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Hips Don't Lie: Multi-Dimensional Ratings of Opposite-Sex Dancers' Perceived Attractiveness

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ABSTRACT

Previous work has shown that a number of factors can affect perceived attractiveness of opposite-sex dancers. For women watching men, body symmetry, perceived strength, vigor, skillfulness, and agility of movement, as well as greater variability and amplitude of the neck and trunk, are positively related to perceived attractiveness. For men watching women, body symmetry is also important, and femininity/masculinity of movement likely also plays a role for both sexes. Our aim here was to directly compare characteristics of attractive opposite-sex dancers under the same conditions. Sixty-two heterosexual adult participants (mean age = 24.68 years, 34 females) were presented with 48 short (30 s) audio-visual point-light animations of adults dancing to music. Stimuli were comprised of eight females and eight males, each dancing to three songs representative of Techno, Pop, and Latin genres. For each stimulus, participants rated perceived *femininity/ masculinity* as appropriate, *sensuality*, *sexiness*, *mood*, and *interestingness* of the dancer. Seven kinematic and kinetic features – *downforce*, *hip wiggle*, *shoulder vs. hip angle*, *hip-knee phase*, *shoulder-hip ratio*, *hip-body ratio*, and *body symmetry* – were computationally extracted from the stimuli. Results indicated that, for men watching women, hip-knee phase angle was positively related to ratings of perceived interestingness and mood, and hip-body ratio was positively related to ratings of perceived sensuality. For women watching men, downforce was positively related to ratings of perceived sensuality. Our results partially support previous work, and highlight some similarities and differences between male and female perceptions of attractiveness of opposite-sex dancers.

I. INTRODUCTION

Charles Darwin (1872) was one of the first to suggest that dynamic cues are more useful than static cues when attempting to understand others. Indeed, humans are highly social creatures, constantly gathering information about other's intentions from their gestures and expressions (Blake and Shiffrar, 2007; Troje, 2003). The fact that point-light displays (Johansson, 1973, 1976) are only interpretable when the dots are in motion further supports the view that motion cues are crucial in understanding others' actions. A significant body of work has confirmed that humans are sensitive to biological motion, and that this sensitivity is most likely an innate capacity of the visual system (e.g., Fox and McDaniel, 1982; Kuhlmeier, Troje & Lee, 2010; Moore, Goodwin, George, Axelsson, & Braddick, 2007; Norman, Payton, Long, & Hawkes, 2004; Pavlova, Krägeloh-Mann, Birbaumer, and Sokolov, 2001; Piotrowski, Jakobson, &Troje, 2007; Simion, Regolin & Bulf, 2008; Stevenage, Nixon, & Vince, 1999).

Research has revealed that we can derive a huge amount of information about a person from their movement patterns. In terms of physical properties, for example, we can detect a person's sex (e.g., Barclay, Cutting, & Kozlowski, 1978; Kozlowski & Cutting, 1977, 1978; Mather & Murdoch, 1994; Sumi, 2000; Troje, 2002), age (e.g., Montepare & Zebrowitz-McArthur, 1988), size (Jok- isch & Troje, 2003; Troje, 2003), and even their identity (e.g., Cutting & Kozlowski, 1977; Hill & Pollick, 2000; Loula, Prasad, Harber, & Shiffrar, 2005; Stevenage et al., 1999; Troje, Westhoff, & Lavrov, 2005; Westhoff & Troje, 2007) from the way they move their body. We are also able to infer certain qualities about a person from their movement characteristics, including their emotional state (Atkin- son, Dittrich, Gemmell, & Young, 2004; Brownlow, Dixon, Egbert, & Radcliff, 1997; Clarke, Bradshaw, Field, Hampson, & Rose, 2005; Dittrich Troscianko, Lea, & Morgan, 1996; Pollick, Patterson, Bruderlin, & Sandford, 2001; Walk & Homan, 1984), sexual orientation (Ambady, Hallahan, & Conner, 1999), intent to deceive (Runeson and Frykholm, 1983), and whether or not they're depressed (Lemke, Wendorff, Mieth, Buhl, and Linnemann, 2000; Sloman, Berridge, Homatidis, Hunter, and Duck, 1982).

