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Are There Differences in Experts' and Lay Assessors' Attractiveness Judgments of Non-Professional Men's Dance/Gait Movements?

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Abstract

Research on attractiveness assessments of men's dance has shown that raters derive and integrate information about male mating-related qualities into their attractiveness assessments, but prior studies have focused on lay assessors (i.e., individuals with no professional dance background) rather than dance experts. We recruited male and female Russian dance experts ($n = 23$) to judge gender-neutral, featureless virtual characters, animated with motion-captured dance movements and gaits of British men, and compared their dance assessments to those from a group of Russian male and female lay assessors ($n = 73$). The dance experts provided higher dance and

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gait attractiveness judgments than the lay assessors. Both groups judged the gait movements to be of higher attractiveness than the dance movements. Differences in attractiveness assessments between experts and lay assessors were larger for the male judges than for the female judges. In an additional survey, the dance experts (versus lay assessors) placed greater emphasis on the importance of dance-related capacities and skills. We discuss our findings with reference to past research on dance/gait attractiveness as assessed by lay judges and the role of expertise in assessing body movement.

Keywords
men, dance, gait, body movement, attractiveness, dance experts

Introduction

Studies investigating attractiveness perceptions of men's dance have suggested that individual differences in dance performance provide mating-related information (Fink et al., 2015). "Good" male dancers, in the perceptions of these raters, displayed larger and more variable movements, especially in the head/neck and trunk region (Neave et al., 2011). Women judged these types of dancers to be higher on attractiveness, and they allocated more visual attention to their moves (Weege et al., 2012), as compared to the moves of dancers they judged to be "bad." Also, dancers' physical strength has been found to correlate positively with these lay assessments of men's (but not women's) dance attractiveness (Hugill et al., 2009; McCarty et al., 2013; Weege et al., 2015a). Research evidence has been less clear regarding relationships between dancers' personalities and these dance attractiveness ratings. Weege et al. (2015b) found no relationships between men's self-reported personality characteristics on the Big-Five personality factors (Costa & McCrae, 1992) and women's assessments of their personality, based on the men's dance movements. However, dance attractiveness ratings have correlated negatively with dancers' self-reported neuroticism, suggesting that raters attributed and assigned preferences to aspects of dancers' personalities from basic kinematic characteristics of the dancers' movements (amplitude, speed, and velocity; see also Koppensteiner & Grammer, 2010, 2011).

These past studies on dance perception in the context of interpersonal attraction have relied primarily on non-professional raters and dancers as participants. Despite individual variation in experience and dance frequency among" non-dancers", both the lay judgments and the dance movements of "non-dancers" are likely to differ from those of professional dancers. The reasoning implicit in the prior research emphasis on laypersons is that, regardless of

observer differences in attractiveness perceptions of skill differences among dancers, the attractiveness of characteristic body movements will be reliably discerned. Variations in dance attractiveness ratings based on brief movement sequences (i.e., without identity and contextual information) have seemed to suggest that motion information alone affects attractiveness judgments. Although culture-specific preferences in attractiveness assessments have been reported, the identification of what represents "good" and "bad" dancing has seemed to be shared across Western cultures (Fink et al., 2014). It could be argued—especially for attractiveness judgments of non-professional dancers—that apparent similarities between judgments by lay assessors and dance experts are due to a type of subdued dance movements shown by lay dancers who rarely exaggerate dance movements in the manner of professional dancers. However, an absence of research in this area leaves this possibility untested, and it remains unclear whether men's dance attractiveness as perceived by professional raters would be as influenced by mating related information as seems to have been the case for lay raters.

Prior research has suggested that familiarity with the observed dance action influences dance perception such that experts process motion information differently than non-experts (Calvo-Merino et al., 2010). Dance expertise modulates the observer's visual sensitivity to biological movements (Orlandi et al., 2017), possibly because extensive training and practice has improved the rater's motor skills and body awareness, leading to activational changes in the rater's Action Observation Network (AON; e.g., Buccino et al., 2004; Cross et al., 2009; Neal & Kilner, 2010). The AON integrates observed actions with individual motor skills and has shown stronger activation among expert than non-expert dancers (Burzynska et al., 2017). Thus, there may be differences in functional brain connectivity between these groups due to differences in individual skills, repertoire, and training (Calvo-Merino et al., 2005; Turella et al., 2013); and these differences may affect the aesthetic assessment of dance (Kirsch et al., 2013; Kirsch & Cross, 2018). Many experimental studies investigating the neurobiological underpinnings of dance expertise and their effects on perception have either used choreographed dance movements or have focused on specific types of dance (e.g., ballet; Calvo-Merino et al., 2005, 2010) and compared dance experts' with non-experts' responses to these stimuli. Yet, studies focusing instead on dance attractiveness and interpersonal attraction have typically recruited non-professional dancers as assessors, leaving open the question of whether there are differences between lay assessors' and dance experts' attractiveness assessments of non-professional dancers.

