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The Influence of Resource Availability on Preferences for Human Body Weight and Non-Human Objects

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It has been proposed that there may be a general psychological mechanism which interacts with resource availability to influence preferences for human body weight, which may also extend to non-human objects. To test this hypothesis, we first replicated previous studies of preferences for human body weight using a new set of line drawings. The results of this study showed that hunger, as a proxy for resource availability, elicited a preference for a slightly heavier body weight. We then designed three studies that manipulated the size of different objects (an anvil, an empty milk bottle, and differently-filled bottles) and asked participants to rate these for aesthetic appeal. The results showed that the hunger level of participants in the three studies did not affect the aesthetic appeal of the objects being rated. Explanations for these findings are discussed in conclusion.

A robust and long-standing finding in the ethnographic and psychological literature is that cultures differ widely in their attitudes towards such things as obesity and body weight (Brown & Konner, 1987; Ford & Beach, 1952; Sobal & Stunkard, 1989). A raft of anecdotal and experimental evidence exists in support of this supposition. For example, among the Tuareg of the Sahara, the height of beauty borders on the obese and girls are force-fed on mild in order to achieve this (Popenoe, 2003), while for the Siriona of Bolivia, "a desirable sex partner – especially a woman – should also be fat. She should have big hips, good-sized but firm breasts, and a deposit of fat on her sexual organs… Thin women… are summarily dismissed as being *ikaNgi* (bony)" (Holmberg, 1946: 181).

In terms of experimental evidence, several studies have shown that in cultures with scarce resources men tend to prefer heavier women, whereas men in cultures with abundant resources prefer thinner women (e.g., Furnham & Alibhai, 1983; Furnham & Baguma, 1994; Smith & Cogswell, 1994; see also Anderson, Crawford, Nadeau & Lindberg, 1992). Most explanations for this pattern have focused on the optimisation of overall health in a particular ethnic context. For example, on the basis of epidemiological evidence suggesting that different ethnic populations have differing levels of risk for negative health consequences with changing body weight, Tovée and Cornelissen (2001) suggest that there may be a different optimal body weight for health and longevity in different racial groups. As a consequence, there will be a preferred optimal body weight for each group, which will balance environmental and health factors. However, this optimal body weight may differ between groups and environments.

Swami and Tovée (2005a) tested this hypothesis by investigating judgements of body weight among Malays, Chinese and Indians in Malaysia, who are known to have different optimal body weights for health and mortality. However, in their study, observers from the three ethnicities were all found to have a similar preference for relatively slender figures. Nevertheless, the authors did find differences in preferences when they investigated judgements of body weight along a socio-economic status (SES) gradient: observers from high SES settings in Britain and Malaysia tended to prefer thinner women than did low SES observers in rural Malaysia. They go on to argue that their results support the view that physical attractiveness is linked less to ethnicity than SES (Sobal & Stunkard, 1989), and a similar pattern of preferences has been found among several different national groups (e.g., Swami & Tovée, in press; Tovée, Swami, Furnham & Mangalparsad, in press; see also Swami, in press). Furthermore, the pattern linking observer SES and preference for body weight has been found when women are asked to judge images of men (Swami & Tovée, 2005b).

Nelson and Morrison (2005) proposed an implicit psychological mechanism based on the situational influence of environmental conditions to account for the link between body weight preference and SES. 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. Moreover, 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 preferences. In a series of inventive studies, Nelson and Morrison (2005) tested this hypothesis by manipulating people's financial satisfaction or hunger (both these being proxies for personal resources in industrialised 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.

Swami and Tovée (2006) replicated their study on hunger, asking hungry and satiated participants to rate a series of photographs of women with known body weight and shape. Corroborating the findings of Nelson and Morrison (2005), this study found that hungry men had a preference for slightly heavier women (measured in terms of body mass index) than did satiated men; hungry men also rated overweight and obese women more positively. These studies share a conceptual background with Pettijohn and Tesser's (1999) Environmental Security Hypothesis, a context dependent theory of attraction and preferences drawing on evolutionary and ecological theories. This hypothesis suggests that when social and economic conditions are threatening, individuals will prefer others with more mature characteristics compared to non-threatening conditions. This is because maturity is thought to be associated with the ability to handle threatening situations (Pettijohn & Tesser, 1999; Pettijohn & Jungeberg, 2004). The importance of this theory for the link between SES and body weight preferences is that, if a heavier body weight in humans is seen as a more mature characteristic, then it may make sense to prefer a heavier body weight during threatening periods.

