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WAIST-TO-HIP RATIO AND PREFERENCES FOR BODY SHAPE: A REPLICATION AND EXTENSION

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Summary—Evidence from Singh (1993a, *Journal of Personality and Social Psychology*, *65*, 293–307; 1993b, *Human Nature*, *4*, 297–321; 1994, *Personality and Individual Differences*, *16*, 123–132; 1995, *Journal of Personality and Social Psychology*, *69*, 1089–1101) clearly demonstrates the relation of waist-to-hip ratio (WHR) and apparent overall body weight to attractiveness judgements of male and female figures. The present study is a cross-cultural replication of Singh's studies. In addition, sex difference meta-perceptions of attractiveness were considered. Overall results support Singh's work, which finds the WHR the most parsimonious measure of body physical attractiveness. With regard to the latter, a large consensus on preferences of ideal figures was found. Participants' perceptions of body shape and size showed both similarities and differences to those in Singh's research, and are discussed in terms of WHR as an evolutionary adaptation. © 1997 Elsevier Science Ltd. All rights reserved.

INTRODUCTION

The theme of physical beauty is manifested throughout the centuries in literature and art. Further social, clinical and psycho-biologists have investigated the factors associated with ratings of human facial and physical bodily attractiveness. All human mate selection theories, generated on the basis of evolutionary principles, assume that concealed ovulation in females forces males to rely on extraneous cues to convey their fecundity and health, hence the emphasis on attractiveness of more salient morphological features (Buss, 1987; Kenrick, 1989; Symons, 1979). Consequently, there is a growing interest among psychologists in judgements about beauty.

Females, it is assumed, choose males based on their high status and ability to provide resources for their offspring, and this is achieved through competition with other members of social and economic hierarchy. Therefore, physical attractiveness is assigned far more significance to women by men rather than vice versa (Buss, 1987; Feingold, 1990; Townsend, 1989). Much research in this area has revolved around attempts to discover the possible existence of a specialised adaptive mechanism which is utilised in the judgement of a person's "good looks".

This invariably leads to the question: what constitutes this universal criterion of "attractiveness"? Social biologists assume cultural invariance, but social and cross-cultural psychologists assume cultural-specific factors associated with beauty.

Where judgements of *facial characteristics* are concerned, abundant evidence of inter-individual concordance has emerged from the plethora of experiments carried out. Henss' (1995a) meta-analysis of over 100 studies generated a true variance of more than 40% in the judgements of facial attractiveness. Several studies have also yielded cross-cultural similarities (Cunningham, Roberts, Wu, Barbee & Druen, 1995; Zebrowitz, Montepare & Lee, 1993). However, facial features like shape of eyes and nose, thickness of lips or skin colour do not primarily indicate reproductive capabilities, and seem secondary in the considerations of a potential mate (Singh, 1993b). Consequently, the shift in focus on *bodily* features as ways to convey one's physical attractiveness.

Cross-cultural studies on judgements of human figures have shown that standards of attractiveness between various societies exist and are predictable (Furnham & Alibhai, 1983; Furnham & Baguma, 1994). Initial studies on preferences of human figures were carried out in the light of the rising prevalence of dieting and eating disorders among women, mainly within the Western cultures. These phenomena arise from an increase in stigma associated with obesity and pressure on women to conform to ideals of slimness associated with elegance, attractiveness, self-control and youth (Garner, Garfinkle, Schwartz & Thompson, 1980). One of the main factors which induced this negative association between obesity and attractiveness are supposedly the effects of media and fashion

(Garner *et al.*, 1980). These findings that beauty is really "in the eye of the beholder" are, in part, culturally conditioned. This position downplays the socio-biological argument that male judgements of female preferences are based primarily on specialised adaptive mechanisms.

However, recently Singh presented evidence that body fat distribution as measured by the waist-to-hip ratio (WHR) may be related to *both* judgements of a woman's attractiveness *and* potential reproductive success (Singh, 1993a, b, 1994; Singh & Luis, 1995). Singh's reasons for investigating this particular morphological features are primarily due to its uniqueness. The WHR, he argues, is the only known feature that is directly related to proximate mechanisms regulating health and reproductive capabilities in humans. Secondly, variations in WHR and reproductive capabilities have been found to be correlated. More importantly, the features concerned with the measurement of the WHR, the waist and buttocks, are unique to humans (Schultz, 1969) and it is therefore probable that it serves some unique functional significance.

