beliefs. The possibility of such concordance, termed the "*biomechanics problem*" (Stelmach, 1978) has long been questioned, but, to the best of our knowledge, is yet to be thoroughly assessed.

A first aim of the present paper was thus to investigate the potential concordance between self-efficacy and biomechanical performance data collected during the task.

A second approach to understanding the mechanisms underlying individual performance is the consideration of certain personality traits. Of particular interest, narcissism has been suggested to strongly influence the way individuals interact with task circumstances and hence how they approach task and performance situations (Wallace & Baumeister, 2002). As summarized by Campbell, Hoffman, Campbell and Marchisio (2011), narcissism is conceptually considered as a combination of intra- and interpersonal dynamics, both fuelling specific regulation strategies. Thus, on an intrapersonal level, narcissism relates to feelings of uniqueness and grandiosity (Bogart, Benotsch & Pavlovic, 2004; Stucke & Sporer, 2002), whilst simultaneously being marked by a fragile self-concept (Fukushima & Hosoe, 2011) and contingent self-esteem (Collins & Stukas, 2008). Further to this, "low levels of empathy and emotional intimacy" (Campbell *et al.*, 2011, p.269) characterise the interpersonal experience of narcissism. Taken together, these aspects of trait narcissism provide an explanatory

backdrop for the motives underlying narcissists' endeavours, or, in other words, their regulation strategies. Moreover, they provide an explanation for the circumstances under which a narcissist will inject effort into the task at hand. Recent research in sport has, for example, shown that narcissists tend to be more prone to social loafing when circumstances permit (Woodman, Roberts, Hardy, Callow & Rogers, 2011). In other words, narcissists appear swifter to identify the circumstances under which they may reap the greatest benefits, a phenomenon previously referred to as "perceived opportunity for glory" by Wallace and Baumeister (2002, p.819).

Further to this, Campbell, Goodie and Foster (2004) have related a strong positive relationship between narcissism and self-confidence, a relationship that appears to withstand failure and is thus not inherently dependent on performance. A three-part model may thus be best prescribed when attempting to understand performance-related behaviours. This in mind, it may be that narcissism also contributes to the lack of sturdy findings with regards to the relationship between self-efficacy and overall performance.

The second aim of the present study was therefore to test the relationship between narcissism and biomechanical performance during an individual task, thus contributing to a growing body of literature suggesting that normal trait narcissism may be a key determinant in individuals' approach behaviours.

Finally, the present authors aim to assess whether a three-way model (moderation or mediation) may account for relationship between trait narcissism, self-efficacy and motor performance. Indeed, past research has evidenced narcissists' myopic focus on potential rewards (Foster, Shenesey & Goff, 2009), as well as their vulnerability with regards to the online expectancy bias (Taylor, Bomyea & Amir, 2010). Such heuristic biases may take root in an ongoing dialog between narcissism and self-efficacy. It is thus suggested that including

these variables in one same model, alongside different dimensions of performance, may provide researchers with new options whilst attempting to prehend situation-specific task-related behaviours.

METHODS

Population

Ten subjects took part in the present research. All subjects were expert darts players. It may be noted that throughout this paper, the terms "expert darts player" will be used to refer to individuals who have practiced darts twice a week or more for at least two years. All subjects were male with an average age of 33.7 years (SD = 10.44).

Data Collection

Data collection took place during an international darts tournament, held once yearly, and spanning across one weekend. Participants were approached at the event and asked if they would spare 20 minutes to take part in a biomechanical study. The nature of the data collected, however, was dual, calling upon both self-report questionnaires and biomechanical motion analysis.

