



Does hunger influence judgments of female physical attractiveness?

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To account for male preferences for female body weight following a consistent socio-economic pattern, Nelson and Morrison (2005) proposed a social-cognitive model based on the individual experience of resource scarcity. We replicated their studies showing that calorific dissatisfaction can influence preference for female body weight using a different dependent variable, namely photographic stimuli of women with known body weight and shape. Using this revised methodology, we found that operationalized intra-individual resource scarcity affects preferences for body weight: 30 hungry male participants preferred figures with a higher body weight and rated as more attractive heavier figures than 31 satiated male participants. Hungrier men were also less likely to be influenced by cues for body shape, supporting extant cross-cultural studies on female physical attractiveness. These findings corroborate those of Nelson and Morrison (2005) and are discussed in terms of how cultural contexts shape individual psychological experience as predicted by the theory of mutual constitution.

Ethnographers have long held that cultures differ widely in their attitudes towards obesity and body shape (Brown & Konner, 1987; Ford & Beach, 1952; Popenoe, 2003; Sobal & Stunkard, 1989; but see Ember, Ember, Korotayez, & de Munck, 2005), and a number of psychological studies have since confirmed the existence of cross-cultural differences in what constitutes a desired or desirable body size (e.g. Furnham & Alibhai, 1983; Furnham & Baguma, 1994; Marlowe & Wetsman, 2001; Swami & Tovée, 2005a; Wetsman & Marlowe, 1999; Yu & Shepard, 1998). In particular, it has been frequently noted that there seems to be a greater positive association between body fat and prestige in the South Pacific, as body fat is more likely to reflect access to food resources (Becker, 1995; Brewis & McGarvey, 2000; Craig, Swinburn, Matenga-Smith, Matangi, & Vaughan 1996; McGarvey, 1991; Wilkinson, Ben-Tovin, & Walker, 1994).

A series of recent studies (e.g. Swami, Knight, Tovée, Davies, & Furnham, 2006; Swami & Tovée, 2005a; Swami, Tovée, Furnham, & Mangalparsad, in press) have confirmed that body weight, as opposed to body shape (measured by the waist-to-hip ratio; WHR), is the

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primary cue to female physical attractiveness across cultures. Importantly, these studies show that the judgments of body weight differs according to socio-economic status (SES), with low SES observers preferring heavier figures than high SES observers. Swami and Tovée (2005a), for example, investigated judgments of body weight along a socio-economic gradient in Malaysia and Britain, finding that observers from high SES settings in both countries tended to prefer a lower female body weight than observers from a medium SES setting, who in turn preferred a lower body weight than a comparatively low SES group. They argue that their results lend credence to the view that physical attractiveness may be linked less to ethnicity than increased SES (Lee & Lee, 2000; Sobal & Stunkard, 1989).

Until recently, this pattern linking resource availability (as indicated by SES) and female body weight lacked an obvious psychological mechanism. One possible suggestion is that this pattern of norms derives from individuals' direct assessment of collective resources. Nelson and Morrison (2005), however, think this unlikely, as perceptions of the economy show only modest accuracy and, in any case, are thought to reflect personal political beliefs more than the actual state of the economy (Mutz, 1998). Furthermore, personal experience plays a role in perceptions of the economy, leading to wide variability. Finally, direct assessment is unlikely because, even when reported as conscious decisions, preferences seem to be made at the subconscious level (e.g. Wiederman & Dubois, 1998).

Instead, Nelson and Morrison (2005) proposed an implicit psychological mechanism based on the situational influence of environmental conditions. They argue that the consequence of collective resource scarcity is that individual members of a society in which resources are scarce are likely to lack resources themselves. They further argue that the affective and physiological states associated with individual-level resource availability provide implicit information about collective resource availability, and that this then plays a role in the construction of judgments.

