Individual differences in athletes' perception of expressive body movements
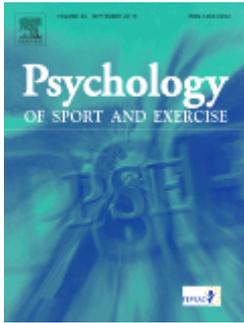
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Abstract

Objectives: Understanding others' actions depends on the observer's individual characteristics and sensorimotor experience. Motor performance domains, such as sports and the performing arts, provide optimal situations to investigate the determinants of action perception. We investigated athletes' perceptual identification of expression intensity in body movements. *Design:* A within-subjects design was used. *Method:* Participants watched point-light displays (1,000 ms long) depicting expressive and inexpressive dance movements. The task was to identify the dancer's intended expression intensity. *Results:* The results indicate that expressive body movements can be reliably identified, with judgement accuracy correlating with self-report empathy indices, intuitive/deliberate decision-making preferences, and indices of sports training. Only years of sports training could predict perceptual identification accuracy. *Conclusions:* We discuss the findings in relation to motor and cognitive–emotional contributions to action simulation. The potential of cross-domain transfer of motor expertise for boosting perceptual judgements and a hierarchical role of factors eliciting action simulation are also outlined.

Keywords: perception; action; expression; empathy; intuition

1. Introduction

In performance domains such as sports and the performing arts (e.g., music, dance), body movement is the prime means to achieve optimal outcomes: For instance, ensemble dancers must adjust their bodies to perform a movement routine efficiently but also to monitor their own and the other dancers' actions. These corporeal competencies depend on both sensorimotor skills and cognitive–emotional characteristics (for reviews, see Raab, Johnson, & Heekeren, 2009; Sevdalis & Keller, 2011a, 2014; Sevdalis & Raab, 2014). We focused on investigating the role such factors play in the assessment of point-light light displays of dancing performances by motorically trained individuals (i.e., athletes). Specifically, we were interested in how individual differences in sensorimotor experience as well as empathic and decision-making tendencies affect perceptual accuracy in discriminating between expressive and inexpressive body movements. Below, we first address the topics of action perception and individual differences in motor performance, and then provide a rationale for a synthesis of these topics and introduce an empirical study.

1.1 Action perception

Research across performance domains has shown that action perception is modulated by multiple factors. Accumulating evidence suggests that action observation encompasses a strong motor component (for a review, see Wilson & Knoblich, 2005). Previous experience, training, or familiarity with executing an action can be critical in the identification of observed movement features, such as action identity or accuracy: This was the case in experiments where individuals observed themselves acting (vs. observing the movements of another individual; Cañal-Bruland, Balch, & Niesert, 2015; Sevdalis & Keller, 2009, 2010, 2011b) or had incidental experience with executing the depicted action (Sevdalis & Keller, 2012). Furthermore, perceptual accuracy is boosted in cases of domain-specific, deliberately cultivated activities (e.g., when expert pianists recognize their own performances; Repp &

Knoblich, 2004) and motor-training-based evaluations (e.g., when expert officials with experience as former athletes judge athletes; Pizzera & Raab, 2012). These studies indicate that observers are sensitive to subtle movement characteristics as a function of their own (embodied) experience.

The human body in motion can be a major research tool for understanding affective dimensions of behaviour and bodily communication (de Gelder, 2009). A number of research articles has shown that communication of basic emotions (e.g., happiness, sadness, fear) is possible when experimental participants observe bodily motions depicted as point light displays: the actions depicted in these situations ranged from simple arm movements (Pollick, et al., 2001), to full body movements (Atkinson, et al., 2004), including interpersonal dialogue (Clarke, et al., 2005; Kaiser & Keller, 2011) and dance (Dittrich, et al., 1996). Experimental manipulations of expressive movements and sounds are also common in music and dance performance contexts: Musicians, conductors or dancers are asked to use different levels of expression while they perform and their recordings are subsequently judged by observers (Broughton & Stevens, 2009; Dahl & Friberg, 2007; Davidson, 1993; Sevdalis, 2011b; Wöllner 2012). More recently, researchers have been investigating individual differences in the perception of biological motion, in cases such as alexithymia (Lorey, et al., 2012), personality (Kaletsch, et al., 2014a), and depressive disorders (Kaletsch, et al., 2014b). Thus, the human body can be a communicative tool for providing information about an individual's affective states.