***Narcissism*.** The Narcissistic Personality Inventory (NPI; Raskin & Hall, 1979) was used to assess normal trait narcissism. The NPI assesses extraverted narcissism, termed overt, or grandiose (Miller *et al.*, 2011) which has been much the focus of recent narcissism-related research. Each item comprises of two choices (one narcissistic, one non-narcissistic) from which respondents are asked to choose that which best describes them. Notwithstanding the debate surrounding the inventory's latent structure (cfr. Ackerman *et al.*, 2010), a composite score was created for each respondent and deemed to reflect trait overt narcissism. The NPI was translated following the steps suggested by Vallerand (1989). Competing latent structures

were tested via confirmatory factor analysis using LISREL 8.80, resulting in 21 items being retained, closely matching the 2-factor latent structure suggest by Corry, Merritt, Mrug and Pamp (2008). For the purpose of the present investigation, however, a single-score was used, calculated by summing up participants' answers to each of the 21 items. Cronbach's alpha for the current study was .751.

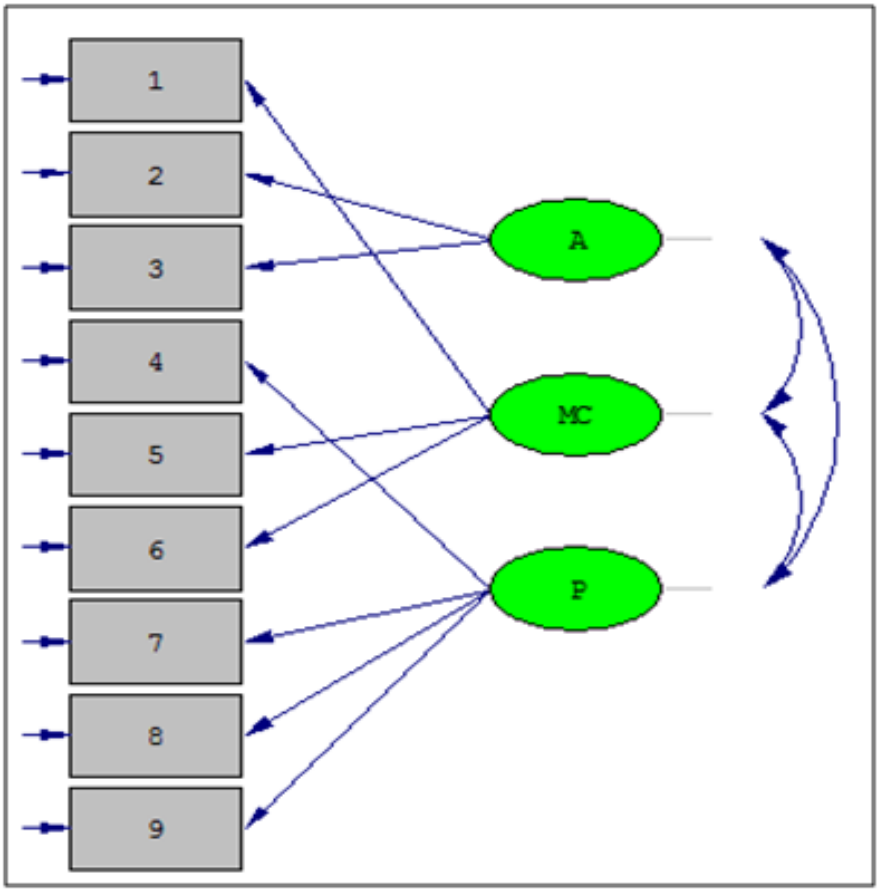
Self-Efficacy. A Darts Precision Self-Efficacy (DPSE) questionnaire was developed and validated according to Bandura's (2006) guidelines. For a self-efficacy scale to be theoretically sound, researchers must first consider the sub-skills which serve the higher-order skill that individuals' ratings apply to (Bandura, 2006). For the purpose of this study, the sub-scales, and the items that compose them, were identified and developed based on darts and precision sports research literature. Three aspects of a successful darts throw were hereby developed: (1) Attentional capabilities (A), (2) efferent Motor Control Capabilities (MC), and (3) afferent Performance capabilities (P).

Items were then submitted to an expert darts player, whose feedback allowed for them to be modified and refined when necessary. Nine items were retained following this first step. All items were formulated in terms of affirmed perceived capability (*"I can…*"). A 7-point Likert scale (ranging from 1 "*Completely disagree"* to 7 "*Completely agree*") was chosen for the response format, as it was deemed to allow for sufficient sensitivity and gradation of individuals' concurrence with each affirmation.