In a series of studies, Nelson and Morrison (2005) tested this hypothesis by manipulating people's financial satisfaction or hunger (both these being proxies for personal resources in industrialized societies) and measuring their preferences for potential romantic partners. Their studies confirmed that implicit cues to resource availability influence preference for potential mates: financially dissatisfied and hungry men preferred a heavier mate than did financially satisfied men or satiated men, respectively. One notable aspect of these studies was the dependent variable used: participants were asked to indicate what they 'personally consider ideal in a member of the opposite sex' by responding on a 15-point scale 'how much he/she would weigh relative to the average member of that sex' (Nelson & Morrison, 2005: 168). Past research indicates, however, that observers have difficulty making accurate judgments of body weight in the absence of corresponding real-life body mass (e.g. Tovée, Emery, & Cohen-Tovée, 2000).

In order to test the validity of Nelson and Morrison's (2005) conclusions, we replicated their studies on hunger with a different dependent variable: we asked participants to rate a series of photographs of women with known body weight and shape. This provides a substantial improvement over the original study for a number of reasons. First, by using a set of stimuli depicting real women, it is possible to more sensitively determine the effects of hunger on ratings of attractiveness in ways that more closely approach real-life decisions. Second, it allows the data here to be compared with respect to previous studies that have used the same methodology and analysis (e.g. Swami, & Tovée, 2005a; Tovée, Hancock, Mahmoodi, Singleton, & Cornelissen,

2002). Finally, by using photographic stimuli where body weight is quantified as the body mass index (BMI), we are able to show more precisely the effects of changes to judgments, in contrast to previous studies that have used only a general measure of body weight. In addition, we used a more stringent measure of hunger and satiety than that which was employed in the original study. Whereas Nelson and Morrison (2005) employed a division between pre- and post-dinner participants, we asked participants to self-identify their level of hunger or satiety.

We looked in particular at hunger because of two main reasons (Nelson & Morrison, 2005, pp. 168, 170). Firstly, much research has documented the influence of physiology on judgment and evaluations in a wide variety of domains (e.g. Friedman & Förster, 2000; Stepper & Strack, 1993) and these emphasize the primacy of physiology and proprioceptive cues in immediate and unconscious evaluations (Neumann, Förster, & Strack, 2003). Secondly, many cultures do not view financial satisfaction in the same way that modern western societies do and, in most cases, resource scarcity has meant not financial dissatisfaction, but food scarcity. Thus, we replicated Nelson and Morrison's studies with a focus on food scarcity.

Methods

Materials

Participants were asked to rate black and white images of 50 real women in front view. To generate the images, consenting women were videoed standing in a set pose at a standard distance, wearing tight grey leotards and leggings in front view. Images were then frame-grabbed and stored as 24-bit images (see Tovée *et al.*, 2002, for an example). The use of high-resolution photographic images is more realistic than the line drawings used to date, but it should be noted that a two-dimensional image may not capture all the visual cues available from a three-dimensional image seen from the same viewing point (DeSoto & Kopp, 2003). However, a recent study that compared the ratings of two-dimensional photographs with ratings of movie clips of the same bodies rotated through 360° found no differences (Smith, Cornelissen, & Tovée, 2006), suggesting that two-dimensional photographs can capture much of the visual information available in three-dimensional images.

The heads of the women in the images were obscured, so that they could not be identified and so that facial attractiveness would not be a factor in an observer's ratings. In addition, the nature of the stimuli employed ensure that information such as ethnicity, wealth and age were not available to participants through direct observation. For the stimulus set of this experiment, 10 images of women were drawn from each of the five BMI categories (Bray, 1998): emaciated (below 15 kg/m²), underweight (15 to 18.5 kg/m²), normal (18.5 to 24.9 kg/m²), overweight (25.0 to 29.9 kg/m²) and obese (over 30 kg/m²). The women in this study varied in WHR from 0.68 to 0.98, with the ranges of BMI and WHR values representing the widest range available in the researchers' library. In a previous study, Tovée, Maisey, Emery, and Cornelissen (1999) examined the effect of varying the relative ranges of BMI and WHR for images in front view, and found that BMI remained the primary predictor even when the range of BMI was very narrow relative to the WHR range.

For this experiment, the images of women were printed on sheets of A4 paper, so that each image covered the entire page. 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 (age, gender, ethnicity, weight and height). Other pages in the booklet provided a 9-point horizontal Likert scale, which appeared below the question, 'How physically attractive is the person in the photograph?' and on which participants were asked to record their ratings.