In their study, Swami and Tovée (2006) cautioned that the finding linking hunger and body weight preferences may simply reflect a more general psychological phenomenon: they could not rule out the possibility that hungry men may also judge all heavier objects as more aesthetically pleasing. To test this possibility, we followed Swami and Tovée's (2006) suggestion to conduct a study with appropriate controls, where hungry and satiated observers are asked to judge human and non-human images. In Study 1, we replicated their study using a different set of line-drawn stimuli. The stimuli were selected from Furnham, Swami and Shah (2006), and combine three levels of body weight with three levels of waist-to-hip ratio (WHR), the latter being a measure of body shape. In Studies 2 and 3, we asked participants to rate a series of images of different sizes.

Choosing which objects to use in the present study was considered during the design and development phase of this study. To our knowledge, previous studies have not generally considered the aesthetic value of individual objects, especially similar objects that vary in weight. In Study 2, therefore, we chose an object that we felt most parsimoniously represents an object of considerable weight, namely an anvil. In children's cartoons, for example, anvils are typically used to depict an object of substantial weight. However, because of the possibility that not all participants were familiar with anvils, we used a more readily available object in Study 3, namely empty milk bottles. Finally, in Study 4, we manipulated the fill in the milk bottles rather than the object size per se. There was an additional logistical reason for the choice these objects: future studies may wish to examine the effect of being able to actively weigh different objects before making judgements. We, therefore, chose objects that are easily available and can readily be manipulated.

If the experimental manipulation succeeds for all four studies, then we will have provided evidence of a general psychological mechanism that influences preferences for both human and non-human objects. By contrast, if the three non-human objects do not show a positive result, then we will have supported a human-only proximate mechanism influencing preferences for body weight.

Study 1

Method

Participants were asked to rate a set of line drawings of the female body (see Furnham et al., 2006, for examples), depicting three levels of body weight (underweight, average weight and overweight) and three levels of WHR (0.7, 0.9 and 1.1). There were thus a total of 9 stimuli; this set of images was selected so as to minimise the time spent on the experimental procedure. For this set, the arms and legs were narrowed or thickened within each weight category. All other facial and bodily features (e.g., breast size) were kept constant. In addition, the stimuli had originally been designed to be ethnically ambiguous and were clad in a non-descript swimming costume.

The images were printed in greyscale on sheets of paper measuring 210 x 297mm, so that each image was framed within the same border. All images were presented randomly to participants. To record their ratings, participants were presented with a brief questionnaire, which provided brief instructions and requested participants' demographic details (age, gender, ethnicity, weight and height). The questionnaire also provided seven-point Likert scales on which participants were asked to record their ratings according to physical attractiveness (7=very physically attractive, 1=not physically attractive).

We followed Nelson and Morrison (2005) in asking male university students to take part in the study as they entered or exited a campus dining hall during dinner (approximately 6:00 to 7:00pm). 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. We also followed Swami and Tovée (2006) in employing an unrelated 'hunger questionnaire' on which participants were asked to report their level of hunger on a seven-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 males who indicated they were more hungry than full (n=28), more full than hungry (n=22), or unsure (n=3) were not analysed, as we wished to exclude participants who reported only moderate levels of hunger or satiety. Past research (e.g., Swami & Tovée, 2006) and our own observations suggest that moderate levels of hunger do not influence or alter attractiveness ratings.

The final sample consisted of 43 hungry male participants (age M=20.65, SD=2.34) and 36 satiated male participants (age M=21.11, SD=3.42). There were no significant differences in the means ages of the different groups ($F_{1, 78}=0.50$, $p>0.05$). Participants were tested in group settings 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 randomised order, and the entire procedure took approximately 15 minutes to complete. Upon completion of the experiment, participants were debriefed as appropriate.