To better understand any differences in dancer attractiveness perceptions between lay and expert dance observers, we presented brief sequences of non-professional men's dance movements to both dance experts and lay assessors who rated them for attractiveness. To identify any specific perceptual differences between these groups, we also collected and compared their separate

assessments of the non-professional male dancers' gait attractiveness. Unlike prior researchers who compared perceptions of dance experts' and laypersons' specific dance choreography (e.g., Brownlow et al., 1997), we did not expect our two rater groups to show differences in their attractiveness ratings of non-professional men's "free" dance or gait movements. We expected individual, but not group, differences in these attractiveness assessments, as individual differences have been reported in previous studies using similar stimuli (e.g., Neave et al., 2011; Weege et al., 2015a, 2015b). We also expected to find a positive correlation between ratings of dance and gait attractiveness.

Method

Dance Participants

Participant dancers were 80 men aged 18–42 years ($M = 21.61$, $SD = 4.01$), recruited mainly from a college student population in the northeastern United Kingdom. All participants were non-professional dancers who had experienced no injuries that might affect their natural movement (by self-report). They did not wear shoes at the dance recording. All participants provided informed consent for participation in the study, and all were debriefed after the completion of all tasks. The study protocol was approved by the ethical committees of Northumbria University (U.K.) and the University of Göttingen (Germany).

Dance and Gait Recordings

We recorded these participants' dance movements and gaits with a 3 D optical motion capture system (Vicon, Oxford, UK), running Vicon Nexus software in a room dedicated to motion-capturing. A male and a female investigator were present during all recordings. We attached 39 reflective markers (a plug-in-gait marker set) to each participant's major joints and body parts, and the movements of these markers were recorded at a rate of 200 frames-per-second. To control for music preferences, we played the same 125 beats-per-minute drum pattern to each participant. We instructed participants to dance freely for 30 seconds to this basic drumbeat, as they would in a nightclub. We gave no specific instructions on how to walk, but we instructed participants to remain within an area of approximately 7 x 2.5 meters (marked on the floor with adhesive tape).

We applied the dance and gait recordings to standard size and shape, gender-neutral humanoid characters using Motionbuilder software (Autodesk Inc., San Rafael, CA, USA) and rendered them into video clips of 773 x 632 pixels (see Figure 1). We isolated 15-second sequences from the middle of each dance video (same location in the video for all dancers) for subsequent rating studies (see Weege et al., 2015a, 2015b). We isolated a three-second (4–5 strides)

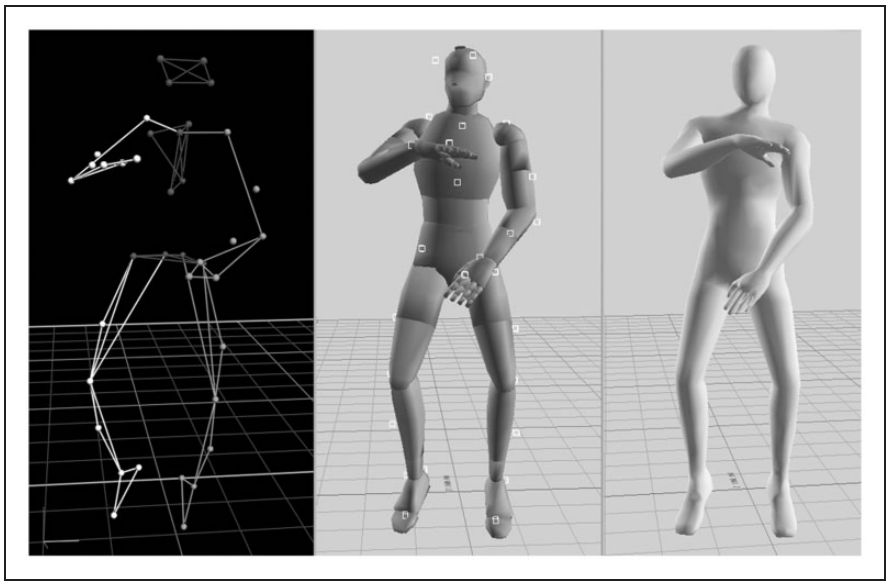

Figure 1. Snapshot From the Creation Process of a Size- and Shape-Standardized, Sex-Neutral, Humanoid Character Clip From a Dancing Sequence as Shown in the Rating Study.