1.2 Individual differences

Researchers have begun to identify contributions to action perception that extend beyond the (sensori)motor to cognitive and affective aspects (Grafton, 2009; Keysers, 2011). Differences between individuals can occur at the level of behaviour patterns or tendencies. Such tendencies may be long established or spontaneously induced. Recent evidence suggests

that individuals' perceptual decisions when judging action parameters in performance contexts are modulated by empathic and decision-making tendencies (on empathy: Sevdalis & Raab, 2014; on decision making: Plessner, Betsch, & Betsch, 2008; see also Laborde, Dosseville, & Raab, 2013, for a general overview on emotion). Below we describe links between empathy and decision making when observing and/or performing actions.

Regarding empathy, research has shown that when jazz musicians were asked to identify whether recorded piano melodies were improvised or imitated, their judgement accuracy correlated positively with a self-report empathy subscale (i.e., perspective taking, Engel & Keller, 2011). When musically trained individuals were asked to observe recordings of performing ensemble musicians, individuals with higher empathy were more accurate in estimating the ensemble musicians' intended expression (Wöllner, 2012). Similar results were obtained when non-expert individuals observed dance performances depicted as point-light displays and were asked to identify the performers' intended expression intensity (expressive vs. inexpressive): Identification accuracy and empathic tendencies were positively related (Sevdalis & Keller, 2011b, 2012). Taken together, the above results suggest that empathic tendencies can contribute positively to identification of emotionally laden movements.

An additional boost to identifying emotionally laden movements can occur if an individual executes decisions in a particular mode. Skilled performance contexts are often characterized by complexity, time limitations, and stressful events. Optimal performance in such contexts is commonly associated with intuitive tendencies, for instance, a preference for making fast, heuristic-based decisions "from the gut" rather than following effortful, rule-based, and rational processes (for an overview see Plessner et al., 2008). For example, Raab and Laborde (2011) showed that players classified as intuitive decision makers made faster and better tactical choices in their game than players classified as deliberative decision makers. In this study intuition was also associated with expertise, with expert players relying

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more on intuitive decisions (Raab & Laborde, 2011). Yet deliberative decisions were more frequent than intuitive ones in a case study of an expert cello performance (Bangert, Fabian, Schubert, & Yeadon, 2014). In another study, facial emotional expressions such as anger, fear, and sadness were better identified when participants were given instructions to focus on each expression and deliberate on their response (as opposed to being quick; Tracy & Robins, 2008). These results suggest a complex relation between performance and intuition/deliberation tendencies, mostly dependent on expertise, situation, and task.

1.3 Rationale for synthesis

The above studies indicate that both motor and cognitive–emotional characteristics can affect performance when perceiving actions. Essentially, the recruitment of sensorimotor resources while observing actions is based on a common representational format between observed and executed actions. Individuals rely on their own sensorimotor experience when observing the properties of the actions (Herwig, Beisert, & Prinz, 2013; Prinz, 1990). For instance, while observing someone performing an action, observers can recruit some of their own sensorimotor resources as if they were performing the action themselves. This mapping of observed movements onto one's own sensory-motor system is known as *action simulation*. Action simulation prompts the investigation of the factors that evoke this simulation.