Results and discussion

A 3 x 3 repeated measures analysis of variance (ANOVA) with 79 participants was computed. Body weight and WHR were treated as within subjects factors. Where the Mauchly's Test of Sphericity was shown to be significant, the Greenhouse-Geisser correction was applied. A summary of the ANOVA results, main effects and the effect sizes measured by Cohen's (1973) partial eta squared (η_p^2) of WHR and body weight, and their interactions, are shown in Table 1.

The ANOVA revealed that both body weight and WHR had significant effects on the overall ratings of figures, although the effect sizes revealed that BMI accounted for more of the variance in the data than WHR. More importantly, the results showed a significant interaction between body weight and resource availability. In general, satiated participants showed a preference for underweight figures, followed by average weight figures and lastly overweight figures. By contrast, hungry participants showed a 'peak' preference for average weight figures, followed by underweight and overweight figures (see Figure 1). In short, hungry participants rated a heavier body weight as more attractive than did satiated participants.

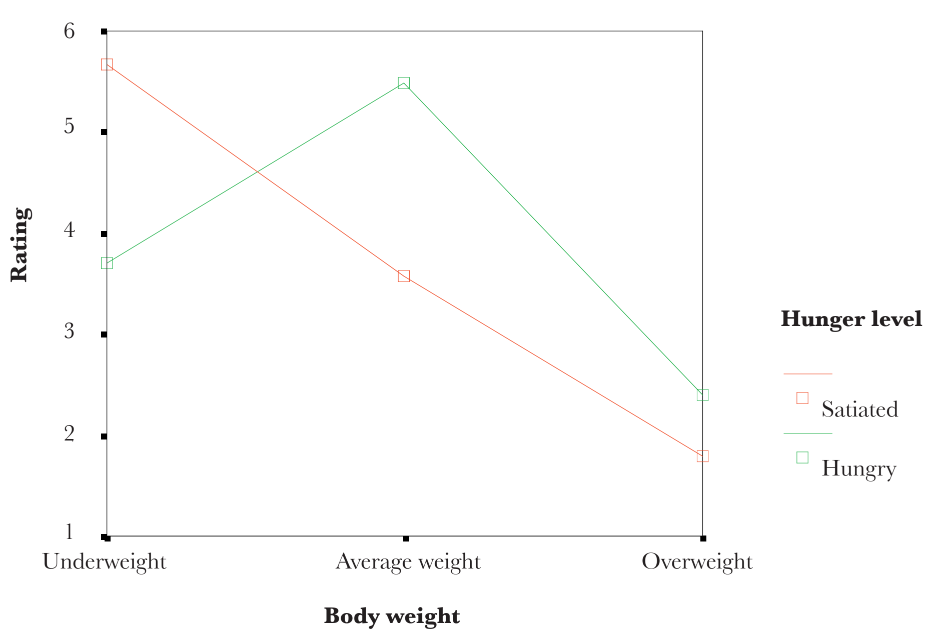
The results of this study corroborate previous findings suggesting that hungry participants rate a significantly heavier body weight as more attractive than satiated participants (Nelson & Morrison, 2005; Swami & Tovée, 2006). This is particularly important as studies have now been conducted using verbal reports, line-drawn stimuli and photographic images, and all support the extant finding that resource availability has an influence on attractiveness preferences. Moreover, the results of the present study suggest that, while this pattern of results can be extended to human body weight, the same cannot be said of body shape as measured by the WHR. Of course, in real life settings, body weight and shape are highly correlated (Tovée & Cornelissen, 2001). However, previous studies have shown that the WHR may simply be a weak predictor of

Table 1. *ANOVA results with main effects of waist-to-hip ratio and body weight, and their interactions, for Study 1*