Moreover, our initial impression of potential mates is more often than not based upon an analysis of their movement patterns as opposed to static form cues (Grossmann & Blake, 1999; Montepare & Zebrowitz- McArthur, 1988; Pavlova, Krägeloh- Mann, Birbaumer, & Sokolov, 2002). For example, research has revealed that, when opposite-sex strangers meet for the first time, interest in the other is often indicated by the frequency and quality of body movement. Women tend to make eye contact then look away, for example, and use particular postures and gaits to signal their interest in men (Grammer (1990).

Furthermore, amplitude and speed of these signaling behaviors is also crucial. Women who signal their interest in men by moving more frequently, but with smaller amplitude and slower speed, are rated as more positive and pleasant (Grammer, Juette, Schmitt, & Honda, 1999). Thus, attractiveness is influenced not only by the type of movements or postures made, but also their qualities.

More recent work has extended these ideas to the attractiveness of opposite-sex dance movements, revealing that perceived attractiveness correlates with certain aspects of an individual's mate quality (Brown et al., 2005; Hugill, Fink, Neave, & Seydel, 2009). Brown et al. (2005), for example, identified body symmetry, an indicator of genetic quality, as playing a significant role in women's attractiveness ratings of men, with more symmetrical men being rated as more attractive dancers. Brown et al. (2005) further hypothesize that symmetry is an important factor in female attractiveness.

Hugill et al. (2009) propose a number of factors evident in dancing which provide information about an individual's mate quality in terms of health and strength. Neave et al. (2010) identified three movement features of male dance moves

which predicted females' ratings of dance quality: Variability and amplitude of neck movement, variability and amplitude of trunk movement, and speed of movements of the right knee. Neave et al. (2010) propose that these movements reveal something about the dancer's health, vigor and strength.

In addition to body symmetry, perceived strength, vigor, skillfulness, and agility of movements, as well as greater variability and amplitude of the neck and trunk, attractiveness is also likely related to perceived femininity/ masculinity of movement. Perceived femininity of human movement in general is positively related to a person's shoulder-hip movement ratio (Cutting, 1978), shoulder-hip width ratio (Cutting, 1978; Bar- clay, Cutting, & Kozlowski, 1978; Cutting, Proffitt, & Kozlowski, 1978), height of centre of gravity (Cutting, 1978), lateral sway of the upper body (Mather & Murdoch, 1994), and anti-phase vertical movement of the hip compared to the ipsilateral knee and foot (Troje, 2002), and negatively related to both height of centre of movement (Cutting, 1978) and lateral hip movement (Murray, Kory, & Sepic, 1970; Cho, Park, & Kwon, 2004; Smith, Lelas, & Kerrigan, 2002)[1].

The likelihood of movement playing a role in perceptions of attractiveness is especially high if we consider the typical situation in a nightclub or other social dance situation, where lighting conditions are highly variable and often dim, and occlusions caused by other dancers and passers-by the norm. Given these factors, the way a person dances will likely have an unusually large influence over how others perceive them, including how attractive they are considered to be.

However, comprehensive data concerning ratings of both male and female dancers' opposite-sex attractiveness, including ratings of femininity/masculinity, appear never to have been collected in the same study. Our aim here, then, was to directly compare characteristics of opposite sex dancers under the same conditions. Specifically, we were interested in 1) the kind of dance moves which appeal to men and women, and how, if at all, they differ between the sexes, and 2) the kinds of personal characteristics people attribute to different dancers based purely on the way they move.

