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Women's visual attention to variation in men's dance quality

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ABSTRACT

Recent research shows that 'good' male dancers display larger and more variable movements of their head, neck and trunk, and differ in certain personality characteristics from 'bad' dancers. Here we elaborate on these findings by testing the hypothesis that 'good' male dancers will also receive higher visual attention and will be judged as being more attractive by women. The eye-gaze of 46 women aged 19–33 years was tracked whilst they viewed pairs of video clips of male dancers in the form of avatars created using motion capture, each pair showing one 'good' and one 'bad' dancer together on the screen. In a subsequent rating task, women judged each dance avatar on perceived attractiveness and masculinity. Our data show that women viewed 'good' dancers significantly longer and more often than 'bad' dancers. In addition, visual attention was positively correlated with perceived attractiveness and masculinity, though the latter association failed to reach statistical significance. We conclude that (i) 'good' male dancers receive higher visual attention from women as compared to 'bad' dancers, and (ii) 'good' dancers are being judged as more attractive. This suggests that in following mating-related motives, women are selectively processing male dynamic displays, such as dance movements.

1. Introduction

It is known that the morphology of both the human face and body affects people's perception of others, and that this perception has consequences for social attribution (Gangestad & Scheyd, 2005; Rhodes, 2006). Evolutionary psychologists argue that the human sensitivity towards variation in facial and body morphology is neither arbitrarily nor culturally bound, but reflects evolved cognitive mechanisms, which eventually facilitate mate selection and reproductive success (Grammer, Fink, Møller, & Thornhill, 2003; Little, Jones, & DeBruine, 2011). Following this logic, it is argued that attractiveness decisions characterize people's preference for an individual's facial and/or body morphology, which conveys aspects of partner 'quality'. This quality includes physical and personality characteristics, both of which affect the way we perceive the attractiveness of others (Buss, 1994). While the evidence in support of the evolutionary psychology perspective on human social perception seems to be strong, the majority of studies investigating the relationships between certain physical features and attractiveness have concentrated on static representations of faces and bodies. Thus, there has been criticism with regard to the inherent lack of ecological validity of studies that utilize photographs of faces/bodies, as they do not account for the possible effect of motion and behavioural cues (Rubenstein, 2005). There is indeed evidence that attractiveness judgements depend on the type of stimulus used (Langlois et al., 2000) and that attractiveness perception is viewpoint-dependent (e.g., Doyle, 2009; ÓToole, Edelman, & Bülthoff, 1998).

Evolutionary psychology researchers have, therefore, begun to investigate the perception of body movements, and link these to objectively assessed anthropometric and biomechanical measures, and (self-reported) personality characteristics. Human dance movements have been primarily studied, possibly because dance is one of the most complex forms of movement, and because it arises in almost all human societies within a mating/courtship context (Hugill, Fink, & Neave, 2010). Hanna (1987) argues that dance may be an adaptive behavioural pattern in sexual selection, as it is a medium, which displays beauty, health, strength and thus sexual attractiveness. Recent research supports this assertion, as there is evidence that dance movements, particularly those of men, were found to correlate with body symmetry (Brown et al., 2005; but see for a re-analysis Trivers, Palestis, & Zaatari, 2009), a measure of developmental stability and health, and physical strength (Hugill, Fink, Neave, & Seydel, 2009), such that high symmetric and physically strong dancers were judged as attractive by women. In addition to these anthropometric correlates, it was reported that dance quality was also associated with certain personality characteristics, such as sensation seeking propensity (Hugill, Fink, Neave, Besson, & Bunse, 2011), and global personality descriptors (i.e., the 'big-five' of personality; Fink et al., 2012). There is thus accumulating evidence that male dance movements convey aspects of both