This study is an extension and cross-cultural replication of Singh's research, hence the WHR will be considered in greater detail. Before and after puberty, body shape differences between sexes are negligible and only during early reproductive life is there maximal differentiation (Vague, 1956). This is brought about by the active sex hormones during and after puberty, which influences the anatomical distribution of fat cells (adipose tissues). In women, circulating oestrogen stimulates fat cells to accumulate in buttocks and thighs (gluteofemoral region) and inhibits accumulation in the abdominal region. In contrast, circulating testosterone in men maximally stimulates accumulation of fat cells in the abdominal region and inhibits fat deposits in the gluteofemoral region. Moreover, fat cells are not functionally homogenous and differences on their morphology and physiological function depend upon their anatomical position (Bjorntorp, 1987, 1988, 1991; Rebuffe-Scrive, 1987, 1988, 1991).

These differences produce a *gynoid* and *android* body fat distribution respectively, which in turn can be measured by the WHR (the ratio between the circumference of the waist and the circumference of the hips). The WHR are relatively similar for both sexes during infancy, childhood and old age. After puberty, women preferentially deposit more fat on their hips, hence their WHR is significantly lower than men's. The WHR for a healthy, premenopausal woman lies between 0.67 and 0.80, and the ratio for a healthy adult man lies between 0.85 and 0.95. Throughout her reproductive age, despite moderate obesity, a woman's WHR remains significantly lower than a man's, and is elevated typically around the menopausal stages and after.

Ample evidence has shown the WHR, independent of overall body weight, to be an accurate indicator of androgenicity, osestrogenicity (Evans, Hoffmann, Kalkhoff & Kissebah, 1983; Evans, Barth & Burke, 1988), reproductive potential (DeRidder, Bruning, Zonderland, Thijssen, Bonfrer, Blankenstein, Huisveld & Erich, 1990) and risk of major diseases (Bjorntorp, 1988).

Married women with higher WHRs and lower body mass indexes (BMIs) have reported having difficulty becoming pregnant and have their first live birth at a later age. Also, more illuminating evidence for the role of WHR and fecundity has been reported from a Dutch study on outcome in an artificial insemination programme where a negative association between high WHR and probability of conception was found (Zaadstra, Seidell, Van Noord, te Velde, Habbema, Vrieswijk & Karbaat, 1993). These are consistent with the assumption that although skeletal (pelvic size) and energetic (fat deposits) factors regulate abilities of conception and delivery of a child, a woman's reproductive success depends on the energetic factor alone once pelvic maturation is reached, and a significant portion of this essential fat comes for the gluteofemoral region (Ellison, 1990).

Exogenous sex hormones can also alter the size of WHR. Men treated with oestrogen for prostate cancer have lower WHR and also non-obese menopausal women who take oestrogen-enhancing mediation retain comparably low ratios to counteract the typical increase in WHR precipitated by menopause (Tonkelaar, Seidell, Van Noord, Baanders, Halwijk & Ouwehand, 1990). Hence, not only does WHR signal reproductive capability and health, but reproductive age as well. Furthermore, many clinical and epidemiological studies have found that risk for obesity-related diseases such as diabetes, hypertension, heart attack, stroke and certain cancers vary with *distribution* of body fat, rather than total amount (Bjorntorp, 1988; Seidell, 1992).

Evidence therefore strongly suggests close links between WHR and proximate mechanisms regulating health and fecundity, and it is probable that males (and females) have evolved mechanisms to detect and utilise the WHR to infer to potential mate value. However, empirical proof is required to establish that WHR is a critical feature in determining female attractiveness. Furthermore, if the assumption that attractiveness is related to healthiness and reproductive potential is true, WHR should also therefore affect perceived healthiness and reproductive capability.