The 9-item scale was then pre-tested using 88 novice darts players (little or no experience). Using the subsequently collected data, the suggested factor structure was tested via confirmatory factor analysis (CFA). Analyses were conducted using LISREL 8.80 software which has been deemed acceptable when conducting CFAs on ordinal data (Allbright & Park, 2009). In the tested three-factor model, 2 items loaded onto factor "A", 3 items loaded onto

factor "MC", and 4 items loaded onto factor "P" (Figure 1). As the input data is ordinal, and that pre-analyses revealed that multivariate normality could not be assumed, ULS method of estimation was used for the present CFA. Analysis revealed all fit indices to be satisfactory by existing conventions: χ^2 corrected for non-normality (24, n = 88) = 25.16, p = .40, GFI = .99, NFI = .96, CFI = 1.00. Residual scores were equally satisfactory by existing conventions, with RMR = .045, RMSEA = .016, and all standardized residuals comprised between -3 and +3. Overall cronbach's alpha for the current study was .931, whilst those for the A, MC and P dimensions were .608, .800 and .922, respectively.

Figure 1: CFA pathway diagram for the self-efficacy inventory



The tested 3-factor model in which items 2 and 3 loaded onto factor "A" (perceived Attentional capabilities), items 1, 5 and 6 loaded onto factor "MC" (perceived Motor Control capabilities), and items 4, 7, 8 and 9 loaded onto factor "P" (perceived Performance capabilities).

Performance. Following a 5 minute warm-up, each subject was instructed to perform 30 dart throws at a dartboard positioned according to World Darts Federation rules. The horizontal distance between the front of the board and any part of the shoes was at least 2.37 m, and the centre of the board (the bull) was 1.73 m above the floor. Within these constraints, subjects were free to choose their posture when throwing. In contrast with normal dart practice, they were asked to repeatedly aim for the bull. The dart players performed the task with their own personal darts and no manipulation or instruction was given on how the task should be performed.

The performance ratings traditionally used in dart-related research (cfr. Cumming *et al*., 2006), namely using a scoring system based on the dart point-of-impact, was deemed inappropriate for the investigation of the present research questions, and more specifically the "*biomechanics problem*". Moreover, it has been suggested that introducing consistency scores derived from biomechanical data may be used to interpret the effort subjects' inject into the task at-hand (e.g. Lohse, Sherwood & Healy, 2010). Effort expenditure is considered to be a key component of performance-related behaviour (Kuczka & Treasure, 2005) and has already been studied in relation with self-efficacy (Feltz, 2007). Using a single score such as this thus allows for the quantification of the intra- and inter-personal performance.

To evaluate the consistency of the 30 throwing cycles, elbow flexion-extension and the velocity of the hand were measured. A 250e ten camera (Optitrack) motion capture system was used to record arm movements at a rate of 250 Hz (Natural Point Inc., OR, USA). Participants wore thirteen markers according to the following anatomic landmarks: 7th cervical vertebrae, 10th thoracic vertebrae, process xiphoid, notch where the clavicles meets the sternum, right and left acromio-clavicular joints, right upper arm, lateral and medial epicondyles of the right elbow, right forearm, right and left side of the wrist joint of the right wrist, and right hand. From the 3D position of the markers, the evolution of the arm joint

angles and joint center positions were obtained using Plug in Gait software (Vicon motion systems Inc., Oxford, UK) and Matlab (Mathworks Inc.). These angles are consistent with International Society of Biomechanics recommendations (Wu *et al.*, 2005) (humerus plane of elevation, humerus elevation, humerus axial rotation, elbow flexion-extension, forearm pronation-supination, wrist abduction-adduction and flexion-extension).

