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Brief research report

The relative contribution of profile body shape and weight to judgements of women's physical attractiveness in Britain and Malaysia

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Abstract

Ninety-six Malaysian and British men rated for physical attractiveness a set of photographs of real women in profile, with known body mass index (BMI) and waist-to-hip ratio (WHR). Results showed that BMI accounted for the greater amount of variance in all settings. There were also significant differences in preferences for body weight, with low resource, low socioeconomic status (SES) raters preferring a significantly heavier partner than high resource, high SES raters. The disparity with previous findings using line drawings of women in profile was discussed in terms of the weaknesses of line-drawn stimuli.

Keywords: Physical attractiveness; Waist-to-hip ratio; Body mass index; Cross-cultural

Introduction

For more than a decade, the literature on women's physical attractiveness has been dominated by the waist-to-hip ratio (WHR) hypothesis of attractiveness, which predicts that a low WHR will be universally attractive because of its association with optimal fertility and health (Singh, 2006). However, studies using representations of real women suggest that WHR may actually be a weak predictor of judgements of women's attractiveness (e.g., Smith, Cornelissen, & Tovée, 2007; Tovée, Hancock, Mahmoodi, Singleton, & Cornelissen, 2002), a pattern found cross-culturally (e.g., Swami, Neto, Tovée, & Furnham, in press; Swami & Tovée, 2005, 2007; Tovée, Swami, Furnham, & Mangalparsad, 2006). Moreover, in studies where an effect of the WHR is found among groups of relatively low socioeconomic status (SES), the direction of preferences has tended to be for WHRs higher than those preferred by high SES groups (e.g., Marlowe & Wetsman, 2001; Wetsman & Marlowe, 1999; Yu & Shepard, 1998).

These studies also make clear that, across disparate cultural settings, a woman's body weight (typically measured as her body mass index or BMI) plays a much more important role in judgements of attractiveness than WHR (a measure of body shape). Specifically, studies have shown that heavier female figures are judged to be more attractive than thinner figures in contexts of low SES (e.g., Swami & Tovée, 2005, 2007; Tovée et al., 2006), a finding mirrored by differences in preferences between hungry and satiated participants within a single SES context (Nelson & Morrison, 2005; Swami & Tovée, 2006; but see Swami, Tovée, & Furnham, in press).

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To explain the above discrepancy, Marlowe, Apicella, and Reed (2005) proposed that frontal images of women may not capture the contribution of the hips and buttocks to actual WHR. When they used line drawings of women in profile, they found that Hadza hunter-gatherers preferred a lower profile WHR (more protruding buttocks) than American men, which was in contrast to their preference for a higher frontal WHR (Marlowe & Wetsman, 2001). They, therefore, concluded that there was less disparity in their preferences for actual WHR, with there being a general preference for low over high WHRs in all societies.

The line drawings used in their study, however, likely covaried WHR and BMI (cf. Tovée & Cornelissen, 2001): the images of women with bigger hips and buttocks also appear to have a heavier body weight, and so it was not clear whether observers were judging the figures based on WHR or body weight. Earlier studies using line drawings (Furnham & Swami, 2007) and photographs (Tovée & Cornelissen, 2001) of women in profile have found that WHR plays a negligible role in judgements of attractiveness. This would suggest that profile WHR is of limited value in judgements of attractiveness, although its importance may increase when low SES populations are sampled (Marlowe et al., 2005). It is important, therefore, to examine the contribution of profile BMI and WHR to judgments of female attractiveness in different cultural settings, using sets of stimuli that are more accurate than line drawings.

Accordingly, the present study examined the relative contributions of WHR and BMI to judgements of women's physical attractiveness in profile across three societies in Britain and Malaysia. By using photographs of real women with known BMI and WHR, this study was able to overcome the problem of a BMI-WHR confound. In addition, because comparable data was available from Swami and Tovée (2005), we were able to make comparisons between judgements of female attractiveness in frontal and profile view. We hypothesised that BMI would be the greater predictor of female profile attractiveness than WHR, and that preferred body weight would be influenced by relative SES.