sequence from the middle of each gait sequence for presentation in rating studies. We used three repetitions of this sequence to construct a new video showing walk movements in a loop.

Selection of Stimuli

The dance videos of 30 men and their corresponding gait recordings were selected from the initially-recorded 80 participants for presentation to both dance experts and lay assessors. The selected dance videos were based on lay assessors' attractiveness ratings of the dances, using a 5-point scale (1 = *low on attribute* and 5 = *high on attribute*). For this purpose, the assessors were 694 naïve judges (240 men, 454 women) who participated in an online study using Qualtrics software (Qualtrics Inc., Seattle, WA, USA). Before the rating task, these participants received information about the study and provided their informed consent (electronically). The majority of these respondent raters were from Germany (33.4%), the USA (31.6%), and the United Kingdom (6.2%), with others from numerous other countries. Their mean age was 28.65 years ($SD = 10.38$). From these aggregated ratings, we divided the dance videos into 30 "groups," (from low to high attractiveness) and selected one male dancer (and his gait) randomly from each group. The final set of stimuli were then dances/gaits of 30 men aged 18–42 years ($M = 21.30$, $SD = 4.97$).

Mean attractiveness ratings for the male dancers in these videos ranged from 1.87 to 3.43 ($M = 2.63$, $SD = 0.43$).

Dance and Gait Ratings

Dance experts ($n = 23$, age: $M = 40.81$, $SD = 3.14$) and lay assessors ($n = 73$, age: $M = 25.67$, $SD = 1.00$) judged the attractiveness of men's dances and gaits on a 7-point scale (1 = *very unattractive*, 7 = *very attractive*). We recruited the dance experts through personal contact with a former Russian dance professional, and lay judges were recruited mostly from the student population at Moscow State University and the Russian State University for Humanities in Moscow. All participants received information about the study and provided their informed consent (electronically). These participants received no compensation for completing the survey. Dance experts reported having a professional dance background for >20 years (47.8%), 16–20 years (17.4%), or 6–10 years (8.7%) - some participants did not respond to this question. All had secured a personal qualification to serve as a dance judge either at the national (87%) or international (13%) level. Lay assessors reported prior dancing frequencies regularly (9.6%), at every opportunity (26%), rarely (38.4%), or never (1.4%), with the remainder failing to provide an answer to this question.

Each assessor judged all videos (30 dances and 30 gaits). The dance videos were presented without any accompanying audio information on PC monitors next to the rating scale, using Surveymonkey (San Mateo, CA, USA). Dances and gaits were presented in blocks, and the order of videos was randomized within blocks. The total presentation time for all videos was ~8 minutes. After completion of the video ratings, participants responded to further questions about their professional dance experience, dance frequency, and sports activities, in addition to several sociodemographic questions. These responses were recorded electronically in Surveymonkey. Also, participants provided information about their beliefs on the importance of several capacities and skills as determinants of male dance attractiveness on a 5-point scale (1 = *not important*, 5 = *very important*). These were: musicality, muscular strength, coordination, emotional expression, sexual expression, and artistic abilities.

Results

Attractiveness Ratings

Table 1 presents descriptive statistics of attractiveness ratings by the dance experts and the lay assessors. We performed a Linear Mixed Model analysis on the raw scores (attractiveness ratings), with fixed effects *Group* (dance experts vs. lay assessors), *Type* (dance vs. gait), and *Gender* (male vs. female) in a full-factorial design, and accounting for random effects from groupings

Table 1. Descriptive Statistics (M ± SE) of Dance Experts' and Lay Assessors' Ratings of Men's Dance and Gait Attractiveness.