Previous research on novices has shown that throwing patterns do not depend on one parameter alone (Hore, Debicki, Gribble & Watts, 2011; Smeets, Frens & Brenner, 2001). The actual release of the dart cannot be measured technically when working with high performance athletes due to different grip techniques and tactile sense (Hore *et al.*, 2011; Smeets *et al*., 2001), a key factor for the athletes. Based on previous findings, we can consider that the release of the dart occurs just before the hand reaches its peak speed (Hore *et al*., 2011; Smeets *et al*., 2001).

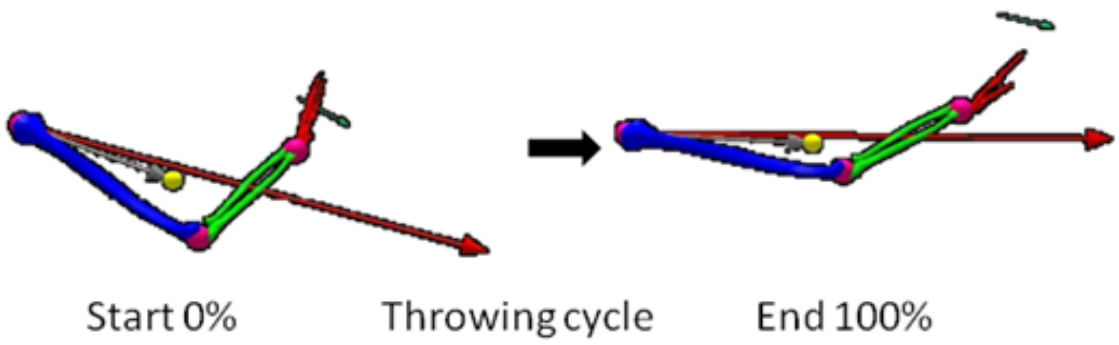
The consistency of the dart players was determined using the elbow flexion extension angle of each throwing cycle. Indeed, it has been suggested that during a throwing motion, when precision is required, the leading joint prior to object release is the elbow (Debicki, Watts, Gribble & Hore, 2010). Considering the above, one biomechanical parameter was finally used to compare the results of the theoretical self-efficacy test with actual movement.

Throwing cycle. The throwing cycle can be defined as a two-phased movement. The first part is the preparation phase, also known as aiming and backward movement. The following and more important phase in terms of consistency is the actual throwing movement, the second phase of the throwing cycle. This phase subsumes the acceleration, deceleration of the forearm including the follow-through until the elbow reaches its maximum flexion-extension angle. The beginning of a throw cycle was considered to be the moment at which

the player starts his throwing sequence. The end of the cycle was determined when the elbow joint extension angle reached its minimum value.

The data was normalized and represented in percentage. 0 equals the start of the throwing sequence whereas 100 represents the end of the throwing sequence. The datasets were normalized to allow the comparison between trials and subjects. Due the players' different throwing strategies, the second phase was normalised from the point of return, were the arm starts its forward movement until the minimum elbow flexion extension angle (Figure 2).

Figure 2: Throwing cycle



Stability Index. The mean elbow flexion extension angles were calculated and used for the comparison of the psychological and biomechanical dimensions. The index contained two variables to define the stability of a player. Each player's thirty throwing trials were normalised over time and divided in the first and second phase of the throwing cycle. To improve the analysis, the mean and the standard deviation of the throwing phases was calculated over time. This method is robust and allows the comparison between different subjects by looking at the steadiness of their movements based on a single index. As a result of different throwing techniques and styles, comparing biomechanical parameters like joint

angles can lead to misinterpretation. A high consistency of a players performance is given when the distribution of the standard deviation is least scattered, and vice versa (figure 3).