Procedure and participants

We tried to follow the procedure used by Nelson and Morrison (2005) in their third study as closely as possible, with one significant difference. Male university students were asked to take part in the study as they entered or exited a campus dining hall during dinner (approximately 6:00 to 7:00 pm). Taking care not to allow participants to respond twice, two experimenters noted whether each subject was entering or exiting the dining hall when he was tested.

Because of the unusual nature of their findings, however, we employed a more stringent determinant of hunger or satiety. Participants were asked to report their hunger on an unrelated 7-point scale: *very hungry* (1), *quite hungry* (2), *more hungry than full* (3), *more full than hungry* (4), *quite full* (5), *very full* (6) and *unsure* (7). Those who indicated a score of 1 or 2 were classified as hungry, whereas those who indicated a score of 5 or 6 were classified as satiated. Responses from male participants who indicated they were more hungry than full ($N = 14$), more full than hungry ($N = 17$) or unsure ($N = 7$) were not analysed, as we wished to exclude participants who reported only moderate levels of hunger or satiety. Past research and our own observations (e.g. Swami & Tovée, 2006) suggest that moderate levels of external factors do not influence or alter attractiveness ratings.

The final sample consisted of 30 hungry participants (mean age = 22.77, $SD = 2.76$) and 31 satiated participants (mean age = 22.06, $SD = 2.22$). There were no significant differences in the means ages of the different groups, $F(1, 60) = 1.22$, $p > .05$. Participants were tested in a group setting and were not compensated for their time. To avoid social contagion effects, which the close proximity of the setting may induce, participants were requested not to cross-refer their ratings with those of other participants. Within the image set, individual images were presented in a randomized order, and subjects were presented with the entire set twice. In the first run through, participants were asked to consider whether the woman depicted was pregnant or not (participants' considerations were not recorded). This was done to make participants aware of the range of variability of body features represented in the images, and to encourage participants to use the whole set of attractiveness ratings from 1 (*least attractive*) to 9 (*most attractive*). Participants were only asked to rate the images according to the leading question on the second run through. The entire procedure took approximately 30 minutes to complete.

Results

To check that the observers in both groups were rating the images in the same way, we carried out an intra-class reliability measure on each group. Intra-class reliability measures show a very high degree of agreement between the observers' ratings. Using the Shrout-Fleiss intra-class reliability for k means, we found a high degree of agreement in both observer groups (Shrout & Fleiss, 1979); for both the hungry and satiated observers, it was 0.97.

A multiple polynomial regression was used to model the contributions of body weight to the attractiveness ratings. Figure 1 shows plots of attractiveness ratings as a function of BMI, with both sets being significantly explained by BMI ($p < .001$ in both cases). It is clear from these figures that the relationship between BMI and attractiveness is non-linear; that is, increases or decreases in BMI either side of the peak of the curve reduces the attractiveness rating. Figure 2 shows the corresponding relationship between attractiveness and WHR, with the satiated set just reaching significance ($p < .05$). By contrast, there was no significant effect of WHR for the hungry group ($p > .05$), suggesting that the WHR does have a slight effect on attractiveness ratings for satiated participants, but not for hungry participants.

There are a large number of non-linear functions that could be used to model these data. Following Tovée *et al.* (1999), we chose the simplest approach possible, which was to include second- and third-order terms in a multiple regression model (see Altman, 1991), to estimate the variance of attractiveness ratings explained by BMI. There appears little justification in the psychological literature for fitting a more complex function. 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 is the attractiveness rating, a is the intercept, x_1 is the WHR, x_2 is the BMI, x_3 is the BMI², x_4 is the BMI³ and e is random error.