Method

Participants

Participants were recruited from Britain and Malaysia, with three groups reflecting either low (Sabah) or high SES (Kuala Lumpur and Britain). The first group consisted of 28 men sampled from two villages on the west coast of Sabah in Malaysian Borneo (age $M = 43.6$ years, $SD = 7.6$). All participants were small-holding paddy farmers who depended on the crop for their livelihood. Both villages in the area of study had a permanent supply of electricity and water, though sources of mass media were restricted to communal televisions (regulated state channels) and local newspapers.

The second group consisted of a community sample of 30 men recruited from the urban centre of Kuala Lumpur in West Malaysia (age $M = 44.3$ years, $SD = 8.4$). The urban-rural distinction made between Sabah and Kuala Lumpur is a meaningful one (see Swami & Tovée, 2005): compared with predominantly rural Sabah (GDP per capita about US$ 2,400), Kuala Lumpur has a GDP per capita of about US$ 8,000 and a low unemployment rate. As a further comparison, a community sample of 38 men were recruited from Greater London in Britain (age $M = 42.3$ years, $SD = 8.3$). Participants in this group were considered to be of high SES due to London's high per capita GDP (approximately US$ 33,700), its metropolitan nature and the ubiquity of sources of mass media.

Materials

Participants in each group rated greyscale images of 50 real women in profile, which were identical to those used in a previous study (Tovée & Cornelissen, 2001). The heads of the women were obscured so that facial attractiveness would not be a factor in ratings. In this stimulus set, 10 images of women were drawn from each of the 5 recommended BMI categories: emaciated (<15 kg/m^2), underweight (15–18.5 kg/m^2), normal (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), and obese (>30 kg/m^2) (BMI range = 11.60–41.23 kg/m^2). The women in these images also varied in WHR from 0.68 to 0.98. All images were adjusted and presented within the same border so that height would not be a consideration in participants' ratings.

The stimuli were printed on sheets of paper measuring 210 mm $\times$ 297 mm so as to facilitate replication in all locations. Participants were presented with a booklet to record their ratings, where the first page consisted of brief instructions and a worked example of a rating, and where the final page requested participants' demographic details. Other pages in the booklet instructed participants to provide ratings

of physical attractiveness for each image on a 9-point Likert scale (1 = *not at all attractive*; 9 = *very attractive*).

Procedure

All participants were tested individually. Within the image set, individual images were presented in a randomised order, and participants were presented with the entire set twice so as to make them aware of the range of variability of body features represented in the images. Participants were only asked to rate the images on the second run through. The experiment was conducted in English for the British group and in Bahasa Melayu (Malay) in both Malaysian settings. The questionnaire was translated into Bahasa Melayu by the first author, and a back-translation by an independent translator certified its validity. Participants in all three groups were recruited opportunistically by the authors of this study and participated on a voluntary basis. All participants were naïve to the aims and hypotheses of the study and ethical permission was obtained as appropriate.

Data analysis

Data were analysed using three statistical software packages: SPSS (v. 14) for between group comparisons, OriginLab (v. 7.5) for interpolating graphs and calculating maximal ratings, and MiniTab (v. 14) for best subsets regressions.

Results

Intra-class reliabilities

Using the Shrout-Fleiss intra-class reliability for *k* means, we found a very high degree of agreement between the participants' ratings in each group: 0.89 for the Sabahan raters; 0.99 for the Kuala Lumpur raters; and 0.98 for the British raters. This suggests that raters in each group were evaluating the images in a similar way.