Figure 3: Comparison between two players of different skill-level

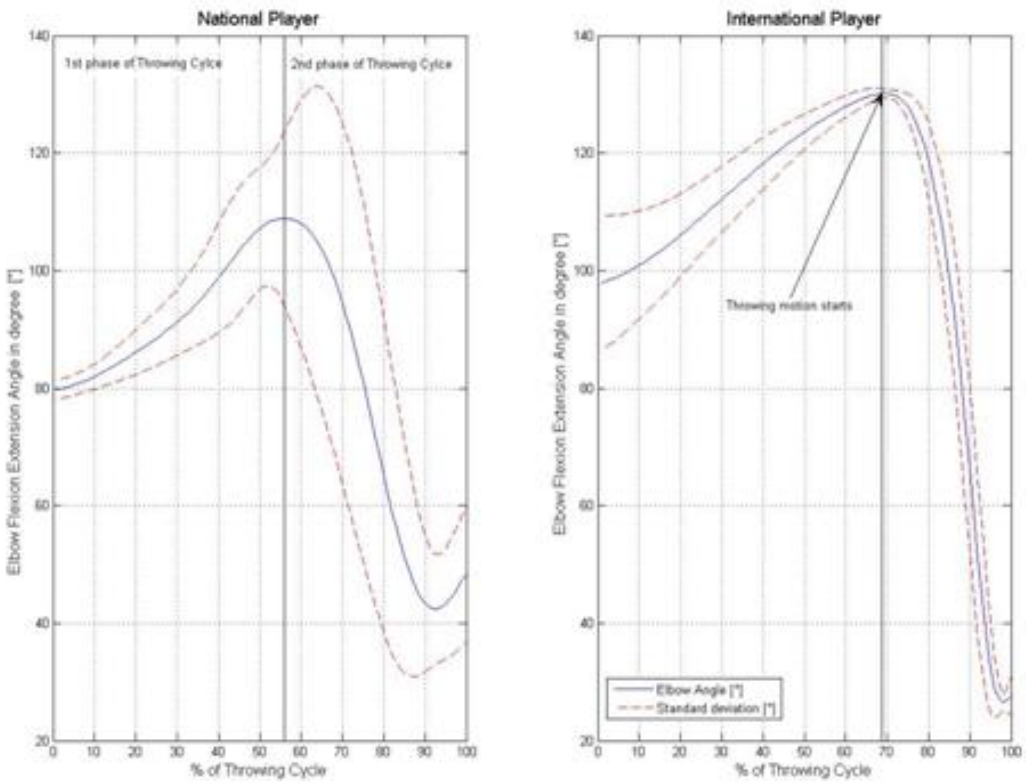


Figure 3 shows a comparison of a national level athlete (right) and a top international player (left). The consistency of the second phase of the throwing cycle is remarkably higher (right) compared to the second athlete whose standard deviation is higher and not as consistent.

RESULTS

Descriptive Statistics. Based on the collected data, the mean score for overall self-efficacy was 47.90 (SD = 7.923). A, MC and P self-efficacy factors had means of 10.90 (SD = 1.792), 15.70 (SD = 2.830) and 21.2 (SD = 3.967), respectively. The mean score computed from participants' answers on the NPI was of 4.90 (SD = 3.542). Finally, the distribution for the Sum of Elbow Angle Deviation (Σ[EA]) in the throwing phase was centered on 571.164 (SD = 356.047).

The correlation between self-report ratings and biomechanical data.

Based on sample size and due to the violation of parametric assumptions, Kendall's Tau correlation coefficients were computed for the present dataset, as displayed in Table 1. Of particular interest are the significant negative correlation between Σ[EA] and NPI, on the one hand, and the significant positive correlation between SE-MC and NPI, on the other hand. Furthermore, there were no correlations observed between self-efficacy scores and the biomechanical scores.

Table 1: Summary of non-parametric correlation coefficients.