In several experiments, Singh has successfully demonstrated that female attractiveness ratings were indeed significantly correlated with WHR (Singh, 1993a, b, 1994). The stimuli used were 12 line drawings of female figures with their weight category and WHR systematically manipulated. Participants of both sexes were presented with all 12 randomly arranged stimuli at once and required to *rank* them on attributes closely related to reproductive success: attractiveness, youthfulness, healthiness, sexiness, and capability of, and desire for, reproduction. There were limitations in this study. Ranked data is strictly non-parametric whereas parametric data is more powerful. Also, showing all the stimuli at once and in systematic order introduces the problem of allowing the experimental manipulations to be obvious to the judges and could have affected their sense of judgement. However, the results showed that figures with higher WHRs were assigned lower ranks. Furthermore, normal weight figures were more highly preferred to under- to over-weight figures. Hence, a normal weight female figure with low WHR of 0.7 was ranked as most healthy and attractive.

Singh investigated judgements of female participant on male stimuli and their desirability for relationships (Singh, 1995). The rationale of this study was the neglect of the role WHR might play in female mate selection and the lack of success in achieving a clear consensus on specific body shape or body parts of men that women find attractive (Beck, Ward-Hull & McLear, 1976; Horvarth, 1979, 1981; Lavrakas, 1975). Singh selected attributes which not only connote potential reproductive capability (e.g. physical attractiveness, health, youthfulness), and also concentrated on aspects that are closely related to personality, resourcefulness and capability to protect the family (e.g. strength, aggressiveness, leadership, capability, intelligence). The results showed that indeed, women rated men with typical male-like WHR much more favourably, and the optimum weight category was shown to be within the normal range. In choosing a male mate, females tend to be equally influenced by a man's ability to obtain and provide adequate material resources for them and their offspring as well as their attractiveness. This is different from *male* mate selection where males look solely at bodily attractiveness because, from the position of stereotyped sex roles that have evolved, the female's most important role is to conceive, carry and deliver the baby, and provide food resources like breast milk during the lactating period immediately after birth. In the latter part of Singh's study, he investigated the claim about male financial status as a deciding factor and manipulated both WHR and "financial status" of three target figures. Results showed that a high financial status did increase the desirability of the male, but this was not enough to compensate for a low, female-like WHR.

Henss (1995b) replicated and extended Singh's studies by using both female and male line drawings and considering the Big Five factors of personality in the ratings. He found that with regard to apparent body weight, his results were consistently different to Singh's. Overweight male and female figures were rated the most unattractive, but the similarity ends there. Underweight females, as opposed to Singh's normal-weight ones, were invariably perceived to be the most attractive normal, and for male stimuli, underweight figures yielded almost identical results. Henss accounted for this discrepancy by pointing out the unconventionality of Singh's ranking methodology and its questionable accuracy. The design employed in his study and purely "between participants" whereby each subject was shown *one* female figure and *one* male figure. This design means that participants had no comparison of stimulus figures by which to gauge their ratings, and hence, assuming their total naivety to the experiment, are not making any form of rational, calculated judgement. Also, there is a risk of inconsistency if different participants rate different pairs of stimuli. From the effects of the waist-to-hip ratio, figures displaying high male-like WHRs were perceived as most attractive, while males with a low female-like WHR were perceived as unattractive. This present study, like Henss', presents a replication and extension of Singh's studies. There are, however, various unique features associated with this study. First, instead of participants *ranking* the figures as in Singh's experiments, this study requires participants to *rate* the figures on a 7-point bipolar scale (e.g. very unattractive–very attractive). Henss's study also employed the use of parametric tests, but the design was purely between participants. Participants in this paper judged *all* 24 male and female figures and is hence a "within subject" design. This allows participants to compare the figures and therefore make more rational judgements, but does not have the disadvantage of the experimental manipulations being too obvious as the stimuli are presented in a totally random order.

The second difference lies with the selection of dependent variables. In his first series of studies regarding female stimuli alone, Singh considered several aspects of physical attractiveness, good health, youthfulness, sex appeal, desire and capability for having children. He pooled results for the last two aspects due to them yielding almost identical results (Singh, 1993b) hence this present study will exclude the desirability for reproduction. Thus a limited number of the most salient dimensions will be used for rating. Participants will be British, as opposed to Singh's American and Henss' German participants.

