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Short Communication

Men's physical strength is associated with women's perceptions of their dancing ability

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ABSTRACT

Prenatal and/or pubertal testosterone (T) directly influences male physical characteristics and behaviors that facilitate the achievement and maintenance of status and resources. In numerous animal species there is evidence that females have evolved preferences for signals of a male's status as such signals may indicate male quality (in terms of health and reproductive success). In humans, it is known that women judge sex-typical (T-linked) physical characteristics of the face and body of men higher on attractiveness, masculinity, and dominance. Moreover, recent research indicates that women are also able to evaluate certain male facial characteristics that signal physical strength. Here we show that women's perception of the attractiveness and assertiveness of men's dancing, correlates with male handgrip strength (as a measure of muscular strength) after controlling for body weight. We conclude that men's dances – in addition to faces and bodies – may be another proxy for male competitiveness, and could thus be used by women to evaluate male quality.

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1. Introduction

Evolutionary psychologists suggest that certain morphological features provide information about an individual's mate quality and are thus relevant in mate choice. However, research on human physical attractiveness has almost exclusively considered visual perception of static representations (i.e. photographs or silhouettes) of faces and bodies, yet little is known about the significance of dynamic display in this context. A number of ethnographic reports give rise to the assertion that body movement (such as dance) is an important aspect of courtship in diverse human cultures (Hanna, 1987; Kaepler, 1978), but there have been only few attempts to empirically investigate its signalling quality in the context of sexual selection. Preliminary results reveal that humans are indeed sensitive to certain movements and rate them higher on attractiveness than others (e.g. Brown et al., 2005; Grammer, Keki, Striebel, Atzmüller, & Fink, 2003; Provost, Troje, & Quinsey, 2008). These studies were based on the assumption that if body movement is a sexually selected display, then it should reflect the genetic or phenotypic quality of the individual.

There is evidence that fluctuating asymmetry (FA; as a measure of developmental stability) correlates with human running performance (Manning & Pickup, 1998). Moreover, Brown et al. (2005) reported a strong positive association between FA and the percep-

tion of dancing ability, which was stronger in men than in women. However, these authors also noted that it is unclear what mediates the association between symmetry and the perception of dance quality. One candidate for such a moderator could be sex hormones, such as testosterone (T). For example, there is a body of evidence for dose-dependent effects of T on athletic abilities and strength, arising from studies on illegal performance enhancement through the use of androgenic-anabolic steroids (e.g. Di Luigi, Romanelli, & Lenzi, 2005). Plasma T improves muscle volume, leading to an increase of muscular strength, which facilitates explosive performance (Cardinale & Stone, 2006). In addition to the effects of circulating T, it was also found that digit ratio (2D:4D, a supposed correlate of prenatal T) is related to physical fitness and athletic abilities (Hönekopp, Manning, & Müller, 2006; Manning, 2002), including skiing (Manning, 2002), sprinting speed in boys (Manning & Hill, 2009), physical strength (Fink, Thanzami, Seydel, & Manning, 2006), and men's dancing ability (Fink, Neave, & Seydel, 2007a). Taken together, the physiological effect of circulating and prenatal T on athletic abilities and performance seems to be well supported.

Evolutionary psychologists speculate that women in particular may have developed cognitive adaptations to visually assess physical fitness, athletic abilities, and thus competitiveness, in men. Being able to select high quality males (i.e. those who succeed in male competition) on the basis of visual cues must have promoted certain females via the actions of sexual selection, and eventually increased their reproductive success. There is accumulating

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evidence that women prefer masculinised male faces as they may consider prenatal and/or pubertal T markers to be an 'honest' indication of good health (Neave, Laing, Fink, & Manning, 2003; Penton-Voak & Chen, 2004; Swaddle & Reirson, 2002). However, such preferences may also indicate potential success in intra-male dominance encounters and thereby a male's potential to achieve and maintain high status. Fink, Seydel, Manning, and Kappeler (2007b) reported that faces of physically stronger men (those with higher handgrip strength) were perceived as being more dominant, masculine, and attractive by women. Recent support for such a link comes from Sell et al. (2008) who showed that men and women were able to accurately estimate the physical strength of male and female targets from photos of their bodies and faces. These authors suggest that humans have cognitive abilities to assess 'formidability' (i.e. fighting ability and resource-holding potential) and strength from facial and bodily stimuli alone.