Source	Df	F	Effect size
Body weight	1.72, 132.62[a]	232.04**	0.75
Waist-to-hip ratio	1.56, 122.85[a]	66.67**	0.46
Body weight x Resource availability	1.72, 132.62 [a]	106.72**	0.58
Waist-to-hip ratio x Resource availability	1.56, 122.85 [a]	0.67	0.01
Waist-to-hip ratio x Body weight	3.47, 267.50 [a]	4.56*	0.06
Waist-to-hip ratio x Body weight x Resource availability	3.47, 267.50 [a]	2.00	0.03

[a] Greenhouse-Geisser corrected, * $p < 0.05$, ** $p < 0.001$

Figure 1. *Preference for different body weights*



attractiveness, and that bodily attractiveness is more highly correlated with overall body weight (e.g., Swami & Tovée, 2005a; Tassinary & Hansen, 1998; Tovée & Cornelissen, 2001; but see Singh, 2002).

Despite the results of the present study, it should be borne in mind that the body weight and WHR measures used in this study are not based on normative data. Furthermore, previous studies have highlighted the methodological weaknesses of using line-drawn stimuli (Swami, in press), which include poor generalisation and issues of ecological validity. The line drawings used in the present study attempted to overcome some of these issues, but concerns still remain about realism and the accuracy of determinants of physical attractiveness. But considered in conjunction with previous studies, the results here suggest strongly that our findings are not an artefact of the design and that it may reflect a meaningful difference in preference as influenced hunger.

While this study manipulated observer levels of hunger to show that it had an effect on preferences for human body weight, it remains the case that any mechanism underlying this preference may also be extended to non-human objects. Therefore, we designed three further studies to test this hypothesis. In Study 2, we asked participants to rate a series of anvils of different sizes. If there is indeed a general mechanism underlying these preferences, then it might be predicted that hungry participants will prefer a heavier anvil than do satiated participants.

Study 2

Method

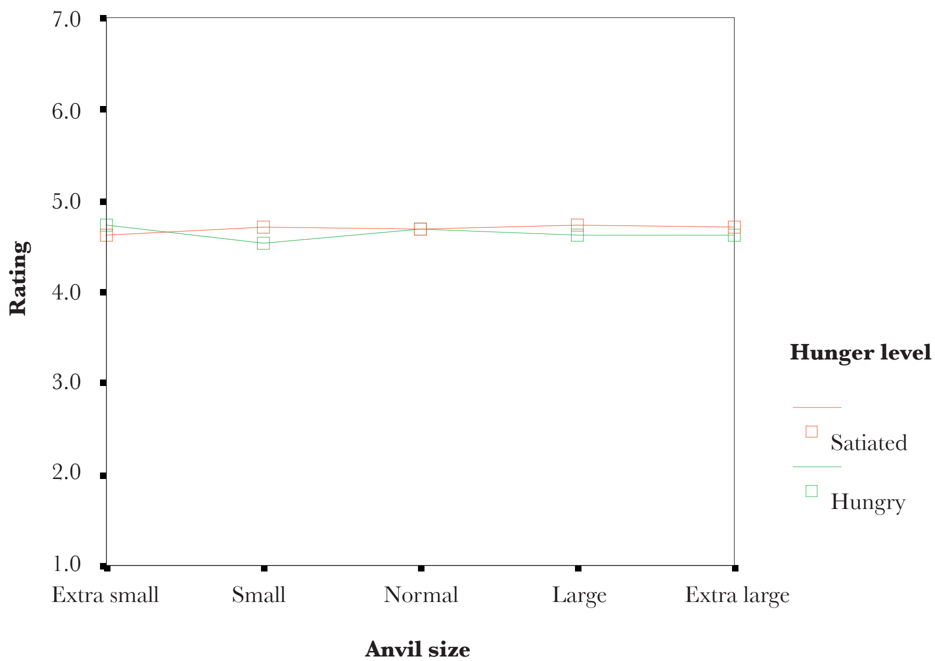
Participants were asked to rate images of anvils of different sizes. As noted earlier, anvils were chosen to represent objects that readily represent objects of considerable weight. In popular culture (e.g., children's cartoons), anvils are typically associated with heaviness and can also come in different weights. To generate the images, an unaltered, original image was either made smaller or larger in increments of 25 per cent. The final set therefore consisted of an original image, two smaller images (75 and 50 per cent reduced) and two larger images (125 and 150 per cent enlarged). Five levels of object weight was used to allow for more meaningful statistical analyses, although it should be noted the range here is greater than that in Study 1, where only three levels of body weight were used. In a pilot study, we asked 16 male participants (age *M*=20.06, *SD*=1.18) to rate, on a five-point Likert scale, the set of images according to how heavy they thought each depicted object was (1=lightest; 5=heaviest). An ANOVA showed a significant effect of anvil size ($F_{2.28, 34.45}=93.27$, $p<0.05$), with a Greenhouse-Geisser correction to the degrees of freedom, suggesting that this is a meaningful manipulation of object weight. That is, participants did indeed believe the larger anvils to be heavier than the smaller anvils.