	Dance experts		Lay assessors	
	Men (n = 10)	Women (n = 13)	Men (n = 20)	Women (n = 53)
Dance	3.61 ± .11	3.40 ± .09	3.30 ± .07	3.35 ± .05
Gait	4.09 ± .11	3.96 ± .09	3.69 ± .07	3.81 ± .05

(by stimulus and subject). The confidence interval for main effects comparisons was adjusted by Bonferroni correction. There were fixed effects for *Group* ($F_{1,2347.3} = 14.17$, $p < .001$) and *Type* ($F_{1,2316} = 75.85$, $p < .001$), and for the interaction of *Group* * *Gender* ($F_{1,2347.3} = 4.38$, $p < .05$). Dance experts provided higher attractiveness ratings than lay judges (mean difference = 0.23) and gaits were judged higher in attractiveness than were dances (mean difference = 0.47). Male dance experts provided higher attractiveness ratings than female dance experts; for lay assessors, female attractiveness ratings were only marginally higher than male ratings (see Figure 2). The interaction of *Group* * *Type* and the three-way interaction *Group* * *Type* * *Gender* on attractiveness ratings were not significant.

Questionnaire Data

Table 2 reports descriptive statistics for dance experts' and lay assessors' ratings of the importance of several capacities and skills as determinants of male dance attractiveness. Considering the ratings of men and women together, there were differences between the two panels (dance experts > lay assessors) for five of six capacities/skills (Mann-Whitney *U*-test; musicality $Z = 2.72$, $p < .01$, muscular strength $Z = 2.99$, $p < .01$, coordination $Z = 2.96$, $p < .01$, emotional expression $Z = 2.42$, $p < .05$, sexual expression $Z = 1.85$, $p = .06$, and artistic abilities $Z = 2.43$, $p < .05$). However, comparing men's and women's ratings by dance experts and lay assessors, respectively, there were no gender differences for these capacities/skills in either panel (Mann-Whitney *U*-tests, all Zs < 1.73, all ps > .08).

Correlations

We calculated correlations (Spearman's *rho*) with the rating scores averaged across participants and by group. Men's dance attractiveness ratings correlated positively with attractiveness ratings of their gait, although for dance experts the relationship did not reach statistical significance (dance experts: $rho = .40$, $p = .11$; lay assessors: $rho = .51$, $p < .001$). Moreover, dance attractiveness ratings correlated positively and strongly with the online ratings used for the

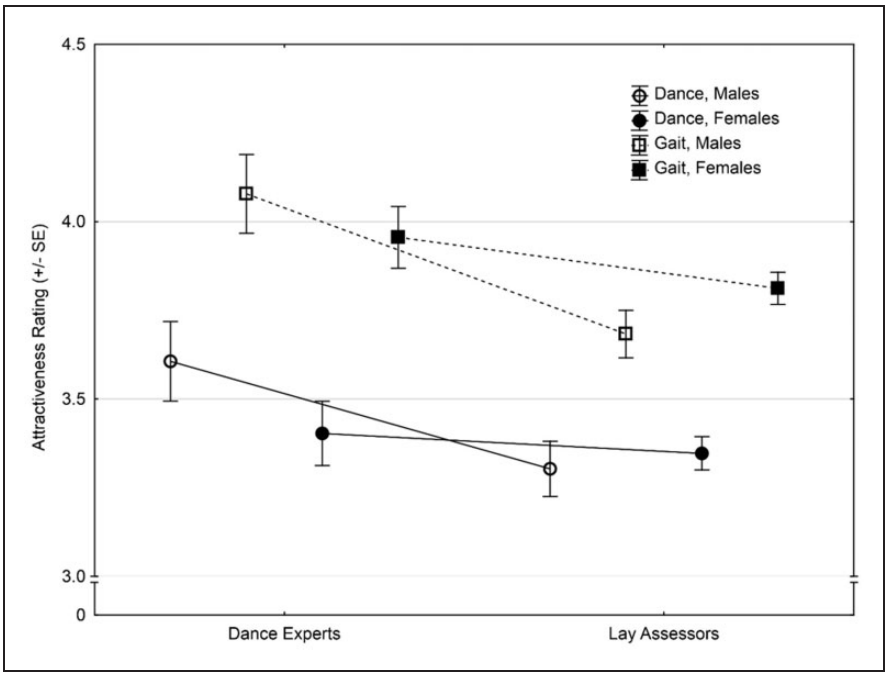

Figure 2. Attractiveness Ratings of Men's Dances and Gaits From Male and Female Dance Experts and Lay Assessors.