In the present study we investigated whether male physical strength is also signalled via their dancing performance. Physical strength shows a strong and robust sex difference in humans such that men are usually stronger than women (Miller, MacDougall, Tarnopolsky, & Sale, 1993; Musselman & Brouwer, 2005). It is known that T plays a major role of this sex difference, since studies have reported a positive correlation between adult T as well as prenatal T and strength (Fink et al., 2006; Hansen, Bangsbo, Twisk, & Klausen, 1999). Handgrip strength (as a measure of muscular strength) is associated with muscular functioning in other muscle groups, with activities in daily life, is relatively heritable, and considered to be a suitable phenotype reflecting physical functioning (e.g. Frederiksen et al., 2002). Furthermore, recent research showed that it is indicative of sexual behavior, certain measures of body morphology, and aggression in male (but not female) college students (Gallup, White, & Gallup, 2007). In this study we hypothesized that if body movement is indicative of male competitiveness, women's perceptions of men's dances should be positively associated with measures of male handgrip strength.

2. Materials and methods

2.1. Participants

Our sample was 40 male dancers (mean age 23.35 ± 3.45 years), recruited from the student population of Göttingen, Germany. As there are strong associations between strength and body mass, and body mass is itself dependent upon ethnic groupings (Deurenberg, Yap, & van Staveren, 1998) we only recruited Caucasian participants. All were non-professional dancers and claimed to be heterosexual and right-handed. Informed written consent of participants was obtained in advance of the data collection.

2.2. Data recording

Handgrip strength was measured in kilograms force (kgf), using a handheld dynamometer (Jamar dynamometer). Participants were requested to perform a maximum force trial for each hand separately. Following the protocol of Fink et al. (2007b) we used the arithmetical mean of right- and left-hand measures for the subsequent statistical analysis. In addition, participants' age (years), body weight (kg), body height (cm), as these variables were considered potential correlates of handgrip strength.

Participants were asked to wear a white overall so that potential variation in clothing was experimentally controlled, and then short digital video clips (30s) of their dances were taken by a digital video camera (Sony DCR-PC 350E, Sony Corporation). Two halogen studio lights (Hedler GmbH, Germany) provided consistent lighting, and grey cardboard was fixed on the wall behind the participant to guarantee a uniform colour background. Each partici-

pant danced alone to the same song, from which only the core rhythm (drums) was presented, so that music likeability could not affect dancing expressiveness. The recorded video clips were converted to grey-scale Macintosh QuickTime movies by using Adobe Premiere (Adobe Systems Inc., San Jose, USA) and a Gaussian blurring filter was applied in order to cover information about the respective participant's body shape with the same software. This procedure degrades individual information about body shape by singling out movement as the targeted variable just by the changes in lightning and grey-values in the videos.

2.3. Dance ratings

A sample of 50 female raters, all college students from a local University, participated in the dance ratings. Out of this sample, one half of the participants (mean age 22.88 ± 3.11 years) rated 10 s from the middle of each video clip (seconds 10–20) on a computer screen for perceived attractiveness, and the other half of the participants (mean age 23.79 ± 4.17 years) rated each video clip for perceived assertiveness. The ratings were made using a seven-point Likert-type scale (1 = low and 7 = high on the attribute). The video clips were presented without audio, and in randomized order using Medialab presentation software (Empirisoft Inc., New York, USA).

3. Results

A one-sample K-S-test indicated that physical measures and dance ratings were normally distributed (all Z 's < 1.30 , all p values > 0.05). There was high consistency of women's judgements of men's dances on both attractiveness and assertiveness (Cronbach's alpha = 0.97 for both attributes).

3.1. Descriptive statistics

Body height of the male dancers ranged from 160 to 190 cm (mean: 178.1 ± 5.87), body weight from 57.4 to 115.8 kg (mean: 74.8 ± 12.88), and handgrip strength from 34 to 63 kgf (mean: 50.65 ± 8.26). The means of attractiveness ratings ranged from 1.52 to 4.56 (mean: 3.03 ± 0.79) and mean assertiveness scores from 1.75 to 5.11 (mean: 3.45 ± 0.98).