Long-term sensorimotor training has the potential to establish internal models of the body and the environment, the result of extensive experience with creating action–perception couplings (Herwig et al., 2013). Can this extended sensorimotor experience of cultivating perception–action links be useful out of the context in which it was initially established? Previous literature in the fields of motor learning and control has established the possibility of skill transfer across motor performance situations if some similarities between them exist, both in terms of movement components and cognitive processes involved (Magil & Anderson, 2014). For instance, recognizing patterns of play may transfer across team sports that process

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a similar structure of play (soccer, hockey, and volleyball, Smeeton, Ward, &Williams, 2004; basketball, netball, and hockey, Abernethy, Baker, & Côté, 2005). Furthermore, anticipatory skills when observing movements can transfer across domains (karate, taekwondo, and football, Rosalie & Müller, 2014). Music training skills have been also associated with enhancements in the recognition of emotions expressed by speech in expert musicians (Lima & Castro, 2011) and other auditory working memory and phonetic discrimination tasks in musically trained children (Rochette, Moussard, & Bigand, 2014). Therefore, evidence suggest that specialized training may be beneficial in a different domain than the one initially acquired (see also Sevdalis & Wöllner, 2016 for a theoretical overview).

This observation becomes particularly important if one considers the diversity in the developmental histories of individuals towards the development of expertise. In motor performance domains such as sports, music and dance, it is quite common for an individual to engage in multiple corporeal activities before focusing on a particular domain of deliberate practice: sport practitioners usually practice a number of sports and can also engage in dance; dancers can practice musical instruments. Before reaching expertise through deliberate practice, a variety of activities have been usually tried (Ericsson & Lehmann, 1996). Interestingly, recent research has highlighted the importance of individual differences in the development of skilled performance (Hambrick et al., 2014; Ruthsatz et al., 2008) and the need to investigate their contribution further beyond domain-specific experience (Hambrick & Meinz, 2011).

1.4 The present study

Sports and dance are prime areas where embodied processes (i.e., engagement of the physical body and bodily actions of an individual) are manifested, and provide ecologically valid contexts for investigating perception-action links. They share similarities both in the engagement of the body (e.g., gross motor skills) and cognitive processes (e.g., perception of

one's own and other's movements). Here, we recruited athletes to determine if sensorimotor experience acquired in a specific motor performance domain (i.e., sports practice) can be generalized to another motor performance domain (i.e., movements depicting dance), thus facilitating perceptual accuracy in discriminating between expressive and inexpressive dance movements. Both long-term expertise by formal training and incidental experience associated with an individual's everyday activities could also provide some perceptual benefit. Formal training refers to deliberate practice of sports by receiving education. Informal experience refers to everyday, incidental experience with sports. Research in sports and the performing arts often focuses only on expertise aspects and their benefits when observing actions (domain-specific expertise). This provides a limited view, since, apart from long-term expertise by formal training, incidental experience associated with an individual's everyday activities can also provide some perceptual benefit (cf. Sevdalis & Keller, 2012). Presumably, observers can make use of sensorimotor experience—irrespective of the domain in which it is acquired—by relying on generative processes of internal perception–action models, recruiting the observer's sensorimotor resources. We assessed the formal (i.e., deliberately cultivated by education) and informal experience (i.e., incidental engagement), which have been commonly associated with accurate discrimination in perceptual tasks (cf. Sevdalis & Keller, 2012), with a self-report questionnaire.

Besides sensorimotor experience, individual differences in cognitive–emotional (not strictly motoric) aspects of behaviour have been shown to influence action simulation (Grafton, 2009; Keysers, 2011). In theory, action simulation is an instantaneous process, engaging sensorimotor resources in a prompt, automatic-like manner. Certain individual characteristics that support this immediacy may be especially effective in eliciting the simulation process. Empathy may be a particularly potent means of embodying an individual's cognitive or affective states in situations that involve the trained human body in

motion (Sevdalis & Raab, 2014). Therefore, we re-examined the association between empathy, which has been thought to significantly boost perceptual judgements, and perceptual identification accuracy. Like empathy, intuition operates in a rapid fashion and is cultivated through prior knowledge, learning, and experience (Plessner et al., 2008). Thus, we also assessed athletes' preferences for intuition versus deliberation to determine if general tendencies in the way individuals generate decisions affect their perceptual judgements in an experimental context that requires prompt perceptual responses under conditions of limited information. Taken together, augmented sensorimotor experience, empathy, and intuition indices can be expected to be associated with higher perceptual accuracy, as they modulate (i.e., boost) the simulation process.