We presented volunteers with a series of point-light movies of people dancing to music. Participants rated perceived *Femininity/Masculinity* (as appropriate), *Sensuality*, *Sexiness*, *Mood*, and *Interestingness* of each dancer on a series of 7-point Likert scales. We also collected pertinent background information, such as gender, dance experience, and relationship status via a comprehensive questionnaire. A range of relevant structural and kinematic features – *Body symmetry*, *Hip-body ratio*, *Shoulder-hip ratio*, *Hip-knee phase angle*, *Shoulder-hip angle*, *Hip wiggle*, and *Downforce* – were computationally extracted from the dancers' movement data, and subsequently correlated with participants' ratings of the five dimensions above.

Based on previous work, we hypothesized that Femininity would be positively related to *Shoulder-hip movement angle*, *Shoulder-hip width ratio*, and *Hip-knee phase angle* (all negatively for Masculinity), that *Sensuality* would be positively related to *Femininity* ratings, regardless of the dancer's sex, that *Sexiness* would be in some way related to hip movement (non-directional), that *Mood* would be positively related to *Downforce*, and that *Interestingness* would be positively related to variety of movement in general.

II. METHOD

A. Participants

Sixty-two heterosexual adults (mean age = 24.68 years, 34 females) participated in return for a movie ticket.

B. Stimuli and Procedure

Each participant was presented with 48 short (30 s) audiovisual point-light animations of adults dan- cing to music. Stimuli were comprised of eight males and eight females, each dancing to three songs repre- sentative of Techno, Pop, and Latin genres. Presentation was via an Apple iMac computer and a specially-written Max/MSP patch. During presentation of each stimulus, participants re- sponded to five questions regarding perceived characteristics of each dan- cer: 1) How masculine or feminine (as appropriate) is their dancing? 2) How sensual is their dancing? How sexy is their dancing? 4) How good a mood are they in? 5) How interesting a per- son are they? Responses were given via seven-point Likert scales. Partici- pants were able to repeat each stimu- lus as many times as they wished. After answering all questions for each stimulus, they moved onto the next.

III. RESULTS

C. Feature Extraction

Seven structural and kinematic features were computationally extracted from the stimuli:

1) Body Symmetry: Sum of absolute differences between contralateral body segments.

2) Hip-Body Ratio: Ratio between hip width and body height.

3) Shoulder-Hip Ratio: Ratio between shoulder width and hip width.

4) Hip-Knee Phase Angle: Degree of synchrony between the vertical movement of the hip and knee (averaged between the left and right sides).

5) Shoulder-Hip Angle: Mean absolute difference between the lateral tilt angles of the shoulder segment and the hip segment.

6) Hip Wiggle: Mean absolue angular velocity of the hips around the anteroposterior axis.

7) Downforce: Skewness of the distribution of the vertical component of instantaneous speed of the root marker.

These features were based on previous work in this area, and considered most relevant to perceived attractiveness. Mean values of each feature for each stimulus were subsequently correlated with mean ratings of perceived *Femininity/Masculinity*, *Sensuality*, *Sexiness*, *Mood*, and

[1] Relationships are reversed for perceived masculinity

Interestingness of the dancers, separately for women watching women and men watching women. Correlation coefficients of the two groups are shown in Table 1 and Table 2.

Table 1. Correlation coefficients between the seven movement features and mean ratings of perceived *Masculinity*, *Sensuality*, *Sexiness*, *Mood*, and *Interestingness*, for women watching men.

	Masc.	Sens.	Sex.	Mood	Int.
Body Symmetry	.003	-.057	-.042	-.060	-.034
Hip-Body Ratio	-.018	-.285	-.188	-.212	-.141
Shoulder-Hip Ratio	-.001	.049	.025	.038	-.027
Hip-Knee Phase Angle	-.004	-.241	-.147	-.115	-.079
Shoulder-Hip Angle	.187	-.025	-.023	-.002	-.025
Hip Wiggle	.242	-.024	-.003	.030	.027
Downforce	.064	.412*	.312	.266	.236

Table 2. Correlation coefficients between the seven movement features and mean ratings of perceived *Femininity*, *Sensuality*, *Sexiness*, *Mood*, and *Interestingness*, for men watching women.