Third, in view of previous research on female attractiveness, male and female participants were found to differ in their ideal figure. Female participants thought male preference would be for much thinner figures than the latter's really was (Fallon & Rozin, 1985; Rozin & Fallon, 1988). This, however, is concerned with the examination of overall body *size*. Furnham, Hester and Weir (1990) found some evidence of sex differences in the meta-perception of body shape. Singh (1993b) did carry out a study on the metaperception of body *shapes* using female figures and generated results with a high degree of agreement between both sexes of participants. This present study will examine the metaperception of participants using *both* female and male stimuli. Here, a between-subjects design will be employed. It is hypothesised that the results will mirror Singh's and agreement between male and female participants on ideal female *and* male figures will be found.

METHOD

Participants

A total of 90 undergraduates, of which two-thirds were female and the rest male, participated in this experiment. Their ages ranged between 18 and 47 years, mean = 21.75 (sd = 5.54). Educational and socio-economic backgrounds were fairly homogenous, and all participants were naive to the role of the waist-to-hip ratio in the perception of physical attractiveness.

Materials

All participants were given a 10 page booklet. The first page was an instruction sheet and the lasts requested simple demographic details (sex, age, height and weight). The stimuli of 24 line drawings, 12 female and 12 male were contained within the remaining 8 pages. The three levels of weight category (normal, underweight and overweight) and 4 levels of WHR (0.7, 0.8, 0.9 and 1.0) were systematically manipulated within each set of drawings. Previous research using these pictures has proved them to be both salient and discriminating (Singh, 1993a, 1994; Henss, 1995a, b). A scoring table for SELF- (own ratings) and OTHER- (estimated of the ratings of the opposite sex) ratings, together with requests for height and weight estimates (measured in pounds and inches) were placed beside each stimulus.

Procedure

Seventy-five of the participants were tested in a group setting, and the rest individually. The instruction sheet in the booklet was designed to make the experimental procedure self-explanatory; however, the experimenter was present for the whole duration to answer any queries in both settings. To avoid social contagion effects which the close proximity of the former setting may induce, participants were requested not to cross-refer their ratings with those of other participants.

After brief informal directions from the experimenter, participants proceeded to firstly rate each of the 24 stimulus figures on a 7-point bipolar scale on the five attributes (Attractiveness, Youthfulness, Sexiness, Healthiness and Capability of Reproduction) according to their own judgements (SELF-ratings—how they perceived each figure), and secondly, rate them according to the judgements of the opposite sex (OTHER-ratings—how they perceived a member of the opposite sex would rate them). Finally, they estimated each figure's weight and height. The task took about 20 min. Where possible, participants were debriefed.

RESULTS

A factor analysis on the total 10 SELF- and OTHER-rating scores, given to each of the 24 stimuli, for all 5 attributes, was carried out. It revealed that SELF- and OTHER-ratings of each attribute were highly positively correlated (mean $r = 0.83$). A principal component analysis yielded three factors with eigenvalues greater than 1 (5.69, 1.23, 1.18). Employing the varimax method, three factors were extracted and orthogonally rotated, and these factors explain 81.2% of the total variance. On the basis of the loading pattern, they were interpreted as follows: Factor 1: *Attractiveness* (includes SELF- and OTHER-ratings for both physical attractiveness and sexiness); Factor 2: *Healthiness*: (includes SELF- and OTHER-ratings for both healthiness and reproductive capability); Factor 3: *Youthfulness* (includes SELF- and OTHER-ratings for youthfulness).

For each factor, the average pooled data from the constituent rating scores were considered in the subsequent analyses. Thus, scores for the three factors *Attractiveness, Healthiness and Youthfulness* will be used as dependent rating variables in the following univariate-ANOVA and analysis carried out.

A. Attractiveness

Factor 1, *Attractiveness*, generated highly significant main effects of sex of stimulus, body weight and WHR [$F(1,88) = 65.60$, <0.001; $F = (2,176) = 108.62, p < 0.001$; $F(3,264) = 76.17, p < 0.001$]. Effect of sex of participants was not significant.