Multiple regression results

To examine the relative importance of BMI and WHR in ratings of attractiveness, we followed previous studies in running a multiple regression that included second- and third-order polynomials for BMI (e.g., Tovée, Maisey, Emery, & Cornelissen, 1999).[1] This procedure balances the amount of variance accounted for with the simplest possible regression model. The model, run separately for the different groups, was:

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + e$$

where y was the attractiveness rating, a the intercept, x_1 the WHR, x_2 the BMI, x_3 the BMI^2, x_4 the BMI^3 and e was random error.

Fig. 1 shows plots of attractiveness rating as a function of BMI, with all sets being significantly explained by BMI [Britain $t(49) = 7.23$, $p < .001$; Kuala Lumpur $t(49) = 7.50$, $p < .001$; Sabah $t(49) = 4.19$, $p < .001$]. Fig. 2 shows the same relationship between attractiveness and WHR, with only the Kuala Lumpur set showing a significant relationship with WHR [$t(49) = .94$, $p < .05$]. By contrast, there was no significant effect of WHR on the attractiveness ratings of Sabahans [$t(49) = -1.26$, $p > .05$] or Britons [$t(49) = -.71$, $p > .05$]. This suggests that the WHR was a much weaker predictor of attractiveness ratings than BMI, a result borne out by the total variance explained by the model for the relationship between BMI or WHR and attractiveness. For the relationship between BMI and attractiveness, the total variance was over 65% for all three groups: 86.0% for the Sabahan group; 70.3% for the Kuala Lumpur group; and 69.6% for the British group. The variance explained by WHR and attractiveness ratings was 1.2% for the Sabahans, 9.3% for the Kuala Lumpur raters, and 7.4% for the Britons. We, therefore, dropped WHR from further analysis.

Group differences

To determine the preferred BMI for each group, third-order polynomials were fitted to the attractiveness

[1] For a previous data set (Tovée & Cornelissen, 2001), we calculated a series of regressions running up to ninth-order polynomials, and found that there is no 'best' polynomial to fit to the data, since R^2 never fully reaches an asymptote. But a third-order polynomial balances the amount of variance accounted for with simplest possible regression model. That is, the addition of a cubed term (BMI^3) to the squared (BMI^2) and linear (BMI) terms makes a significant difference to the amount of the variance accounted for, but the addition of a quadratic term (BMI^4) or additional terms makes only a small amount of difference. Additionally, it is necessary to apply the same regression model to all observer groups, as different polynomials may be produce slightly different peaks for the same data set. So any differences across groups might be an artefact of the analysis. By applying the same regression model to these sets of data, and to other sets of cross-cultural data in other studies, we allow a direct comparison of results.