2. Method

2.1 Participants

Forty-six adults (23 females; aged 19–31 years; mean age: 23.6 years) participated in the study in return for financial compensation. They were university students who had a wide range of sports experience (mean weekly practice time: 10.3 hr, range: 4–25 hr; mean number of years practicing sports: 14.6 years; range 3–22 years). Participants engaged in a variety of sports concurrently, with the most frequently reported being football (19 individuals), tennis (15 individuals), track and field (15 individuals), swimming (14 individuals), and volleyball (12 individuals). They also participated in a variety of sports leagues, ranging from amateur and regional competitions up to the national leagues of their respective sports. Thirty-six participants had occasional dance experience (dancing on average 3.02 hr/week). Thirteen participants reported also having occasional music experience (playing music on average 2.09 hr/week). All participants reported having normal or corrected-to-normal vision. None had previous experience with point-light displays, and they were not informed about the experimental hypotheses. The treatment of the participants complied with the guidelines of

the local university where the research was conducted. Participants signed a consent form before the experiment began.

2.2 Design

We ran the experiment with a within-subject design. Participants rated point-light displays generated from motion capture recordings in a single session. The independent variable of interest was expression intensity (i.e., expressive vs. inexpressive movements of the dancers). Indices of self-reported empathy, decision-making profiles, and sports experience were included as additional measures. The dependent variable was accuracy in the task of discriminating between two expression intensities (expressive vs. inexpressive). We applied signal detection theory to compute the discriminability index (d') of expressive versus inexpressive displays (Macmillan & Creelman, 1991). The d' measure takes response bias into account by subtracting z-transformed false alarm rates ('expressive' for 'inexpressive' displays) from hit rates (correct 'expressive' responses). High d' scores indicate accurate performance (i.e., high identification accuracy of expression intensity).

2.3 Materials

Sevdalis and Keller (2011b) created a library of motion capture recordings of individual dancers in profile (left or right), using 13 markers located at the head and the main joints, based on Vicon's PlugIn gait marker placement model (see Fig. 1). In this study (Sevdalis & Keller, 2011b), the participants were invited to execute the dancing action with two intentions for expression intensity (expressive vs. inexpressive), in time with each of two musical pieces. In the expressive condition, participants were instructed to dance to the pieces as they would naturally. In the inexpressive condition, participants were instructed to dance with less expression than in the expressive condition. The dancers were non-experts with no extensive training in a particular dance style. They danced in a freestyle manner to funk music. From this library we chose the visual-only stimuli (i.e., without audio) of nine dancers

(432 stimulus movies, 48 per dancer), organized as three groups of selections (s1, s2, and s3) of eight expressive and eight inexpressive stimulus movies for each dancer. (Selections refer to portions of the entire original dancing performance; see Sevdalis & Keller (2011b) for details of the data collection and stimulus creation.) The frame rate for movie presentation was 24 frames per second.

To counterbalance the presentation of expression intensity, we used a Latin square design for the dancers and the selections. The first participant saw movies from Selection 1 (s1) of Dancer 1, Selection 2 (s2) of Dancer 2, Selection 3 (s3) of Dancer 3, s1 of Dancer 4, s2 of Dancer 5, s3 of Dancer 6, s1 of Dancer 7, s2 of Dancer 8, and s3 of Dancer 9. The second participant saw movies from s2 of Dancer 1, s3 of Dancer 2, s1 of Dancer 3, s2 of Dancer 4, s3 of Dancer 5, s1 of Dancer 6, s3 of Dancer 7, s2 of Dancer 8, and s1 of Dancer 9. This procedure was continued for each new participant and repeated from the beginning after every three participants. Each selection (s1, s2, and s3) contained 16 movies. Thus, each individual received 144 trials: 2 intensities (expressive, inexpressive) $\times$ 72 point-light movies (according to selection/dancer). The point-light movies were presented for a duration of 1,000 ms.