The images were printed on sheets of paper measuring 210 x 297mm and were presented randomly to participants. All other materials were identical to those used in Study 1. The exception to this was that participants were asked to rate how aesthetically pleasing they thought each image was (7=very aesthetically pleasing, 1=not aesthetically pleasing). The final sample consisted of 40 hungry participants (age *M*= 21.70, *SD*=4.39) and 40 satiated participants (age *M*=21.86, *SD*=3.94). There were no significant differences in the means ages of the different groups ($F_{1, 79}=0.04$, $p>0.05$).

Results and discussion

An ANOVA with 80 participants was computed to examine the prediction that hungry men would prefer a heavier anvil than satiated men. Anvil size was treated as a within subjects factor, whereas observer hunger was treated as a between subjects factor. Because Mauchly's Test of Sphericity was non-significant, no appropriate correction was performed to the degrees of freedom. The mean rating for each of the images is presented in Table 2. The ANOVA revealed that anvil size did not have an effect on participants' ratings ($F_{4,\ 312}$=0.12, p>0.05, η_p^2=0.002) and that there was no anvil x observer hunger interaction ($F_{4,\ 312}$=0.46, p>0.05, η_p^2=0.006). These results suggest that all participants were rating each of the anvils in the same way, that is, that both hungry and satiated participants judge light-, normal and heavy-weight anvils to be no more aesthetically-pleasing than one another (see Figure 2).

Figure 2. *Preference for differently-sized anvils*



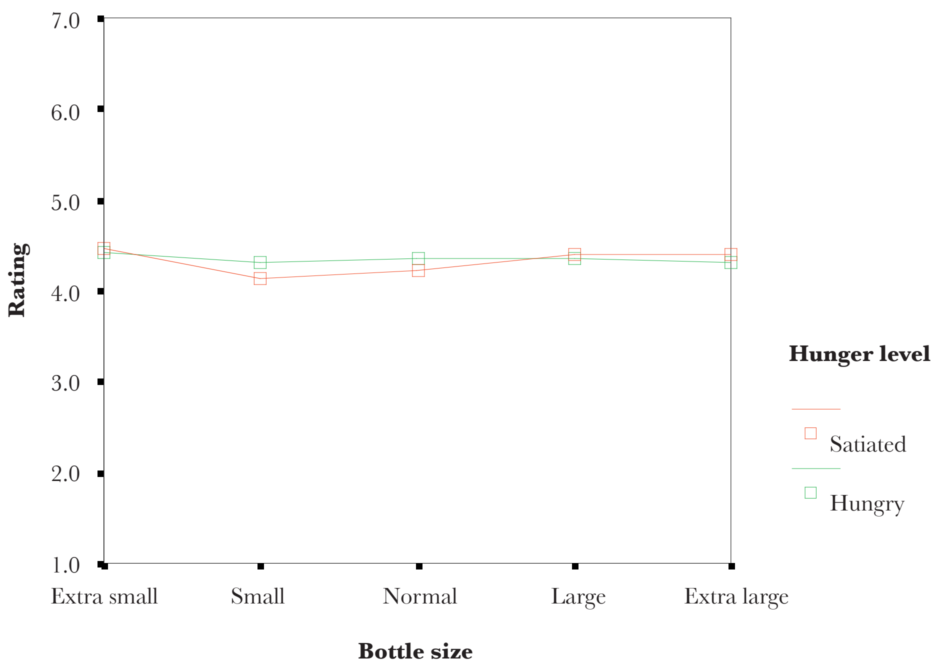
Study 2 manipulated observer levels of hunger and showed that this did not have an effect on ratings of differently-sized anvils. However, it may be the case that participants in our study were not sufficiently knowledgeable about anvils to make appropriate judgements about object weight. In Study 3, therefore, we used an object that participants would have some experience handling in real-life situations: differently-sized empty milk bottles. If there is a general psychological mechanism governing preferences for body weight, then it might be predicted that hungry men should find larger milk bottles more aesthetically pleasing than satiated observers.