3.2. Correlations

A significant positive correlation (Pearson r) was found between handgrip strength and body weight ($r = 0.317$, $p < 0.05$). There were no significant correlations between handgrip strength and the other physical measures (age: $r = 0.003$, $p = 0.987$; body height: $r = 0.011$, $p = 0.947$). Perceived attractiveness was highly correlated with assertiveness ($r = 0.717$, $p < 0.01$). Because of the significant correlation of handgrip strength with body weight, we used partial correlations (r_p) to assess associations between handgrip strength and perceived attributes controlling for body weight. The correlations of perceived attractiveness and assertiveness of dances with handgrip strength were positive and significant (attractiveness: $r_p = 0.352$, $p < 0.05$; assertiveness: $r_p = 0.309$, $p < 0.05$) (Fig. 1). These associations between strength and attractiveness and assertiveness are independent of weight. However, to confirm this we regressed strength on weight and considered the relationships between the residuals and attractiveness and assertiveness. We obtained essentially the same results.

4. Discussion

Our data support the hypothesis that male physical strength is not only signalled via static representations (e.g. photographs) of

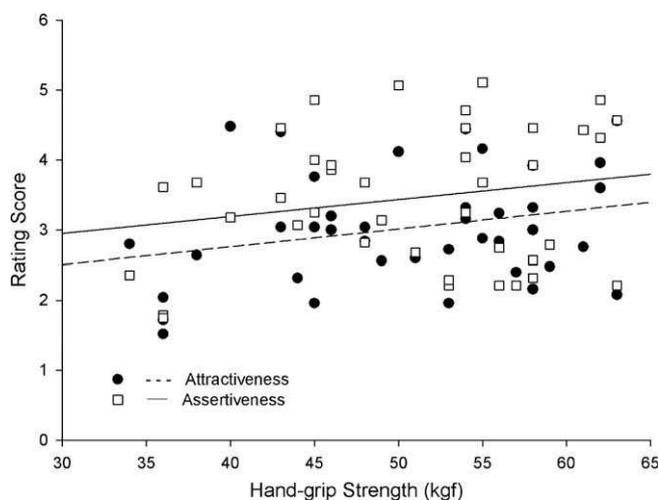


Fig. 1. Scatterplots with regression lines showing the associations between handgrip strength and women's perceptions of attractiveness and assertiveness of men's dances.

facial and bodily morphology (Fink et al., 2007b; Sell et al., 2008) but also via dynamic display such as dance. Women perceived dances of men who were physically stronger (i.e. those with higher hand-grip strength) as more attractive and assertive. These findings support recent research suggesting that women have evolved cognitive adaptations for the visual assessment of strength and fighting ability from male faces, bodies, and dances.

The association of physical strength with dancing ability could be moderated by an effect of T on both dancing ability (Fink et al., 2007a) and physical strength (Fink et al., 2006). Testosterone production and metabolism mobilizes resources for the efforts of males to attract and compete for mates (Ellison, 2001). Several studies have reported links between T and human dominance encounters (e.g. Booth, Shelley, Mazur, Tharp, & Kittok, 1989; Neave & Wolfson, 2003) and there is also some support for the suggestion of an association between prenatal effects of T and male competition (Manning & Taylor, 2001). Dance is a complex form of exercise with various demands on the body, including physiological efforts and neuromuscular coordination, all of which is difficult to integrate and perform attractively. Because of this complexity, Brown et al. (2005) speculated that preferences for certain dances could have evolved as a mechanism to visually assess an individual's mate quality. Our data suggest that physical strength could be another moderator of the variance in men's dance movements and women's perception of them. Studies have shown that as in most sports, dance fitness depends on the ability to develop high levels of muscle tension, i.e. muscle strength (Fitt, 1982; Koutedakis & Sharp, 1999) and that muscular strength together with agility, balance and flexibility are positively associated with dance performance (Bushey, 1966).

Given that T seems to play a central role in the organization of physical performance and muscle strength in men, we argue that women may have evolved visual preferences to the assessment of certain face and body morphology, but also dances in men, as these features may facilitate sexual selection of competitive, high quality mates. While we used a 'core' rhythm and thus were able to control for music likeability, it is possible that rhythm likeability/interpretation could be an important variable to consider in future studies. Dancing is highly dependent upon musical likeability and interpretation, and as music ability has been linked to prenatal T (e.g. Sluming & Manning, 2000) it is clear that such factors may influence both the expression of a dance movement and the perception of it.

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