	NPI	Σ[EA]	SE-P	SE-MC	SE-A
SEtot	.368	.090	.864**	.861**	.676**
SE-A	.513	-.072	.531*	.494	/
SE-MC	.518*	-.046	.861**	/	
SE-P	.322	.135	/		
Σ[EA]	-.523*	/			

Non-parametric correlation coefficients (Kendall's Tau) for Overall Self-Efficacy (SEtot) ; Attention Self-Efficacy (SE-A) ; Motor Control Self-Efficacy (SE-MC) ; Performance Self-Efficacy (SE-P) ; Sum of Elbow Angle Deviation (Σ[EA]) ; and Overt Narcissism (NPI).
*** indicates a significant correlation at p = .05**
****indicates a significant correlation at p = .01**

These results evidence the apparent null relationship between percepts of self-efficacy and biomechanical performance measurements in the present study, thus rejecting any potential concordance between constructs. Further to this, the pattern of correlations between NPI, Σ(EA) and SE-MC suggest that a moderation model may best explain this three-way relation. The lack of consistent results reported by Moritz *et al.* (2001) may thus indeed stem from the lack of inclusion of other explanatory variables such as personality traits.

The moderating effect of self-efficacy on the narcissism – performance relationship.

Testing the potential moderation of SE-MC on the relationship between NPI and Σ[EA] was performed following guidelines prescribed by Aiken and West (1991). In a first step, the

predictor variable (NPI) and suggested moderator (Σ[EA]) were both centered. Multiple regressions were then carried out, gradually partialling out the explanatory strength of both predictor and moderator alone, in order to, finally, observe the variance explained over and above these first regressions by a "moderator*predictor" interaction term. Further to this, given that the quality of regression analyses depends on the size of the sample utilized, Preacher and Hayes' (2008) bootstrap procedure was implemented throughout analyses to theoretically increase sample size to N=1000.

Table 2: Summary of hierarchical regression analyses

	Model	A	SE_A	β	*t*	*p*
STEP 1	NPI	-54.922	29.768	-.546	-1.845	.102
STEP 2	NPI	-48.279	37.857	-.480	-1.275	.243
	SE-MC	-15.092	47.372	-.120	-.319	.759
STEP 3	NPI	-91.619	28.190	-.911	-3.250	.017
	SE-MC	-107.757	42.301	-.857	-2.547	.044
	SE-MC*NPI	26.579	8.259	1.231	3.218	.018

Summary of the hierarchical regression analysis implemented to test the moderation effect of perceived effer motor control self-efficacy (SE-MC) on the relationship between overt narcissism (NPI) and actual biomechan performance (Σ[EA]).

Simple regression analyses reveal that whilst the amount of Σ[EA] variance explained by NPI (Step 1) is marginally significant (p=.102), that explained by SE-MC is not significantly different from zero (p=.273). Further to this, in the hierarchical regression model testing for the proportion of Σ[EA] variance explained by the NPI*SE-MC interaction (step 3) when the effects of NPI (step 1) and SE-MC (step 2) are controlled for, it appears that this proportion is significant (p = .018). Finally, whilst the R square change between steps 1 and 2 is negligible ($R^2{}_{change}$ = .01), the R square change between step 2 and step 3 is of .428. Thus, even though percepts of efferent motor control self-efficacy do not predict a significant portion of actual motor performance variance, they appear to strongly and significantly moderate the relationship between narcissism and performance. Results from the hierarchical regression analyses are compiled in table 2.

DISCUSSION

The aims of the present research were (1) to test the individual predictive strength of a purpose-built self-efficacy measure and trait narcissism on the biomechanically measured effort put into a dart-throwing performance by 10 expert dart players; and (2) to test the moderation effect of self-efficacy on the relation between trait narcissism and performance effort with a view to increasing the overall strength of the predictor variables. Results showed that whilst narcissism was negatively correlated with biomechanical effort, self-efficacy, uncorrelated with effort, significantly moderated this relationship. Moreover, the biggest effort was observed for individuals with high relative narcissism scores and low self-efficacy percepts.

Narcissism and self-efficacy. These results appear to provide an interesting new perspective with regards to previous research literature. Evidently, the present research does not plead in favour of self-efficacy as a significant predictor of effort, whereby casting further doubt on the consideration of self-efficacy alone in understanding the psychological determinants of performance. The lack of sturdy relations related by Moritz *et al.* (2001) may therefore be explained by the confounding, or even overpowering effect of more stable personality traits such as normal narcissism.