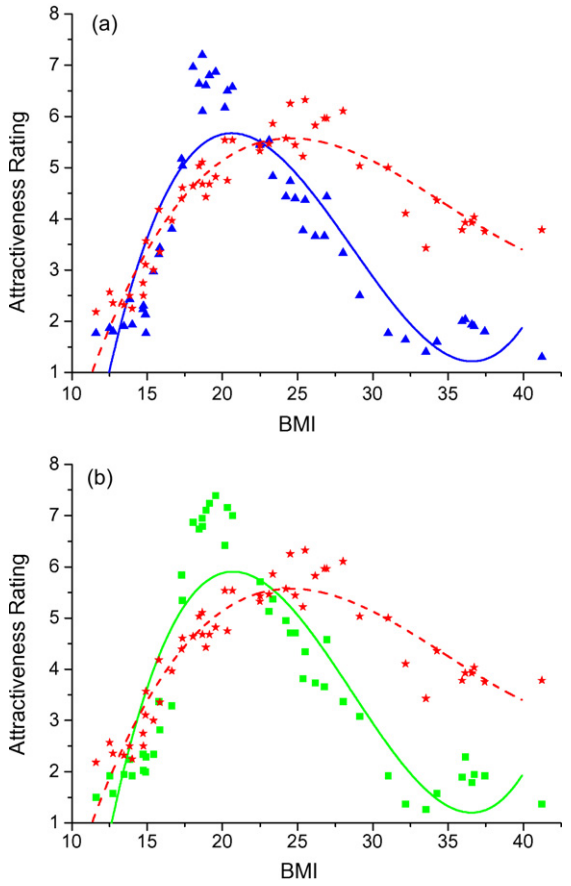

Fig. 1. Comparison plots of attractiveness as a function of BMI, comparing the attractiveness functions of raters from the low SES environment with raters from the high SES environment. Each point represents the average attractiveness judgements made by a group for a particular image. Panel (a) is a comparison of the Sabah raters (dotted line and stars) with Kuala Lumpur raters (connected line and triangles). Panel (b) is a comparison of the Sabah raters (dotted line and stars) with London raters (connected line and squares).

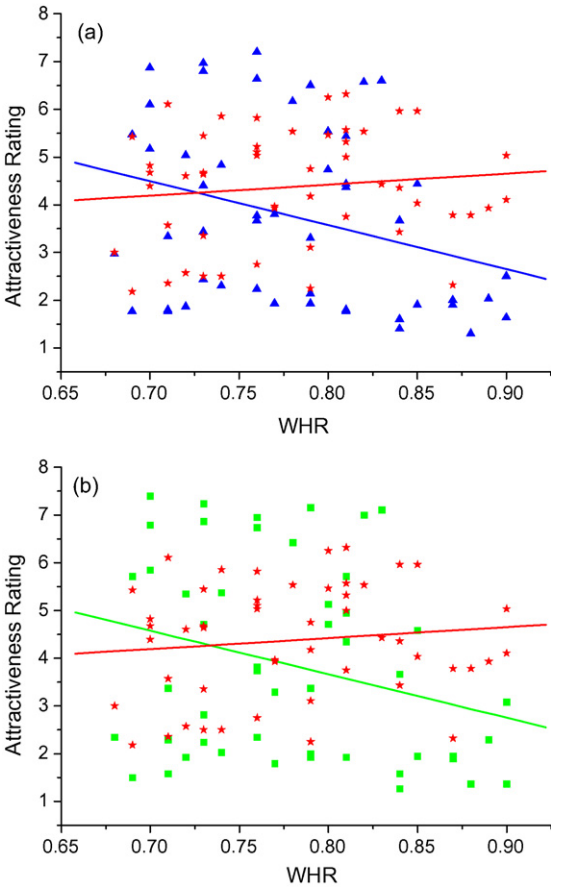

Fig. 2. Comparison plots of attractiveness as a function of WHR, comparing the attractiveness functions of raters from the low SES environment with raters from the high SES environment. Each point represents the average attractiveness judgements made by a group for a particular image. Panel (a) is a comparison of the Sabah observers (dotted line and stars) with Kuala Lumpur observers (connected line and triangles). Panel (b) is a comparison of the Sabah raters (dotted line and stars) with London raters (connected line and squares).

and BMI function for each observer in each group, allowing the BMI at peak attractiveness to be calculated for each participant. For the Sabahan group, this peak was 25.15 kg/m^2 (SD = 4.26); Kuala Lumpur 20.35 kg/m^2 (SD = 3.27); and Britain 20.74 kg/m^2 (SD = 1.77). There were significant differences between the different groups [$F(2,93) = 35.37$, $p < .001$], and a post hoc Tukey HSD showed that the Sabahan group was significantly different from the Kuala Lumpur and British groups ($p < .001$), who were not significantly different from each other ($p > .05$). These differences were also stable at higher BMI values. For instance, there were significant between-group differences at BMI 35 [$F(2,93) = 62.88$, $p < .001$], with the Sabahan observers providing higher ratings at this BMI than the other two groups.