Looking at mean *Attractiveness* ratings in Table 1, normal-weight males and females were judged most attractive and overweight figures least. Concerning effects of WHR, males with typical male-like high WHR of 0.9 or 1.0 were consistently judged most attractive across the three weight categories. Females within the normal-weight category show clearly that a low female-like ratio of 0.7 is rated most highly and as WHR increases, ratings decrease steadily. However, with both underweight and normal weight categories, female figures with 0.7 have higher attractiveness ratings than figures with 0.8 (underweight 0.7 ratings 3.82 vs 3.49 for 0.8 figure; normal weight 0.7 rating 5.33 vs 5.10 rating for 0.8). Only in the overweight category is the attractiveness rating of the 0.8 higher than the figure with 0.7. It is puzzling finding, but then so is the finding that the overweight figure with 0.8 WHR has a higher attractiveness rating than the underweight figure with 0.8 WHR. Why there is a preference for the overweight figure over the slim figure with similar WHR is unclear.

These rather mixed results could be due to participants' difficulty in discriminating the stimuli which showed relatively small subtle differences. However, the mean *Attractiveness* ratings dependent upon WHR alone in Table 1 show that females with 0.8 are rated most highly, almost identical to the 0.7 figure followed by 0.9, and lastly 1.0.

Table 2 reiterates the male findings, but does so more explicitly, showing WHR 0.9 was rated most attractive, then WHR 1.0, and WHR 0.7 the least. The interaction between sex of stimulus and WHR is highly significant [$F(3,264) = 110.02, p < 0.001$)].

The interaction between weight and WHR is significant [$F(6,528) = 7.21, p < 0.001$)]. Female stimuli on the whole were rated higher than male stimuli (Highest score: Females = 5.33,

Table 1. Mean *Attractiveness* ratings of each stimulus ($N = 90$)

Weight	Under				Normal				Over			
WHR	0.7	0.8	0.9	1.0	0.7	0.8	0.9	1.0	0.7	0.8	0.9	1.0
Male stimuli	2.47	3.71	3.87	3.31	2.14	3.98	4.20	4.40	1.75	2.29	3.81	2.83
Female stimuli	3.82	3.49	3.80	3.07	5.33	5.10	4.55	3.29	2.86	3.65	3.02	2.87

Scale 1–7.

Table 2. Effect of WHR on mean *Attractiveness* ratings

	WHR 0.7	0.8	0.9	1.0
M	2.12	3.34	3.96	3.51
F	4.00	4.08	3.79	3.07

Table 3. Mean *Healthiness* ratings of each stimulus ($N = 90$)

Weight	Under				Normal				Over			
WHR	0.7	0.8	0.9	1.0	0.7	0.8	0.9	1.0	0.7	0.8	0.9	1.0
Male	3.95	5.24	4.94	4.57	3.67	5.14	5.47	5.23	3.14	3.77	4.95	4.13
Female	3.92	3.45	3.85	3.70	5.61	5.45	5.16	4.50	4.17	4.88	4.46	4.37

Table 4. Effect of body weight on mean *Healthiness* ratings

	Under	Normal	Over
Male	4.80	4.87	4.00
Female	3.73	5.19	4.46

Table 5. Effect of WHR on mean *Healthiness* ratings

WHR	0.7	0.8	0.9	1.0
Male	3.58	4.72	5.12	4.64
Female	4.57	4.52	4.49	4.20

Males = 4.40; Lowest score: Females = 2.86, Males = 1.75). Sex of stimulus significantly interacted with the ratings as female stimuli were rated more attractive overall than male stimuli [$F(6{,}534) = 41.91, p < 0.001$]. This is due to an "attractive bonus" effect (Henns, 1992).

B. Healthiness

Significant main effects of body weight and WHR [$F(2{,}176) = 60.57, p < 0.001$; $F(3{,}264 = 52.25)$, $p < 0.001$] were Factor 2 *Healthiness*. Effects of sex of participants and sex of stimulus were not significant. The interaction between body weight and WHR was, however, significant [$F(6{,}528) = 4.85, p < 0.001$)].