Study 3

Method

The same methods and procedures were used as in Study 2, with the only difference being the stimuli used: to generate the images, an unaltered image of an empty milk bottle was either made smaller (again in two 25 per cent manipulations) or larger (two 25 per cent increments). Milk bottles were used as we felt this would be an object that most participants would have some experience handling or at least have some knowledge about. Moreover, milk bottles lend themselves to easy manipulation, such as different fill levels (see Study 4). In a pilot study, we asked 14 male participants (age M=20.79, SD = 1.48)

Figure 3. *Preference for differently-sized bottles*



to rate the images for weight, on a 5-point Likert scale (1=lightest, 5=heaviest). Results of an ANOVA showed a significant effect of bottle size ($F_{2.31, 30.04}=27.64$, $p<0.05$), after a Greenhouse-Geisser correction to the degrees of freedom, suggesting that participants believed the larger bottles to also be heavier.

Responses from participants who indicated they were more hungry than full (*n*=5), more full than hungry (*n*=2), or unsure (*n*=9) were not analysed. The final sample consisted of 32 hungry participants (age *M*=21.31, *SD* = 2.81) and 33 satiated participants (age *M*=21.12, *SD*=2.88). There were no significant differences in the means ages of the different groups ($F_{1, 64}=0.07$, $p>0.05$).

Results and discussion

As in Study 2, an ANOVA with 65 participants was computed to examine the prediction that hungry men would prefer a larger bottle than satiated men. Bottle size was treated as a within subjects factor, whereas observer hunger was treated as a between subjects factor. Because Mauchly's Test of Sphericity was non-significant, no appropriate correction was performed to the degrees of freedom. The mean rating for each of the images is presented in Table 2. The ANOVA revealed that bottle size did not have an effect on participants' ratings ($F_{4, 252}=1.15$, $p>0.05$, $\eta_p^2=0.018$) and that there was no bottle x observer hunger interaction ($F_{4, 252}=0.58$, $p>0.05$, $\eta_p^2=0.009$). These results suggest that all participants were rating each of the bottles in a similar way, with no difference between hungry and satiated participants (see Figure 3). In sum, the second and third studies offer some evidence that there is no general mechanism governing preferences for body weight. However, as a final test of this hypothesis, we repeated the above studies using a final set of stimuli: differently-filled milk bottles.

Study 4

Methods

The methods and procedures were again identical to those in Study 2, with the exception of the stimuli used. A single original stimulus was manipulated to depict a milk bottle in five filled conditions: empty, one-quarter full, half-full, three-quarters full, or completely full. This study was considered an extension to Study 3. Responses from participants who indicated they were more hungry than full (*n*=12), more full than hungry (*n*=12), or unsure (*n*=2) were not analysed. The sample of participants consisted of 35 hungry participants (age M = 21.37, SD = 4.17) and 35 satiated participants (age M=21.71, SD=3.92). There were no significant differences in the means ages of the different groups ($F_{1, 69}$=0.13, p>0.05).