Table 2. Descriptive Statistics (M ± SD) of Dance Experts' and Lay Assessors' Statements About the Importance of Certain Capacities and Skills for Men's Dance Attractiveness.

	Dance experts		Lay assessors	
	Men (n = 6)	Women (n = 11)	Men (n = 14)	Women (n = 37)
Musicality	4.83 ± .41	4.82 ± .60	3.93 ± .83	4.30 ± 1.02
Muscular Strength	3.83 ± 1.17	3.55 ± 1.29	2.36 ± 1.08	2.73 ± 1.02
Coordination	4.67 ± .52	5.00 ± .00	4.43 ± .65	4.35 ± .72
Emotional Expression	4.83 ± .41	4.73 ± .47	3.86 ± 1.03	4.38 ± .72
Sexual Expression	3.67 ± 1.03	4.36 ± .67	3.57 ± 1.22	3.51 ± 1.17
Artistic Abilities	3.83 ± 1.17	4.64 ± .67	3.50 ± 1.16	3.78 ± .95

selection of stimuli (dance experts: $rho = .90$, $p < .001$; lay assessors: $rho = .88$, $p < .001$). The correlations of importance ratings of capacities and skills for men's dance attractiveness with attractiveness ratings of dances and gaits were uniformly positive for dance experts but inconsistent for lay assessors

Table 3. Correlations (Spearman's *rho*) of Dance Experts' and Lay Assessors' Statements About the Importance of Certain Capacities and Skills for Men's Dance Attractiveness With Attractiveness Ratings of Men's Dances and Gaits.

	Dance experts (n = 17)		Lay assessors (n = 51)	
	Dance Attractiveness	Gait Attractiveness	Dance Attractiveness	Gait Attractiveness
Musicality	.29	.32	−.23	−.22
Muscular Strength	.47	.48	.02	.02
Coordination	.11	.22	.02	−.10
Emotional Expression	.17	.34	−.07	.13
Sexual Expression	.11	.51*	−.03	−.08
Artistic Abilities	.17	.42	.09	.07

Note: * $p < .05$.

(see Table 3). However, only one relationship was statistically significant (sexual expression with gait attractiveness, for dance experts).

Discussion

The main findings of the present study were: (a) dance experts provided higher attractiveness ratings than lay assessors; (b) men's gaits were judged higher on attractiveness than their corresponding dances; and (c) male dance experts provided higher attractiveness ratings than female dance experts, whereas, for lay assessors, this gender difference tended to be in the opposite direction. We did not detect an interaction effect of *Group * Type* on attractiveness ratings. This would have suggested a difference in attractiveness assessments between dance experts and lay assessors for one of the two types of body movement (i.e. dance or gait). One might have speculated that expertise in professional dance might cause dance experts to be less positive about non-dancers, compared to lay assessors because dance experts regularly view professional dance choreography; but this was not found. In fact, dance experts (especially men) provided higher attractiveness judgments than did lay assessors. Moreover, there was no *Group * Type * Gender* interaction detected for attractiveness assessments, suggesting that the absence of a difference between dance experts and lay assessors for (non-professional) men's dances and their gaits generalized across men and women.

We expected no rating differences between dance experts and lay assessors, but we did expect individual differences between raters. More specifically, we reasoned that observers with a professional background in dancing might be more sensitive to individual variation in body movements, and might thus pay

closer attention to the presence (or absence) of certain characteristics (see Pollick et al., 2013). Asking dance experts and lay assessors about the importance of several capacities and skills as determinants of male dance attractiveness revealed several group differences between assessors. Dance experts emphasized musicality, muscular strength, coordination, emotional expression, and artistic abilities. However, these group differences in areas of perceived dance movement importance did not translate into group differences in attractiveness ratings of men's dances and gaits between dance experts and lay assessors. We consider it plausible that these findings may have been different, had these raters' judgments been directed toward professional dance choreography, as there would have then been specific factors professional judges would likely have considered, following both guidelines provided by professional dance associations and these raters' personal experiences.