Body weight effects on mean *Healthiness* ratings differ slightly between the two stimuli sexes as depicted in Table 3. Again, normal-weight males and females were judged to be the healthiest, but that is the only similarity. Overweight figures were judged to be the unhealthiest for males, as opposed to underweight ones for females as seen more clearly in Table 4 [$F(2{,}176) = 71.52, p < 0.001$]. Thus, effects of body weight on *Healthiness* ratings for male figures mirror that of *Attractiveness* ratings, but not so for female figures.

Males with high WHR are judged to be the healthiest, and ones with WHR 0.7 the unhealthiest. This trend varies little within each body weight category. Normal-weight females once again show a clear trend of $0.7 > 0.8 > 0.9 > 1.0$. However, the other two weight categories show mixed results with WHRs of 0.8 and 0.7 being rated the unhealthiest for underweight and overweight categories respectively. Nonetheless, Table 2, which shows the mean *Healthiness* ratings dependent on WHR alone, indicates that females with WHR 0.7 were rated as nearly equally healthy as those with WHR 0.8, regardless of body weight, and as the WHR progressively increases, the *Healthiness* ratings steadily declined.

C. Youthfulness

Factor 3, *Youthfulness*, generated highly significant main effects of body weight and WHR [$F(2{,}176) = 148.82, p < 0.001$; $F(3{,}264) = 41.69, p < 0.001$]. Neither effects of sex of participants, nor sex of stimuli were significant. Interaction between weight and WHR was, however, significant [$F(6{,}528) = 2.89, p < 0.025$].

Mean *Youthfulness* ratings in Table 6 show that underweight males with WHR of 0.9 were perceived to be the most youthful. Normal-weight females with low WHR of 0.8 were judged most youthful, almost identical to the 0.7 figure (5.30 vs 5.28), although scores within underweight category were similar to that of the normal-weight category.

Looking at Table 7 below, underweight females were given the same *Youthfulness* ratings as

Table 6. Mean *Youthfulness* ratings of each stimulus ($N = 90$)

Weight	Under				Normal				Over			
WHR	0.7	0.8	0.9	1.0	0.7	0.8	0.9	1.0	0.7	0.8	0.9	1.0
Male	4.34	5.86	5.53	5.35	3.48	4.72	4.81	4.90	3.21	3.45	4.39	3.72
Female	4.85	4.82	5.19	4.66	5.28	5.30	4.95	4.97	3.57	4.08	3.74	3.51

Table 7. Effect of body weight on mean *Youthfulness* ratings

	Under	Normal	Over
Male figures	5.27	4.48	3.69
Female figures	4.88	4.88	3.67

Table 8. Effect of WHR on mean *Youthfulness* ratings

WHR	0.7	0.8	0.9	1.0
Male figures	3.68	4.68	4.91	4.66
Female figures	4.50	4.73	4.63	4.04

normal-weights. Therefore, the trend in effect of body weight for males is $U > N > 0$, and for females, $U = N > 0$ [significant interaction: $F(2,176) = 15.66, p < 0.001$].

With regard to effects of WHR on *Youthfulness* ratings, Table 7 shows a mixed set of results across the weight categories for both sexes of stimuli. A clearer picture, however, is obtained in Table 8, and the trends shown by female and male stimuli have certain similarities [$F(3,264) = 39.91$; $p < 0.001$]. Males with WHR 0.9 were rated most youthful, WHR 0.8 less so, WHR 1.0 even less so, and WHR 0.7 the least youthful. Females with WHR 0.8 were rated most youthful, WHR 0.9 less so, WHR 0.7 even less so, and WHR 1.0 the least youthful. The two WHR values within the more youthful hemisphere and the other two within the less youthful hemisphere for both sets of stimuli were the same, albeit in different order.