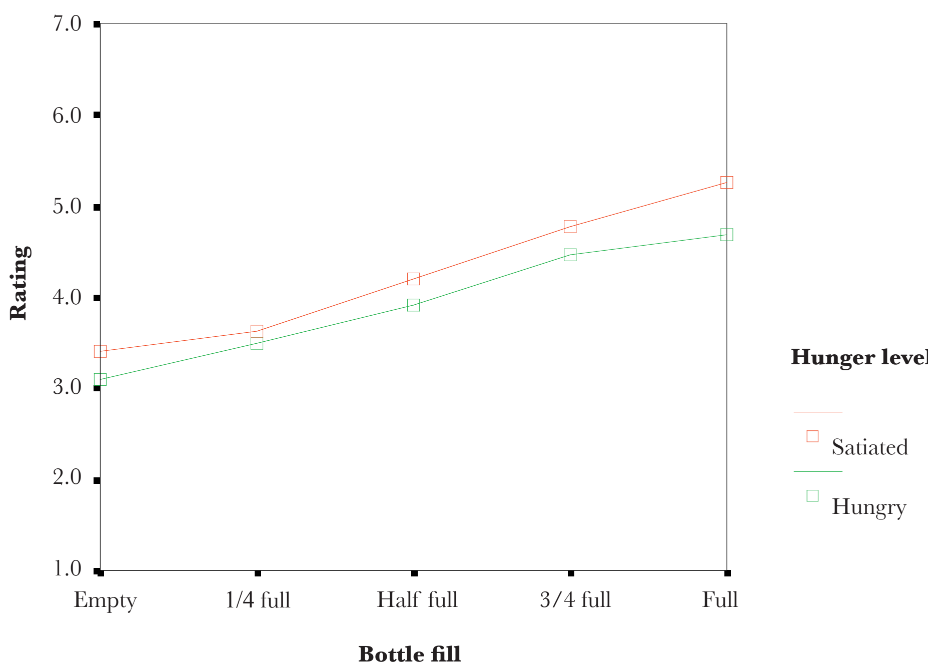
Results and discussion

A one-way ANOVA with 70 participants was computed to examine the prediction that hungry men would prefer a fuller bottle than satiated men. Bottle fill was treated as a within subjects factor, whereas observer hunger was treated as a between subjects factor. Due to the violation of the sphericity assumption, the Greenhouse-Geisser correction was applied to the degrees of freedom. The mean rating for each of the images is presented in Table 2. The ANOVA revealed that bottle fill had an effect on participants' ratings ($F_{2.57, 174.52}$=53.82, p<0.05, η_p^2=0.44). This is illustrated in Figure 4, where it can be seen that in general participants preferred the completely full bottle over the less-filled and empty bottles. However, the results did not show a significant bottle fill x observer hunger interaction ($F_{4, 272}$=0.63, p>0.05, η_p^2=0.009), suggesting that there were no differences between hungry and satiated participants. Nevertheless, it can be seen from Figure 4 that hungry participants consistently rated the images more positively than satiated participants. Further testing, however, showed that there were no significant differences between hungry and satiated participants at each of the five bottle fill levels.

Table 2. *Mean ratings and standard deviations (in brackets) for each of the images in Studies 2-4.*

		Hungry	Satiated
Study 2	50% reduced	4.63 (1.25)	4.73 (1.30)
	75% reduced	4.70 (1.11)	4.53 (1.18)
	Unaltered	4.68 (1.00)	4.68 (1.27)
	125% enlarged	4.73 (1.11)	4.63 (1.29)
	150% enlarged	4.70 (1.24)	4.63 (1.25)
Study 3	50% reduced	4.47 (1.74)	4.42 (1.58)
	75% reduced	4.13 (1.72)	4.30 (1.61)
	Unaltered	4.22 (1.43)	4.36 (1.60)
	125% enlarged	4.41 (1.50)	4.36 (1.67)
	150% enlarged	4.40 (1.64)	4.30 (1.85)
Study 4	Empty	3.40 (1.38)	3.09 (1.36)
	¼ full	3.63 (1.21)	3.49 (1.38)
	½ full	4.20 (1.43)	3.91 (1.36)
	¾ full	4.77 (1.52)	4.47 (1.74)
	Full	5.26 (1.40)	4.89 (1.69)