The total variance explained by this model for the relationship between BMI and attractiveness ratings was 74.2% for the hungry observers and 75.8% for satiated observers. This is consistent with the findings of previous studies which show BMI to account for over 70% of attractiveness ratings (Swami & Tovée, 2005a; Tovée *et al.*, 2002, 1999). It is also dramatically different from the effect sizes for the relationship between WHR and attractiveness ratings (8.4% and 0.9% for satiated and hungry observers, respectively). Although the latter relationship was weak in both cases, it is noticeable that BMI accounted for more than 15 times more variance than WHR, suggesting that BMI is a considerably stronger determinant of bodily attractiveness than WHR.

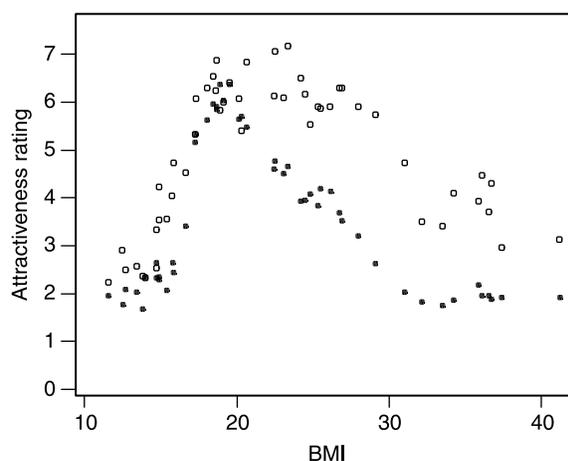


Figure 1. Plots of attractiveness as functions of BMI. Each point represents the 50 attractiveness judgments made by participants. Solid circles refer to satiated ratings, open circles to hungry ratings.

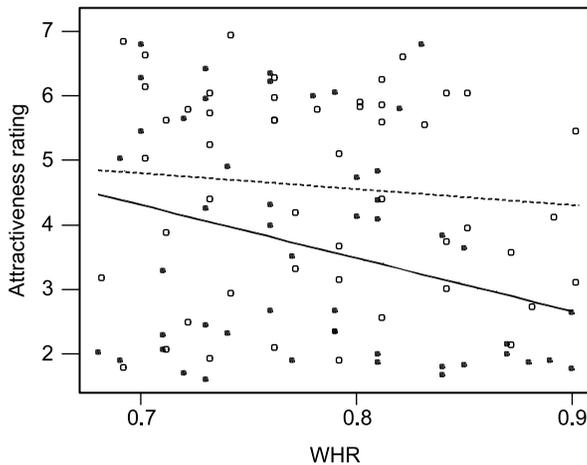


Figure 2. Plots of attractiveness as functions of WHR. Each point represents the 50 attractiveness judgments made by participants. Satiated ratings and regression lines are solid, hungry ratings and regression lines are open/dotted.

Although the shape of the attractiveness versus BMI function is very similar for both groups, it is possible the function may have been shifted in one group (i.e. the peak or 'ideal' BMI value may differ between the groups). To explore this possibility, third-order polynomials for BMI were fitted to the attractiveness ratings made by all participants in each group, allowing the BMI at peak attractiveness to be calculated for each participant. The peak BMI for the satiated group was 20.72, and for the hungry group, it was 22.97. There were overall significant differences between ratings made by participants from the two groups, $F(1, 60) = 34.79, p < .001$, with the satiated group having a significantly smaller peak attractiveness than the hungry group. Although a direct comparison should not be made between the two studies because of the different methodologies, it is notable that the effect size of this result ($\eta_p^2 = .60$) is considerably larger than that found by Nelson and Morrison (2005).

In order to further investigate shape differences between the functions at the higher BMI values, we measured the attractiveness rating at several BMI points for each observer. We then carried out a simple one-way ANOVA to determine whether the curves in each observer group were significantly different at that point. The results showed no significant differences at BMI 15, $F(1, 60) = 2.45, p > .05$, and BMI 20, $F(1, 60) = 3.55, p > .05$, but were significant at BMI 25, $F(1, 60) = 45.91, p < .001$, and BMI 30, $F(1, 60) = 82.89, p < .001$, suggesting that the hungry observers rated as more attractive heavier figures than satiated observers.