Please insert Fig.1 about here

2.4 Equipment and Procedure

Participants watched the movies on a computer monitor. The session started with the participants completing a block of four practice trials, two expressive and two inexpressive. Each of the four practice trials depicted a different dancer. Before each trial onset, a white fixation cross appeared at the centre of the monitor and lasted for 1,000 ms. The participant pressed the space bar to initiate the trial. The task for the participants was to indicate the dancer's expression intensity (expressive vs. inexpressive) as a two-alternative forced choice.

Responses were registered by mouse click on correspondingly labelled squares on the computer monitor (i.e., the left square was labelled inexpressive and the right square was labelled expressive). No feedback about correctness was provided after responses. At the end of the experiment, participants completed a background questionnaire about their sports experience[1] and two standard questionnaires commonly used for the assessment of individual differences in motor performance domains, such as sports and the performing arts (Plessner et al. 2008; Sevdalis & Raab, 2014): the Preference for Intuition and Deliberation (PID) questionnaire[2] (Betsch, 2004) for the assessment of decision-making profiles, and the Interpersonal Reactivity Index (IRI) questionnaire[3] (Davis, 1980) for the assessment of empathy disposition. The experimental session lasted about 60 min.

3. Results

All results reported were obtained by setting the significance level to .05, two-tailed, unless otherwise mentioned. Expression intensity identification was assessed by computing the d' of expressive versus inexpressive displays. Intensity identification accuracy was significantly better than chance ($d' = 0$), $t(45) = 46.36$, $p < .01$, with a mean $d' = 1.56$ ($SE = 0.03$). The raw score, when collapsed across both expression intensity levels, for correct

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[1] Examples of these questions: How many hours per week do you do sports? How many years have you trained in sports? Do you practice sports with other people? Two questions additionally assessed liking and perceived difficulty of the experiment. The answers were provided on a 5-point scale with anchors *not at all* and *very much*, except for those that required a response with a specific number of hours/years.

[2] The PID is an 18-item self-report questionnaire that measures affect- and cognition-based decision making. It contains two subscales, preference for intuition (PID-I) and preference for deliberation (PID-D). Answers are given on a 5-point scale (anchors: *I do not agree* and *I totally agree*).

[3] The IRI is a 28-item self-report measure that contains four subscales: empathic concern, the tendency to feel compassion toward others; perspective taking, the tendency to take the point of view of another person; fantasy, the tendency to relate to fictional characters; and personal distress, the tendency to feel negative emotion in stressful situations. Each question is answered using a 5-point scale (anchors: does not describe me at all-describes me very well).

identification performance (i.e., correctly identifying expressive and inexpressive) was

77.47% ($SE = 4.21$).

Correlation analyses were conducted to address relationships between questionnaire

data and identification performance (see Table 1). Regarding empathy, there was a significant

negative correlation between the score on the personal distress scale of the IRI and

identification accuracy (as assessed by d'): $r = -.26$, $p = .040$ (one-tailed).[4] That is, participants

who reported less personal distress were more accurate in their judgements. Separate

correlation analyses conducted with each of the three other individual scales of the IRI and

identification accuracy scores did not reach significance ($rs < .11$, n.s.).

Please insert Table 1. about here

We also performed correlation analyses to examine relations between PID scores and

accuracy of expression intensity judgements across participants.[5] These analyses revealed a

marginally significant negative correlation between the deliberation score and identification

accuracy: $r = -.24$, $p = .056$ (one-tailed). That is, identification accuracy was lower in

individuals with higher deliberation scores. Furthermore, deliberation and intuition scores

correlated negatively ($r = -.30$, $p = .024$; one-tailed). To explore if identification accuracy

differed between participants according to their decision-making profile, we used a median

split to classify our participants as (a) intuitive decision makers, (b) deliberative decision

makers, or (c) neither intuitive or deliberative—usually called 'situation dependent'. This

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[4] One participant was excluded from these analyses because the scores were greater than 3 times the standard deviation of the residuals (which were computed as the vertical distance of observed scores from the regression line).