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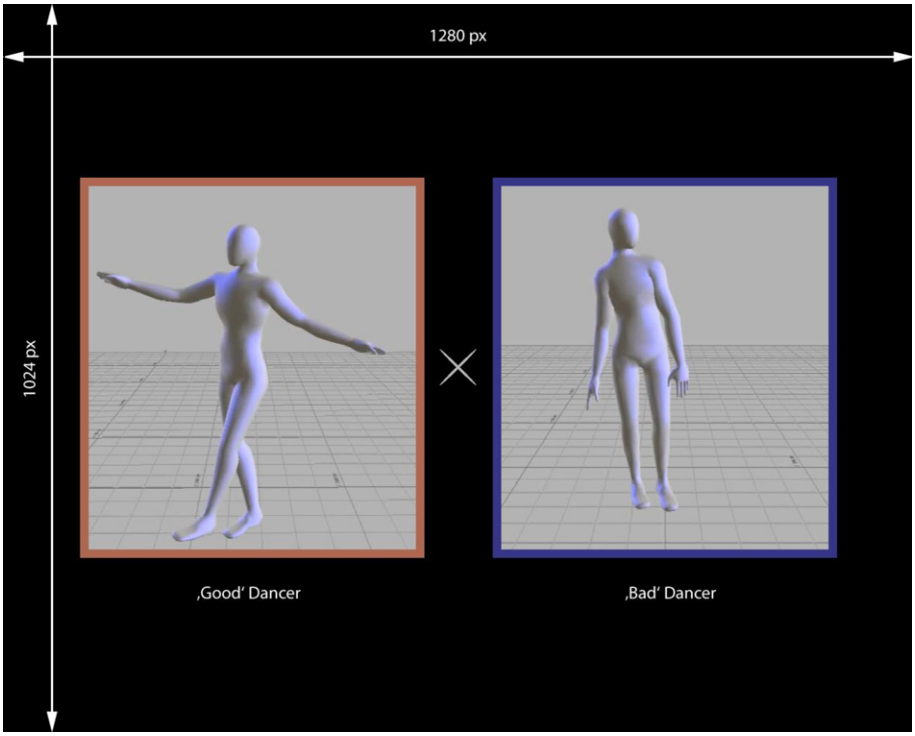

Fig. 1. Screen-capture of a scene showing two virtual characters (dance avatars), one from the 'good' and one from the 'bad' dancers group, as presented in the eye-tracking experiment. The rectangles around the characters depict the areas-of interest, which were defined for all 'good/bad' dancer combinations presented. A blank image with a fixation cross (as shown) preceded the presentation of each scene.

physical and personality 'qualities', and that women are sensitive to these cues in terms of attractiveness decisions. If this were true, it would certainly be of interest what exactly characterises a 'good' male dancer, i.e., which types of movements are associated with women's attractiveness judgements.

In an attempt to address this question, Neave et al. (2011) used three-dimensional motion-capture technology to identify possible biomechanical differences between women's perceptions of 'good' and 'bad' male dancers. The dance movements of men were recorded whilst dancing to a basic drum beat rhythm, and women rated video clips of shape-standardized virtual characters (avatars) for dance quality ('good' vs. 'bad' dancer). It was found that 'good' dancers displayed larger and more variable movements in relation to bending and twisting movements of their head/neck and torso, and faster bending and twisting movements of their right knee. Given that comparative biological studies have suggested that females prefer vigorous and skilled males, Neave et al. concluded that women derive information on physical condition, in terms of health, fitness and genetic quality, from men's dancing abilities.

In the present study we expand the Neave et al. finding by testing whether women are also visually selective to men's dance quality, thus introducing more ecological validity to the question of whether certain male dance moves attract more visual attention and are judged more positively than others. It is known that people spend higher visual attention to stimuli they consider attractive and that this also applies to aspects that are relevant in human mate preferences (Dixson, Grimshaw, Linklater, & Dixson, 2011; Fink et al., 2008; Lykins, Meana, & Kambe, 2006; Maner et al., 2003; Rupp & Wallen, 2007, 2009). If this would apply also to the perception of human body movement, 'good' dancers should receive higher visual attention and be judged higher on attractiveness and masculinity than 'bad' dancers, as previous studies reported positive association of women's attractiveness and assertiveness perception of men's dances with male physical strength (Hugill et al., 2009).