In summary, the sex of the participants did not affect any of the variance in ratings of all three factors. Apart from the exception attractiveness, the effects of sex of stimulus is negligible. Both body weight and WHR not only have independently significant effects, but also have highly significant interactions with each other for all three factors, attractiveness, healthiness and youthfulness. The body weight effects are summarised as follows: For *Attractiveness*, $N > U > O$; *Healthiness*, $N > O > U$ and *Youthfulness*, $U > N > O$, where $N =$ Normal, $O =$ Overweight and $U =$ Underweight. With regard to effects of WHR, males with typical male-like ratios of 0.9 or 1.0, and females with typical low ratios of 0.7 or 0.8 are rated more favourable for all three factors regardless of body weight.

Discussion

This study aimed to investigate the perception and metaperception of male and female body shapes, differing along two dimensions: weight and waist-to-hip ratio. A correlation matrix revealed that SELF- and OTHER-rating scores were closely related and that the loading pattern of each extracted principal factor showed that these two sets of scores were both included in the factor's constituent attributes. Thus, the relation between SELF- and OTHER-scores is such that participants did not give different ratings for own judgements and perceived judgements of other sex (Furnham *et al.*, 1990). Another important point to note about this particular loading pattern is that with each composite attribute contributing two scores, each principal factor has twice as much weight. This differs from Singh's principal factors, which comprised of single scores from each attribute, and the difference will be helpful when explaining discrepancies in results. Regarding attributes on the whole, participants equalled attractiveness with sexiness, healthiness with reproductive capability, and youthfulness was independent of the other four attributes. Therefore, although participants might consider a female/male figure to be attractive, they might not necessarily consider them particularly healthy nor youthful.

This is reflected in the results and is seen more clearly in the effects of body weight. Overweight females and males were undoubtedly judged the most unattractive, but the former was not considered to be the unhealthiest. As mentioned earlier in the paper, essential fat deposits are needed in order to conceive and deliver a child, and as overweight females posses considerably more stored fat than underweight ones, they will be assigned a higher reproductive value, and consequently a higher *Healthiness* rating. On the other hand, males are not required to accumulate energetic factors like females, therefore, healthiness is directly linked to attractiveness, and if a male is perceived as attractive, he will be judged as healthy. These results were similar to those of Singh and Henss.

Contrary to Henss' (1995b) finding, but similar to Singh's (1994), none of the underweight figures, male nor female, were considered to be the best-looking. Although this study used a within-subjects design with parametric tests, Henss' attribution to Singh's methodology for the contrast in their results seems unfounded. In this study, normal weight figures of both sexes were consistently assigned the highest scores for all but one factor, Youthfulness.

Connotation of prepubescence might explain why underweight females were regarded as being the most youthful, and not found to be attractive/sexy. Youthfulness appears not to be a reliable cue for reproductive capability/health. This is explained by Singh (1993a, b) in terms of participants equating youthfulness with sexual immaturity, therefore being dubious about their reproductive capability.

With regard to waist-to-hip ratios, a high WHR was judged to be most desirable, and a low female-like WHR of 0.7 was indisputably less desirable to men, regardless of body weight, high WHR's in females were judged to be most unattractive, unhealthy and unyouthful. This, according to Henss (1992) who found the same results, is because possession of sex-typical features is a critical factor in the attractiveness criteria. Females with high, male-like WHR were judged least favourably. For female stimuli, the ratio of 1.0 was assigned the lowest scores on all three factors, and this is consistent with both Henss' and Singh's finding. However, Singh's studies constantly yielded the ranking order $0.7 > 0.8 > 0.9 > 1.0$, and Henss obtained $0.8 > 0.9 > 0.7 > 1.0$. This study did not reveal such consistent findings although, like Henss, WHR 0.8 came first in all but one of the factors where $0.8 = 0.7$. Once again, Henss (1995b) attributed this discrepancy to Singh's methodology, and in addition, to the weighting of factors. Henss's factors were extracted from an extremely large set of 51 ratings scales and thus had particularly strong weights compared to Singh's factors which were mean rankings of two constituent factors. The three factors of this study were derived from only five rating scales (10 composite scores) and although each factor has a heavier weighting than Singh's, it is incomparable to Henss'. Therefore, unlike Henss, who has the support of strongly weighted scores, the discrepancy in this study could be due to scores with *not enough* weight and consequently yielding inconsistent findings.