[5] The same participant was excluded from these analyses because the scores were greater than 3 times the standard deviation of the residuals (which were computed as the vertical distance of observed scores from the regression line).

resulted in 10 individuals in the intuitive group, 14 in the deliberative group, and 21 in the situation-dependent group. A one-way analysis of variance among the three groups did not reach significance, $F(2, 42) = .44$, $p = .65$.

We then examined the relations between identification performance and questionnaire items assessing participants' sports experience. These data revealed that the number of years of sports training, the age of first sports engagement (i.e., the age participants became casually involved in sports), and the age at first receiving sports education (i.e., formally, by being taught) were associated with identification performance (respectively: $r = .37$, $p = .006$; $r = -.26$, $p = .044$; $r = -.42$, $p = .002$; one-tailed). Therefore, identification accuracy was higher in individuals with more years of training and with an earlier start of sports engagement and education. Overall, no correlation was observed between perceived difficulty and liking of the experiment and identification accuracy.

The questionnaire data were also related to each other. Interestingly, empathy and intuition indices correlated highly with each other. Intuition was correlated with the fantasy subscale ($r = .58$, $p < .001$), the empathic concern subscale ($r = .37$, $p = .013$), the average empathy score (sum of all four subscales; $r = .48$, $p = .001$), and the cognitive empathy score (sum of fantasy and perspective-taking subscales; $r = .60$, $p < .001$) of the IRI. Therefore, individuals who reported higher scores on the empathy subscales also reported being intuitive. The deliberation scale did not correlate with any of the empathy subscales. Regarding athletic experience and decision making, we found a significant correlation only between individuals with an earlier start of sports education and intuition ($r = .37$, $p = .011$). Individuals who started their sports education earlier reported being intuitive. Regarding empathy and athletic experience, we found a significant correlation only between years of training and the personal distress subscale ($r = -.33$, $p = .026$). Individuals with more years of training reported less personal distress.

To determine if any of the factors related to identification accuracy act as predictors of identification accuracy (d' score), we conducted a stepwise regression analysis (with N=45; the outlier participant was excluded), entering the scores on personal distress, intuition, deliberation, years of sports training, age at start of sport engagement, and age at start of sports education. The overall regression model was significant, $F(1,41) = 5.65$, $p = .022$, with $R^2 = .12$. Only the years of sports training score served as a valid predictor of identification accuracy, $Beta = .35$, $t = 2.38$, $p = .022$ (Fig. 2). Collinearity diagnostics did not show multicollinearity between the predictor variables.

Please insert Fig.2 about here

4. Discussion

In this study we investigated the role of individual differences (i.e., empathy, decision making, and experience) in athletes' identification of intended expression intensity in point-light displays depicting dance. The study showed that the intended expression intensity in these displays was reliably recognizable in the short duration of 1,000 ms. Furthermore, discriminating intensities was negatively correlated with scores on a self-report measure of empathy (i.e., personal distress), suggesting that aspects of empathizing with other individuals are associated with accuracy in the intensity identification task. Accuracy of judgements was negatively correlated with deliberation scores—although this correlation fell just short of significance—and we observed a negative correlation between intuition and deliberation tendencies. Finally, accuracy of judgements was positively associated with sports experience indices, such as years of training and age at starting to engage in sports activities formally and informally.

The current results dovetail with evidence from previous research on the links between action execution and action perception, as obtained in experiments employing observation of movements in the sports and performing arts domains (e.g., Sebanz & Shiffrar, 2009; Sevdalis & Keller, 2010, 2011b, 2012). The results show that accurate perceptual discrimination of an action's features (i.e., intended expression intensities) is attainable under severely impoverished conditions (i.e., under spatial and temporal constraints, as with the use of point-light displays and a stimulus duration of 1,000 ms). Previous studies that found rapid perceptual discrimination between expression intensity levels (i.e., expressive vs. inexpressive) were based on experimental designs that used domain-specific sensorimotor experience (e.g., amateur dancers observing dance or themselves dancing; Sevdalis & Keller 2011b, 2012). Here, we found that indices of sports training were associated with higher discrimination performance and only years of training could predict performance. Therefore, it is possible that training acquired in a specific motor performance domain (i.e., sports) can be of assistance when observing movements belonging to another motor performance domain (i.e., dance). Possibly, having trained one's motor skills for a considerable amount of time contributes to the engagement of sensorimotor resources when observing an action, allowing action simulation to occur. The validity of such eventual skill transfer could be investigated further by employing designs that include other combinations of domain-acquired expertise, both across and within domains (e.g., musicians observing athletes in sports conducted in synchrony with music such as rhythmic gymnastics, or expert athletes in a particular sport observing expert athletes from another sport). Since music, dance, and sports engage the human body in challenging tasks that require accuracy in performance (e.g., fine and gross motor skills, coordination with others), it would be interesting to uncover capacities that are relevant in more than one domain. Such investigations could be beneficial for educational purposes (e.g., training in diverse skills) and for meeting demands across development (e.g.,