2. Methods

2.1. Participants

Our initial sample comprised 50 women, aged 19–33 years (M = 23.90, SD = 3.21), mainly undergraduate and graduate students, who were recruited at the local university campus. All participants reported to have good visual acuity. Some had contact lenses, but no one wore glasses. They were instructed to complete two tasks with the same stimulus material, i.e., (i) an eye tracking experiment, and (ii) a rating study. After the completion of both tasks, participants were fully debriefed, and each participant received a payment of 10 €.

2.2. Stimuli

The stimuli were obtained from the sample described in Fink et al. (2012). These authors collected dance recordings of 48 heterosexual men, all non-professional dancers, whose movements were captured using 3D-optical motion capture technology (Vicon, Oxford, UK), and applied them to a gender-neutral, featureless humanoid character (avatar) (see also Neave et al., 2011). Dance avatars were rated by 53 women for perceived dance quality on a 7-point Likert-type rating scale (1 = extremely bad dancer to 7 = extremely good dancer). Of this sample, we selected the five dancers that were judged highest and the five that were judged lowest on perceived dance quality ('best': M = 4.50, SD = .20; 'worst': M = 1.90, SD = .10; $t_{(8)}$ = 26.31, p < .001). The length of the original clips was trimmed to 10 s and scaled to 573 × 632 pixels such that a video pair would fit onto a 19″ computer screen. For the eye-tracking task, one set of video files was created, comprising 25 video pairs, each pair showing one video of the 'good' and one of the 'bad' dancers group, counterbalanced with regard to the side of presentation

(left/right) (Set 1; see Fig. 1). In a second set we used the same experimental setup, but this time the side of presentation of 'good' and 'bad' dancers was exactly the opposite of the first set (Set 2).

2.3. Apparatus

The visual stimuli were displayed at a resolution of 1280 × 1024 pixels on a 19″ colour-calibrated TFT screen (Iiyama ProLite E 4815, Iiyama Corp. Ltd., Nagano, Japan) at a fixed distance of 61.5 cm from the eye-tracking stand. Participants' visual attention to the video clips compositions presented were measured using the iView X High Speed system (SensoMotoric Instruments, Teltow, Germany), a stand-alone, pupil-CR video-based system that recorded the eye movement. The eye-tracking system combines a high-resolution camera and infrared lighting in a column as well as an ergonomic chin rest for a stable head position during recording and a large visual field that allows unhindered sight. Eye positions were sampled at 250 Hz, allowing tracking with a resolution <0.01° and gaze position accuracy from 0.25° to 0.5°. Whilst viewing was binocular, only the participant's left eye was tracked, as monocular recording is an established procedure in eye-tracking research (Lykins et al., 2006; Wang, Sung, & Venkateswarlu, 2005).

For each video pair two areas-of-interest (AOI) were defined using BeGaze software SensoMotoric Instruments, Teltow, Germany); one encompassed the entire size of the 'good' dancer and the other one the 'bad' dancer video clip (Fig. 1). Although there are many ways to quantify and express visual attention from the raw data of continuously recorded gaze, cumulative dwell time and the number of fixations have been reported as the most useful (Duchowski, 2002, 2003). In the present experiment, we calculated the averages of these measures across all participants for the 'good' and the 'bad' dancers, respectively. Dwell time was measured in milliseconds (ms), and a fixation was defined as directed gaze within an area of 40 pixels with a minimum dwell time of 80 ms.