Figure 4. *Preference for differently-filled bottles*



General Discussion

The present study replicated the critical finding from Nelson and Morrison (2005): Study 1 showed that hungry men rated an average weight figure to be more attractive than did satiated participants, who rated the underweight figure to be the most attractive. However, this finding did not extend to non-human objects. Study 2 used images of differently-sized anvils; Study 3 used an object that observers may be more familiar with, namely empty milk bottles; Study 4 manipulated how full the same bottle was. In each of three final studies, hungry observers were not rating the images any differently to satiated observers.

Two basic objections to this research can be discounted. First, it is unlikely that observers in this study were unable to differentiate the objects according to weight. In Studies 1 and 2, when participants were asked to judge the images for heaviness, there was a clear pattern indicating that participants recognised the larger images as also being heavier. In Study 3, the manipulation of bottle filling was generally evident from the images. Of course, size and weight will be highly correlated in real objects, but the fact that participants rated the differently-sized objects as being of different weights (in pilot testing) suggests that weight was meaningfully manipulated in our design. A second objection is that our manipulation of hunger does not meaningfully capture the difference in hunger levels of participants. However, using the same methodology, Swami and Tovée (2006) managed to find a difference in the preference of female body weight between hungry and satiated observers. It should also be pointed out that the methodology used to differentiate hunger levels in this study is an improvement of that used by Nelson and Morrison (2005).

Taken together, then, these findings suggest that the temporary affective states that can produce variation in mate preferences are limited to preferences for human beings and not non-human objects. This is not as puzzling as it may appear at first glance: previous studies examining this effect in humans have explained their findings in terms of individual psychological experience and cultural norms as it pertains to human systems (Nelson & Morrison, 2005; Swami & Tovée, 2006). Any understanding of judgements of body weight requires some analysis of the collective social reality of which that tendency is a constituent part. Indeed, almost all the pertinent structures in this case point to the importance of human values, and there is little evidence to suggest that judgements of non-human objects vary with SES, culture or even time.

This helps to explain why there may not be a general mechanism influencing behaviour with regard to both non-human objects *and* human beings. Furthermore, from an evolutionary psychological point of view, there may be no value in such a mechanism: preferring heavier non-human objects during periods of resource scarcity is unlikely to provide any real benefit. Preferring a heavier potential partner during periods of resource scarcity, on the other hand, makes sense from both an evolutionary and socio-cultural perspective (Swami, in press; Symons, 1979).

There was, however, one interesting and unexpected finding: in Study 4, hungry participants provided more positive ratings of the images than satiated participants at each level of bottle fill (although this did not reach significance at any level). It is possible that because this was a more direct measure of a drink resource, participants were responding to the acquisition of the resource in this case, which may explain why these results are slightly different from the earlier studies. Filled milk bottles may provide a useable resource for hungry individuals and a future resource for satiated individuals. Future studies should examine in greater detail the response of hungry and satiated participants to other food or drink resources to further elucidate these effects.

Indeed, this study only used a range of three stimuli, and it is important to replicate these findings using a wider range of everyday objects. The range of objects used in this study does not preclude the possibility that a general preference mechanism, if it exists, also influences preferences for non-human, living creatures. Future studies may, therefore, wish to look at the effect of resource availability on preferences for differently-sized animals, for instance. Alternately, studies could be designed in which participants are able to actively weigh different objects before making judgements. Similarly, future studies may wish to return to subjective measures of ratings, such as that used by Nelson and Morrison (2005). Second, the present study only involved male participants. Although there is no reason to expect that women will differ in their ratings of non-human objects, future studies would do well to include female participants in their design.

This limitation notwithstanding, the results of the present study point to the existence of a more encapsulated preference mechanism for body weight in human beings, which works in the interplay between individual-level psychology and core cultural assumptions. In the attempt to determine which aspects of physical attraction are universal and which are relative, it is important for researchers to look beyond specific norms to the underlying processes that give rise to them.

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