The multiple regression also suggests that the importance of WHR in attractiveness judgments differs between groups. Attractiveness and WHR is significantly correlated in the satiated group ($r = -.29, p < .05$), but not in the hungry group ($r = -.09, p > .05$). The gradient of this relationship for the satiated observers is -8.23 , and for the hungry observers is -2.36 , suggesting a much steeper gradient in the satiated. A dummy regression (Tukey, 1977) shows that there is a significant difference between the gradients for the satiated and hungry groups ($p < .05$).

Discussion

This study corroborates the findings of Nelson and Morrison (2005) in showing that implicit cues to resource availability influence judgments of female body weight. Using photographic stimuli rather than asking observers to subjectively indicate their ratings, this study found that hungry men preferred heavier women than did satiated men. Although the difference in the peak BMI preferred in each group was relatively small, the significance of this finding is underlined by the fact that hungry men rated as more attractive heavier women than satiated men. In addition, hungry men are less reliant on body shape as a cue for attractiveness and regard a less curvaceous shape as more attractive than satiated men.

These findings provide added evidence that temporary affective states can produce individual variation in mate preferences that mirrors patterns of cultural differences. A wealth of evidence indicates that judgments of female body weight varies according to SES: in less affluent contexts, there is often a general preference for heavier women and less curvaceous body shapes than in more affluent contexts (Swami, Knight *et al.*, 2006; Swami & Tovée, 2005a; Swami, Tovée *et al.*, in press). In addition, several studies based on Pettijohn and Tesser's (1999) environmental security hypothesis have shown that bodily preferences vary consistently with historical economic conditions (e.g. Pettijohn & Jungeberg, 2004). Similarly, in this study, men who were temporarily experiencing a form of resource scarcity (in the form of hunger) preferred heavier women than did men who were temporarily experiencing resource abundance (satiety). Nelson and Morrison (2005) have argued that this subjective experience of resource deprivation provides implicit cues about collective resources, and that people use these cues to construct their preferences.

The findings of this study support Nelson and Morrison's (2005) identification of a proximate mechanism for the manifestations of cultural norms at the individual level, and suggest that male preference for female body weight may not be an evolutionary adaptation. Tovée *et al.* (2002) have suggested that the optimal BMI for health and fertility is struck around 19 kg/m^2 and it would make little sense from an evolutionary psychological point of view. Of course, it might be argued that the difference in preference between hungry and satiated men is relatively small and both groups show a preference for body weights within the 'normal' BMI range. However, the current status of a male in terms of wealth or hunger should not influence the success of reproduction. It makes more sense, therefore, to view these results in terms of the importance of individual resource availability on behaviour. Certainly, fluctuations in motivational state occur many times each day, and judgments of attractiveness may therefore be expected to change frequently. In this case, it would make little sense for an immediate need or motivational state to drive behaviour in the longer term. However, it may be more fruitful to consider the effects that such fluctuation may have on overall judgments. For example, some studies (e.g. Swami, Tovée *et al.*, in press) have suggested that the difference in peak BMI preference can be substantial between those high and low socio-economic contexts, and this would seem to suggest a cumulative temporal effect. To see how this works, it is necessary to consider the relationship between individuals and the culture in which they find themselves.

Nelson and Morrison (2005) propose that their model relies on the interplay between the individual and the collective, a notion central to cultural psychology and, in particular, the theory of mutual constitution (Fiske, Kitayama, Markus, & Nisbett, 1998; Kim & Markus, 1999; Kitayama, Markus, Matsumoto, & Norasakkunkit, 1997).

According to the latter, psychological and sociocultural structures constitute each other in a feedback loop between the individual and the collective. A comprehensive understanding of a particular psychological tendency, such as judgments of body weight revealed in this study, requires some analysis of the collective reality of which that tendency is a constituent part. The collective reality that grounds and affords this psychological tendency includes socioculturally and historically rooted ideas and values, institutions and social practices, which reflect and promote these ideas and values, and also a web of everyday social interactions, which represent and promote these ideas (Kim & Markus, 1999).