2.4. Procedure

In preparation for the eye-tracking task, participants were instructed to place their chin onto the device's chin-rest, and not to move or speak during the recording phase. They did not receive any particular explanation for the viewing task, except from the statement that they will see male dance characters, as this could have resulted in perceptual expectations, and thus altered focal attention (Duchowski, 2003; Yarbus, 1967). External control of the recording process was achieved remotely via an operator and PC connected via serial interface in a neighbouring room. A 13-point-calibration procedure preceded the presentation of stimuli; here the participant was instructed to focus on a target point, which then automatically moved to different locations on the screen after a minimum fixation of 400 ms. Following calibration, the experiment started without delay with the presentation of the first video pair. Half of the participants were assigned to Set 1 and the other half to Set 2 of stimuli. The order of presentation within each set was randomized between participants. A blank stimulus with a fixation cross in the centre of the screen was presented prior to each stimulus scene (1 s) in order to guarantee a constant starting position for each participant. Total viewing time (excluding calibration procedure) was 4 min and 35 s.

After completion, participants were requested to judge the dance videos they saw in the eye-tracking task on perceived attractiveness and masculinity (in blocks), this time in a serial order presentation. Within each block, stimuli were presented in randomised order on a 15.4″ laptop screen set to a resolution of 1440 × 900 pixels, and statements were made on a 7-point Likert-type rating scale (1 = not attractive/masculine, 7 = very attractive/masculine) using Medialab 2006 software (Empirisoft Inc., New York).

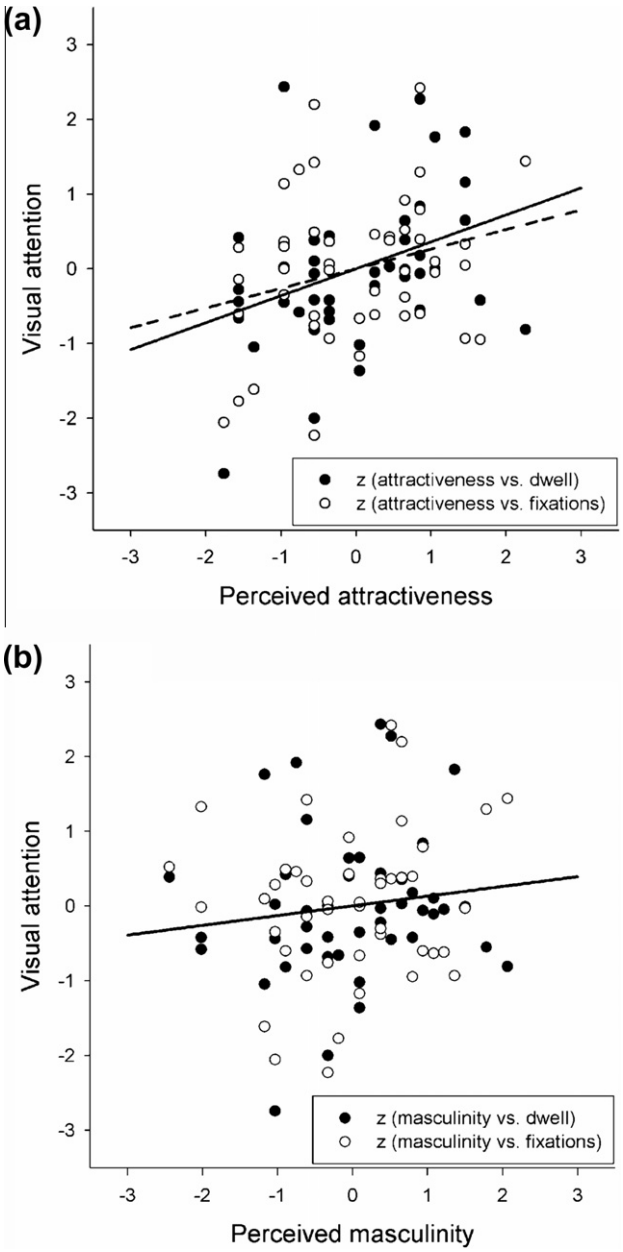

Fig. 2. Associations of visual attention measures (dwell time and number of fixations) with perceived attractiveness (a) and masculinity (b) of virtual male characters varying only in dance quality (mean ratings were transformed into *z*-scores); attractiveness: dwell r^2 = .13, fixations r^2 = .07; masculinity: dwell r^2 = .02, fixations r^2 = .02.