View-invariance of attractiveness judgements

We have previously tested observers in London and Kuala Lumpur on rating attractiveness in the same image set, but in front view (Swami & Tovée, 2005). The ratings in front view in these two groups were highly correlated (Britain $r = .98$, $p < .001$; Kuala Lumpur $r = .98$, $p < .001$), suggesting that the visual cues on which these judgements were based should also be highly correlated in front and profile. Two sets of putative visual cues have been suggested to signal BMI. These are the perimeter-area ratio (PAR; the area of the figure divided by the path length of its perimeter in two-dimensions) and lower body width (Tovée et al., 1999). For PAR, the values calculated in front-view and profile were highly correlated ($r = .95$, $p < .001$). It has

previously been shown that lower body width is closely correlated with BMI (Tovée et al., 1999). So, to obtain a simple index of BMI, an observer simply had to estimate the width of a person's waist or hips. In the image set used here, the widths in front-view and profile were highly correlated with each other ($r = .91$, $p < .001$ and $r = .97$, $p < .001$, respectively). In contrast, the WHR as seen in front-view (i.e., the distance across the waist divided by the distance across the hips) and the WHR seen in profile was comparatively weak ($r = .32$, $p < .05$).

Discussion

As hypothesised, BMI had a large impact on ratings of female attractiveness in profile. The impact of WHR, by contrast, was much less noticeable, suggesting that it is a relatively weak predictor of female attractiveness. In addition, the results showed that participants in both settings of high SES consistently rated relatively slender figures as optimally attractive, while their low SES counterparts showed a preference for heavier figures. We consider these results and their implications in turn.

Consistent with past research, BMI was found to have a larger effect on attractiveness ratings than WHR across all three sites (e.g., Swami & Tovée, 2005, 2007; Tovée & Cornelissen, 2001; Tovée et al., 2006). Why, then, did Marlowe et al. (2005) find a preference for lower profile WHR among the Hadza of Tanzania than among American men? The answer may lie in the stimuli they used. In their line drawings, WHR and body weight were covaried: the line drawings with lower WHRs (more protruding buttocks) also appear to have heavier body weights, and Hadza men may consequently be showing a preference for heavier figures rather than, or in conjunction to, lower profile WHRs. In other words, the apparent preference for low profile WHRs found by Marlowe et al. (2005) could be explained by a preference for a heavier body mass, low WHRs or both.

The present results suggested that there was no significant difference in the perception of images seen in profile and seen in front-view. Comparison with ratings of our image set in profile and front-view in London and Kuala Lumpur showed a very strong correlation in ratings, and the same ideal BMI at around 20 kg/m^2. Additionally, the proportion of variance accounted for by BMI and WHR remained very similar, with BMI being the primary cue and WHR accounting for a comparatively small amount of the variance. If the attractiveness ratings are view-invariant, it logically follows that the visual cues used to make these judgements should also be view-invariant. In our image set, the potential visual cues to BMI did show this invariance, whereas the visual cues to WHR did not.

The results of this study also corroborated previous findings showing that low SES observers tended to prefer a heavier potential partner than did high SES observers (e.g., Swami & Tovée, 2005, 2007). In this study, participants in Kuala Lumpur and London showed a preference for figures with a BMI of about 20 kg/m^2 while their counterparts in rural Sabah preferred slightly heavier figures (about 25 kg/m^2). Possible explanations for this difference include local calibration for differences in resource availability (Nelson & Morrison, 2005; Swami & Tovée, 2005) and sociocultural theories that emphasise the learning of attractiveness ideals within particular cultural contexts (e.g., Swami, Knight, Tovée, Davies, & Furnham, 2007). Nevertheless, it should also be pointed out that this difference may stem from differences in media exposure, rather than differences in SES, although the two variables are of course related (cf. Swami, Einon, & Furnham, in press).

Limitations of this study include the relatively small sample size and concerns over the disparity between the ratings task used here and the way judgements are made in real life settings (see Voracek and Fisher, 2006). Nevertheless, the take-home message of this study is clear: when improved sets of stimuli are used, it becomes possible to more accurately model the effect of different bodily components on ratings of physical attractiveness. Doing so in the present study showed that BMI is of relatively greater importance than WHR in judgements of female attractiveness in profile.

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