maintaining skills in aging). Another idea for future research would be to compare between participants with specialization in different types of sports, such as individual vs. team sports, or sports that require extremely fast decision-making vs. slower-pace ones.

Also of note in this study is that perceptual identification accuracy was related to empathy indices and decision-making preferences. Regarding empathy, the current results confirm the role of characteristics captured by empathy indices in modulating action perception in the performing arts domain (cf. Sevdalis & Keller, 2011b, 2012; Wöllner, 2012) and demonstrates their effects in a sample of athletes. To our knowledge this is the first empirical evidence for such modulation in the sports domain: Although empathic tendencies have been commonly associated with prosocial behaviour in sports contexts (e.g., diminished aggression, better communication between interacting partners), their contribution to athletes' action perception has not been investigated (for a review, see Sevdalis & Raab, 2014). Possibly, the lack of personal distress in athletes occurs because of the competitive nature of their acquired sensorimotor experience: The athletes in our sample mostly practiced their sports in competitive contexts. Such experience may eventually prevent or even protect athletes from feeling anxiety and unease in tense interpersonal settings (hence the low reported personal distress scores).

Additionally, action perception may be modulated by variations in decision-making profiles, with intuition tending to be positively related and deliberation negatively related to discrimination accuracy. The current results are in agreement with those of Raab and Laborde (2011), who showed better and faster performance for intuitive individuals in a sports decision-making context. Although deliberation can be of assistance when individuals' actions or thoughts extend over time (Bangert et al., 2014; Tracy & Robins, 2008), the previous and current findings suggest that in tasks where a limited amount of information or time is available, intuitive decision makers can prevail. Making decisions promptly and

efficiently is a requirement in many of the sports that our participants were practicing. A lack of preference for deliberation in our study may have functioned as a facilitator in the task of expression intensity identification, possibly by contributing to the instantaneous simulation of the observed actions.

Finally, our analyses showed that cognitive and emotional individual differences were related to each other. Nonetheless, only a motor-related variable (i.e., years of training) was a valid predictor of performance in the judgement task. It may be that action simulation was triggered mostly by motor-related information and benefited only secondarily from cognitive–emotional characteristics. However, the current results suggest that to identify expression intensity participants relied on a simulation process that comprised complementary motor and cognitive–emotional components. Future research could explore the hierarchy of these contributions to action simulation. It remains to be established whether these complementary contributions are strictly specialized in nature (i.e., limited to a particular domain-specific acquired sensorimotor experience) or whether any domain-general transfer effects can be traced (i.e., sensorimotor experience in one domain can be beneficial in another). Examining these diverse levels of analysis and encouraging discussion among researchers in applied motor performance domains may broaden the understanding of perception–action links by providing insights not found by domain-specific approaches.