Of the 50 women who were initially recruited, data from four participants had to be excluded from the statistical analysis, as the calibration data did not meet the required standards, rendering our final sample to N = 46. To test whether visual attention measures and judgements of 'good' and 'bad' dancers were significantly different from one another, we calculated delta scores of mean dwell time and the number of fixations, and the same for attractiveness and masculinity ratings, by subtracting the scores of 'good' from those of 'bad' dancers.

3. Results

Mean cumulative dwell time for 'good' dancers ranged from 2115.36 to 7242.40 ms (M = 5365.95, SD = 1020.27) whereas dwell time for bad dancers ranged from 673.04 to 2944.53 ms

(M = 2944.53, SD = 719.45). Number of fixations ranged from 4.64 to 25.44 (M = 13.22, SD = 4.06) for 'good' dancers and from 2.28 to 17.44 (M = 8.49, SD = 3.04) for 'bad' dancers. A one-sample Kolmogorov–Smirnov goodness of fit test indicated no violation of the assumption of normality for the delta scores of visual attention measures and the rating data (all $Z < .98$, all $p > .29$). A one-sampled t-test (against the value of zero), revealed a significant positive deviation for dwell time and number of fixations (dwell: $t_{(45)} = 14.78$, $p < .001$, $d = 3.08$; fixations: $t_{(45)} = 12.66$, $p < .001$, $d = 2.60$; both one-tailed) and also for attractiveness and masculinity ratings (attractiveness: $t_{(45)} = 17.41$, $p < .001$, $d = 3.63$; masculinity: $t_{(45)} = 8.91$, $p < .001$, $d = 1.86$; both one-tailed). Thus, 'good' dancers received significantly higher visual attention (in terms of dwell time and the number of fixations) and were also judged higher on attractiveness and masculinity compared to 'bad' dancers.

Considering the associations of visual attention and rating data, we found that dwell time and the number of fixations correlated significantly positively (Person r) with attractiveness (dwell time: $r = .36$, $p < .01$; fixations: $r = .26$, $p < .05$, one-tailed). Masculinity was positively correlated with dwell time and the number of fixations but failed to reach statistical significance (both $r = .13$, both $p = .20$; both one-tailed). Attractiveness and masculinity ratings showed a significant positive correlation with one another ($r = .45$, $p < .001$, one-tailed) (Fig. 2).

4. Discussion

We predicted that women would be sensitive to the variation in men's dance quality, such that they would display higher visual attention to 'good' dancers, and also judge them to be higher on attractiveness and masculinity, as compared to 'bad' dancers. Our data supports these predictions as visual attention measures of dwell time and fixations were significantly different between these two groups. In addition, both visual attention measures correlated positively with attractiveness and masculinity ratings, although the associations with masculinity perception failed to reach statistical significance. Thus, we conclude that 'good' and 'bad' dancers differ in certain movement properties, and that women are sensitive to these differences, particularly with regard to attractiveness perception. Moreover, the nature of the attentional and perceptual differences seems to be grounded purely in motion cues, i.e., independent of face/body morphology, given that the stimuli used in this present study were featureless virtual humanoid characters that varied only in their dance movements. As such, our data underline the significance of body movements in attractiveness perception in its own right.

Our findings sit comfortably alongside recent research showing that male dance movements convey physical and personality properties that women 'use' in their attractiveness decisions regarding men (Fink et al., 2012; Hugill et al., 2011; Neave et al., 2011). These studies have been influenced by the evolutionary psychology approach to the understanding of women's preferences for certain male cues that are particularly relevant in terms of partner selection (Grammer et al., 2003; Rhodes, 2006), and there is corroborating evidence that the same perceptual mechanisms and evolutionary principles that were demonstrated in research on face/body attractiveness also apply to body movement.