	Fem.	Sens.	Sex.	Mood	Int.
Body Symmetry	.156	.163	.195	.201	.243
Hip-Body Ratio	.354	.407*	.298	.385	.194
Shoulder-Hip Ratio	.071	.027	.029	.02	-.063
Hip-Knee Phase Angle	-.389	-.384	-.352	-.486*	-.411*
Shoulder-Hip Angle	.239	.188	.183	.209	.07
Hip Wiggle	.192	.138	.172	.175	.054
Downforce	.196	.207	.127	.172	.014

It can be seen from Table 1 that, for women watching men, ratings of Sensuality were positively related to Downforce, a measure of 'bounciness' of dancers' movements. This suggests that male dancers who dance in a bouncier, lighter, fashion are perceived by women as being more sensual. Interestingly, greater push-off force or 'bounciness' has been identified as an indicator of more positive mood in other studies (e.g., Sloman, Pier- rynowski, Berridge, Tupling, & Flowers, 1987; Troje, 2008). It's relation- ship to male sensuality in the present study is unclear.

Table 2 reveals that, for men watching women, ratings of *Mood* and *Interestingness* were both negatively related to the dancers' *Hip-Knee Phase Angle*. In other words, female dancers perceived as both more interesting and in a better mood had a lower degree of synchrony between vertical movement of their hips and knees. It can also be seen from Table 1 that male ratings of female dancers' *Sensuality* was positively related to their *Hip-Body Ratio*.

As regards other prominent but statistically non-significant correlations, several are worth noting. For women rating male dancers, there were positive relationships between Sexiness, Mood, and Interestingness and Downforce, and negative relationships between Sensuality and Hip-body ratio and Hip-knee phase angle, as well as between Mood and Hip-body ratio. Downforce is thus likely a good indicator of male dancer attractiveness in general. For men rating female dancers, there were positive relationships between Femininity, Sexiness, and Mood and Hip-body ratio, and negative relation- ships between Femininity, Sensuality, and Sexiness, and Hip-knee phase angle. This suggests that these two features are most strongly related to female dancer attractiveness in general.

IV. DISCUSSION AND CONCLUSIONS

This study represents the first time attractiveness ratings of opposite-sex dancers have been collected for both males and females under the same conditions, and highlights some inter- esting similarities and differences between male and female perceptions of attractiveness. We found that, for men watching women, Hip-knee phase angle was positively related to Interestingness and Mood, and that Hip-body ratio was positively related to Sensuality. For women watching men, Downforce was positively related to Sensuality. Other prominent but non-significant correlations sup- ported the view that these three features are relevant to ratings of female and male dancers' attractiveness in general.

The lack of other significant correlations, however, was disappointing. There are a number of potential reasons why this may have been the case. First, it is possible that the stimuli presented here were not sufficiently diverse in terms of their attractiveness to illicit a wide enough range of responses from participants. Second, the analysis of global mean values as opposed to, say, time- series values, including continuous- response ratings, may have clouded the relationships between attractiveness ratings and structural/movement features.

Another possibility is that, relationships between attraction dimensions and structural/movement features were not linear, rendering correlational techniques useless. In addition, the attractiveness rating scales selected may not have been optimal, and participants may have found it hard to assess such dimensions from point- light stimuli.

Moreover, the structural and kinematic features extracted and analyzed may not have adequately de- scribed the form and motion of the dancers presented to participants. Finally, there is the chance that it is simply not possible to rate dancers' attractiveness from point-light representations regardless of the stimuli, analysis techniques, rating scales, and features selected.

In conclusion, we encourage other researchers to develop the techniques and ideas advanced in this study in the hope of more clearly identifying features of dancing which relate to attractiveness.

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