Normal narcissism is ever increasingly identified as a personality construct that appears to bend the rules and constraints of performance and objectivity. Indeed, amongst other behaviours, an increasing body of research links narcissism to risk-taking (e.g. Campbell *et al.*, 2004; Foster *et al*., 2009). Further to this, Wallace and Baumeister (2002) contend that, where low narcissists will be prone to choking, high narcissists will shine. Narcissists thus appear to be driven by a thirst for opportunism coupled with a fear of self-attributed and other-identifiable under-performance. The present results, for example, provide support for

such an observation. This may be explained by the fact that when percepts of self-efficacy are low, under-performance may be more easily attributed to the individual rather than the circumstances. Extra effort is thus injected into the performance in order to prevent forcefully coming to this conclusion. On the other hand, when percepts of self-efficacy are high, failure or sub-par performance may be controlled or dosed.

Motion analysis. Consistency is a key factor when it comes to playing darts successfully. Comparing the present consistency data with the consistency of a top ten player emphasizes the differences of the throwing patterns within the same task (figure 3). In light of previous research showing that different throwing strategies can be used to fulfil the same task (i.e. Todorov, 2002), the present approach sheds new light onto players' psychological and motor control strategies.

Bernstein's (1967) original hypothesis posits the elimination of redundant degrees of freedom to perform the task. If the central nervous system (CNS) does not eliminate the redundant degrees of freedom, it uses all of them to ensure flexible and stable performance of motor tasks (Scholz & Schöner, 1999).

Todorov and Jordan (2002) suggested that the CNS uses a minimal intervention principle in which noise or errors are not corrected if they do not influence the goal of the task, but are quickly corrected if they affect the task. Regulating noise can lead to new noise, in turn influencing the goal of the task, so the best solution may be to leave noise be. As a result, patterns of movement variability are not random, but show an organization which depends on the goal of the task (Scholz & Schöner, 1999).

Given Debicki *et al*'s (2010) findings that prior to object release the leading joint is the elbow, further hypothesized as a way of maximising precision, the elbow angle extension angle was chosen for analysis in the present study. Further observations and research may however be

conducted to compare multiple biomechanical factors with the psychological parameters of the sport to generalise the present findings.

Limitations. Although ambitious in its setup and conclusions, the present study presents several limitations. Firstly, the size of the sample used (n=10) prevents the generalisation of results. Preacher and Hayes' (2008) bootstrap method was used to palliate for this small sample size, but as this theoretical sample-resample technique depends on the distribution of the input data, it may be advisable to conduct future research with a larger sample.

This consideration is further supported with the distribution of the narcissism data in mind. Indeed, on the basis of the answers provided on the NPI, none of the subjects in the present study may be categorized as "high narcissists". Increasing sample size may thus also increase the heterogeneity of narcissism scores.

In a similar vein to the above, the use of samples comprising female competitors may equally contribute to the generalisability of the present findings.

Secondly, actual performance (i.e. how close to the bull participants' darts landed) was not taken into account in the present study. It may be advisable for future research to consider correlating the stability index derived from the elbow angle during the throwing phase with dart point-of-impact with a view to strengthening the suggestions and conclusions drawn above.

Finally, the question of whether the perception of control hereabove attributed to narcissism is realistic or illusory is not addressed in the present article, and may be the focus of future research in sport.

Future research directions. In our view, the present paper, although exploratory in its approach, provides both conceptual and empirical support for the inclusion of personality

traits in understanding the psychological determinants of sport performance. More specifically, it encourages future researchers to consider the effect of task framing (in both laboratory and natural settings) on subsequent individual performance. Without calling into doubt the observations which motivated Bandura (2006) to delineate clear rationales and methods for developing self-efficacy questionnaires, the present authors do, however, urge researchers to include personality variables which may impact the measured performance over and above self-efficacy.

Ultimately, the present authors contend that the present results draw their value from the ecological nature of this study. Indeed, given the levels of attainment required by both competition contexts and the athletes themselves, such an approach provides researchers with valuable insight into performers' personal experience, rendering the obtained data and results more applicable and evocative of competitors' natural setting.

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