With regard to visual attention and gaze allocation, Foulsham, Cheng, Tracy, Henrich, and Kingstone (2010) reported that status hierarchy could predict participants' eye gaze, such that high-status individuals in a group-decision-making task received most attention. Hence, these authors concluded that the human gaze system is attuned to the social status of individuals, as deriving status information is most useful in social interaction. Interestingly, it seems that information, which is most relevant in social interaction (e.g., action, gender and identity) can be obtained from body movement within a very short time. Foulsham et al. initially recorded 20 min of discussion among individuals, but presented only 20 s to panellists in the eye-tracking paradigm, and were still able to discern high from low status individuals (in terms of visual attention). Fink et al. (2008) presented five shape-standardized female faces, varying only in skin colour distribution, on one screen for 15 s, and Maner et al. (2003), in one study investigating men's and women's mating-related motives, presented male and female facial photographs for only 4 s. In the present study women viewed 10 s of men's dance movements and could discern between 'good' and 'bad' dancers (in terms of perceived attractiveness). Thus, it seems that even within very short time, people are highly selective with regard to their visual attention and social preferences.

Maner et al. (2003) also showed that women selectively attended to physically attractive male targets (faces) and that attentional capacity did not lead to biased estimates of attractive men, thus arguing for the existence of a cognitive bias which facilitates mating-related motives (see also Rupp & Wallen, 2007). Our present data suggests that a cognitive bias not only exists for women's perception of men's faces, but also for female gaze allocation to male body movements. We argue that women are sensitive to male dance quality, such that they spend higher visual attention to 'good' dancers, as these men display certain 'quality' characteristics via their dance moves, that women have a preference for. In considering the findings of Neave et al. (2011) it seems that variability in male dance movements particularly attracts female attention. According to the ecological theory of social perception (McArthur & Baron, 1983), cognition is selectively attuned to adaptively relevant features in the environment, and it has been argued that physical attractiveness is one of the most prominent cues, presumably because it concerns a fundamental aspect of human social behaviour, i.e., mate selection. Using male faces as stimuli, Maner et al. (2003) showed that attractive male targets capture the mind of women, as women selectively attended to good-looking men. Maner et al. admitted that one of the limitations of their research was the use of static, rather than dynamic, stimuli, and they suggested that dynamic stimuli would perhaps provide stronger evidence for the selective processing of features in mating-related context. The results of this present study, using dynamic displays (i.e., dance movements) of men, and studying the relation of women's visual attention to and attractiveness judgements of them, support Maner et al.'s prediction, although it is clear that future studies should also employ more complex scenarios to investigate selective visual processing of dynamic features.

Finally, previous studies have reported positive and significant associations of women's attractiveness and masculinity perceptions of male facial and body morphology (Fink, Täschner, Neave, Hugill, & Dane, 2010), the present study detected a significant positive association of dance quality only with attractiveness (but not masculinity) judgements. We do not necessarily consider this as a result that stands in contrast to previous reports on associations of male physical strength with women's perceptions of attractiveness, masculinity and assertiveness of their dances (Hugill et al., 2009), as our key feature was perceived dance quality, while in the Hugill et al. study it was physical strength. However, taken together, these results argue for some caution with regards to the (correlational) use of attributes in studies on human mate preferences. Windhager, Schaefer, and Fink (2011) arrived at a similar conclusion when they studied male physical strength in relation to both face shape and women's perceptions of facial attractiveness, masculinity and dominance. These authors reported that physical strength was more strongly associated with face shape changes that relate to perceived masculinity and dominance than to attractiveness, suggesting that masculinity/dominance and attractiveness

may reflect different aspects of male mate quality. Applying this finding to our present result, we may speculate that women's attractiveness and masculinity perception of men's dances capture different aspects of dance quality. Thus, future studies on dance quality and its perception should aim to identify additional features to those reported (digit ratio, physical strength, symmetry), such as artistic performance and creativity, and test the proportion of variation they account for in attractiveness assessments.

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