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Figures
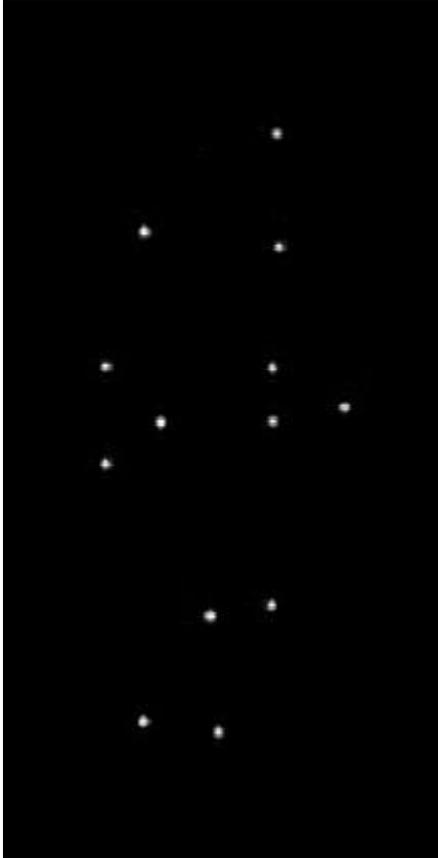
Fig. 1. Point-light depiction of a dancer with 13 markers attached at the head and the main joints of the body.
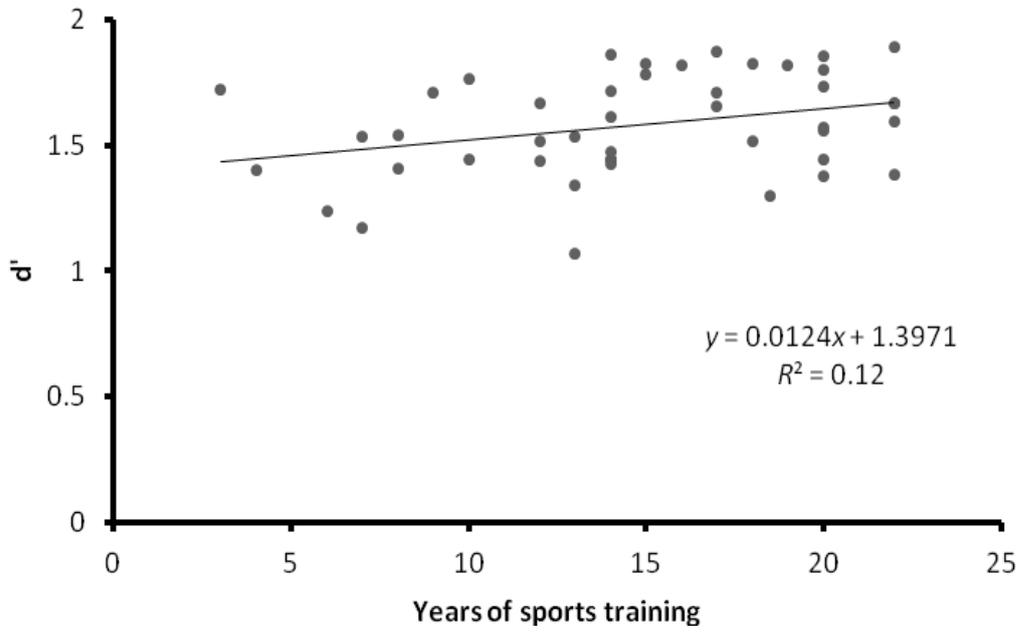
Fig. 2. Regression line between d prime scores and their significant predictor, years of sports training. Higher d prime scores indicate more accurate performance and $d' = 0$ score indicates performance at chance.

Individual differences measures	Correlation with identification performance (d' score)
Perspective taking[1]	$r = .11$, $p = .25$
Fantasy[1]	$r = -.03$, $p = .43$
Empathic concern[1]	$r = .07$, $p = .33$
Personal distress[1]	$r = -.26$, $p = .04$
Intuition[2]	$r = .15$, $p = .15$
Deliberation[2]	$r = -.24$, $p = .056$
Number of years of sports training[3]	$r = .37$, $p = .006$
Age of first sports engagement[3]	$r = -.27$, $p = .04$
Age at first receiving sports education[3]	$r = -.42$, $p = .002$

Table 1. Correlations between individual differences measures and expression intensity identification performance (d' score). 1: Scales of the Interpersonal Reactivity Index; 2: Scales of the Preference for Intuition and Deliberation questionnaire; 3: Items in the sports experience questionnaire.