This explains why judgments of body weight should vary according to SES, as individual judgments depend on situational feelings of resource scarcity. In contexts of low SES, where resource scarcity is more likely to be prevalent, affective and physiological states associated with individual-level resource availability provide implicit information about collective resource availability, and this information then plays a role in the construction of preferences for a heavier body weight. This is supported by the psychological literature: feelings often provide implicit information about our surroundings (Schwarz, 1990) and also influence behaviour in the absence of complex cognitive processes (Cacioppo, Bernston, & Crites, 1996).

This theory also helps explain why judgments of body weight may be malleable, as seen when migrants from rural to urban societies show an increasing idealization of thinner figures (e.g. Swami, Knight *et al.*, 2006; Swami, Tovée *et al.*, in press). In a particular socio-economic context, one may identify a set of ideas and values that is foundational and that is expressed pervasively in many aspects of social life. These ideas and values are conveyed to the individual through a set of socioculturally and historically rooted processes and practices, which include institutions like educational systems, language practices and media products based on these cultural values (Kim & Markus, 1999). Through participation in socioculturally specific processes and practices, individuals come to have an understanding and a feeling of what is ideal, for example with regards to idealized body weights. Individuals who share similar beliefs interact in social episodes in local worlds, and these interactions (along with cultural institutions) shape the individual's psychological experience. Thus, what is desirable in a particular socio-economic context appears desirable in the eyes of individuals, and what is culturally meaningful becomes meaningful to these individuals. As a consequence, the cultural values are internalized and represented in individual psychological tendencies, and they are used by individuals to guide their actions and preferences (Kim & Markus, 1999).

There were a number of limitations to this study that require some consideration. First, our method of familiarizing participants with the body types available in the photographs by asking them to indicate the images that they thought were pregnant may have served to alter judgments of attractiveness. For example, if participants linked certain levels of BMI with pregnancy and pregnant women are thought to be more or less attractive, then by asking participants to indicate pregnancy, we were inevitably altering ratings to reflect pregnancy inferences. Nevertheless, all participants completed the same procedural methods, and so it may be assumed that any effects would have been the same for both hungry and satiated participants. In addition, this methodology has been used previously (e.g. Swami & Tovée, 2005a) and does not seem to have any discernable effect on ratings.

A more serious methodological problem with the current design is the reliance on self-reported hunger or satiety. The setting of a campus dining hall, and our variable of

leaving or entering, contains a much broader psychological context than simple hunger. For example, some participants may not have had a good 'dining experience' and this may have influenced their affective state, which in turn may have affected judgments of attractiveness. A more stringent design would have ensured that participants ate different amounts of food in a laboratory setting. Future studies should use stricter controls, as this would make for a more rigorous test of factors that influence affective state and judgments of physical attractiveness.

Finally, it should be pointed out that there remain unresolved issues concerning the specificity and generalizability of the present findings, which raise the possibility of alternative interpretations. For example, if hungry men judge heavier women as more attractive than satiated men, might they also judge other heavy objects as generally more aesthetically pleasing? Although this may seem unlikely, the possibility could not be ruled out that our findings reflect a more general phenomenon untapped by the current design. One way to directly investigate this possibility would be to conduct the study with appropriate controls where observers are asked to judge, not just the female body, but also non-human objects. In addition, it is of especial importance that this study made no attempt to evaluate the effect that hunger might have on facial attractiveness, and future studies should certainly consider this variable given its importance in overall physical attractiveness (e.g. Furnham, Tan, & McManus, 1997). Finally, future research should also consider the effects that hunger may have on the physical attractiveness preferences of women, given the variability that such preferences show across cultures (Swami & Tovée, 2005b).

In conclusion, this study emphasises the interdependence between culture and individual preference. The existence of culturally incongruent behaviours and attitudes, of course, suggests that cultures are fully integrated systems or coherent wholes. Rather, cultures can best be conceptualized as 'constantly changing, open systems of attitudes, norms, behaviours, artifacts, and institutions that people reinforce but also continually modify or even challenge through diverse means of participation and engagement (Kim & Markus, 1999, p. 798). There are, however, a few core ideas and themes that connect different parts of a given cultural context, which are shared by the majority of its participants. It is the latter that helps to explain the extant findings of cross-cultural psychology with regards to body weight and shape preferences.

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