The fact that men's gaits received more positive judgments than their dance movements was unexpected, but this finding applied to both groups of assessors and was independent of their gender. Dance, and "good" dancing, in particular, is a complex behavioral expression for both professional and non-professional dancers. Although people are sensitive to individual differences in men's gait (Fink et al., 2016, 2017), gait movements show less variation than dance movements, perhaps contributing to the more positive assessments of men's gait than dance. Gait may have been less likely than dance to produce a polarizing or display on the attractiveness dimension. Fink et al. (2014, 2015) have suggested that dance is particularly relevant in mate selection because of its power to provide information about individual variation in mating-related qualities. Because of gender-specific interest in mating-related quality cues, men and women may assess dances (and gaits) of opposite-gender individuals selectively. For example, women may prefer "good" male dancers as mates because this attribute signals strength and vigor to them (Neave et al., 2011), and men may judge women's dances and their gaits higher in attractiveness when these movements are recorded in times of high (vs. low) fertility (Fink et al., 2012). Despite these theories, we did not detect gender differences in the attractiveness ratings of either dance experts or lay assessors, except that male dance experts were more positive than female dance experts about men's gait movements. Whether or not this difference can be generalized as a meaningful and robust finding in replicating studies will require further investigation. Our findings should be interpreted with caution given our small sample sizes, especially when comparing male and female expert raters.

In a related observation, possibly due to insufficient statistical power, we found only one statistically significant relationship (sexual expression and gait attractiveness for dance experts) between ratings of the importance of various skills and capacities for men's dance attractiveness. The patterns of the relationships we observed among dance experts and lay assessors seem noteworthy. While it may seem intuitive that dance experts would be perceived importance

in several skills and capacities for men's dance attractiveness, the absence of observed stronger relationship perceptions among lay assessors was surprising and would seem to reflect, in part, their experience differences in assessing dance movements. Dance experts are trained to evaluate several aspects of dance, whereas lay assessors provide judgments intuitively.

Visual and physical experiences and skills of raters can affect their perception and aesthetic appraisal of dance (Calvo-Merino et al., 2006). Most prior studies supporting this effect considered specific forms of dance, such as ballet. Torrents et al. (2013, 2015) reported relationships between kinematic characteristics of dance and dance experts' "beauty" assessments, similar to results obtained with non-experts. Specifically, Torrents et al. (2015) found that independent of expertise, positive dance assessments were predicted by basic movement characteristics such as movement amplitude. Thus, aesthetic perception when observing isolated specific contemporary dance movements was similar for raters of different dance backgrounds. This result seems consistent with studies that found, even with non-professional dancers, that individual differences in dance attractiveness were driven by certain kinematic characteristics. Bronner and Shippen (2015) noted that, in ballet, dancers make their movements attractive by making them appear effortless. Similarly, apparent effortlessness in displaying vigorous and skillful body movements may make men's dances appealing – not among humans but also in other taxa (Barske et al., 2011; Byers et al., 2010).

Limitations and Directions for Future Research

As noted, among the limitations of this study were the small sample size for lay and expert raters that challenge generalization of these findings, particularly for rater gender comparisons. Additionally, our use of motion-captured animations of virtual characters as stimuli (similar to Torrents et al., 2013, 2015) to reduce the influence of non-dance related cues may have inadvertently influenced dance perceptions in some systematic manner. Other approaches have used videos or point-light displays. There are advantages and disadvantages associated with each of these approaches, and further research is necessary to better understand this manipulation. In the same vein, our decision to have dancers dance only to a drumbeat rather than a more complete and natural music stimulus may have achieved dance standardization at the expense of greater generalizability of our findings. Similarly, we deliberately provided no audio information to assessors to limit audio influences on their assessments, though dance ratings are typically accomplished in a more complete dance context. Finally, our raters viewed videos of only one dancer at a time, preventing them from processing information about dance synchronization with a partner (or group of dancers), perhaps distorting these perceptions to some unknown degree. Studies have documented positive effects on the audience of moving in synchrony, which may facilitate social bonding with viewers and positive appraisals of dancers (Tarr et al., 2014;

Vicary et al., 2017). A full understanding of the impacts of all of these various manipulations, considered singly and/or jointly, will require further research.

Conclusion

This study found that dance experts provided higher attractiveness judgments of non-professional men's dances and gaits than did lay assessors, and this rater difference was larger for male than female dance expert judges. Dance experts, more than lay assessors, emphasized the importance of several skills and capacities as determinants of men's dance attractiveness. Among many variables that might be specifically addressed in replication studies, we particularly recommend having dance experts and lay assessors rate professional dances as "stimuli" rather than the freestyle dances used in this study. In addition to asking raters about their specific determinants of dance attractiveness, it would be useful to secure ratings of these determinants to explain what factors drive visual attractiveness decisions.

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