Also similar to Singh and Henss' findings, the effects of body *weight* were overall stronger than effects of body *shape* on judgements of these factors. However, taking into account that no other experimental manipulators which affected the fat distribution were present, it is reasonable to suggest that sufficient empirical evidence has been obtained in this study to support Singh's view that the waist-to-hip ratio does indeed play a vital role in judgements of healthiness, youthfulness, and in particular, physical attractiveness for both males and females.

The factor analysis revealed that SELF- and OTHER-rating scores were similar and not independent of each other as was mentioned earlier. This was seen for all five initial attributes (Attractiveness, Youthfulness, Sexiness, Healthiness, Capability of Reproduction). Therefore, whatever score the participants assigned to the stimuli from their *own* perspective, they assumed members of the opposite sex would perceived the stimuli similarly, and hence assigned comparable OTHER-scores. This, however, only indicates participants *think* there will be concordance between both sexes of participants, and does not imply that there is no significant difference between personal judgements of male and female participants. Results show that none of the factors indicated any significant effects of sex of participants on variance in ratings. Thus, parallel to Singh's findings, there was large agreement on ideal shape of males and females. It is plausible that this consensual knowledge manifests itself in attempts by females and males to obtain a desirable WHR through body-building and physical exercise or accentuate it through use of ornamentation and clothing in order to emphasise their attractiveness and reproductive capabilities to potential mates (Furnham & Greaves, 1994).

A problem in these studies is the questionable quality of the line drawings. Although the same drawings have been used in many of Singh's, and others' studies, and have proven to be sufficiently salient and discriminating, they still leave much to be desired. This was especially true of male drawings: female stimuli were judged significantly more attractive than male stimuli. Henss (1995a, b) also noted this point in his study, and attributed it to an "attractiveness bonus" effect for young females. As this claim is supported by a large body of literature (Henss, 1991, 1992), it is plausible in explaining the effect of stimulus sex on variance in ratings, but it cannot be denied that the poverty of the quality of male line drawings also affected participants' judgements. Henss noted that males with low WHR's were considered particularly unattractive. This study has also found a consistent difference in mean ratings between the two most unattractive figures: the overweight female with high WHR 1.0, and the overweight male with low WHR 0.7, with the latter rated lower. This is because rather than systematically increasing the *waist* width to manipulate the WHR (as was done to the female stimuli), the male drawings had their *hip* width increased, which made those with low WHRs look especially heavy and odd. Singh has already taken steps to counter this flaw, and has incorporated the use of computer-generated photographic images in one experiment (Singh, 1994). The results obtained were in accordance with the studies done with line drawings. Another possible solution is the simpler method of employing airbrush techniques. Other lines future research could pursue is the aspect of transgenerational stability.

Is WHR really the best predictor of bodily attractiveness preferences? Singh (1993a, b, 1994, 1995) insists it is, and has carried out a series of studies yielding positive results. Papers by other authors (Henss, 1995), including this present paper, have also found that WHR does affect attractiveness and other judgements, albeit sometimes in slightly dissimilar ways. The extent of its effect is closely intertwined with other factors like sex of the person being judged and in particular, his/her body weight. In fact, *all* studies showed that body weight had a stronger influence, despite positively interacting with WHR. Thus, to claim that body shape preferences are based *entirely* on waist-to-hip ratios would be incorrect. WHR is *not* the best predictor, but one cannot overlook its undeniably prominent influence on attractiveness judgements. Finally, the present findings do not confirm some well-established and frequently cited research findings in the area of body shape preference and evaluation. For example, one of the most quoted findings of Rozin and Fallon (1988) is that "female participants thought male preference would be for much thinner figures than the latter's really was". The stimulus figure employed by the present authors had three levels of body weight (underweight, normal and overweight) and four levels of WHR (0.7, 0.8, 0.9 and 1.0), but in spite of body weight difference (as used by Rozin and others), the judgements of male and female participants were highly similar. This lack of sex difference has been previously reported by Singh (1995). Sex differences thus appear when stimulus figures differ only in body weight dimension and disappear when stimulus figure differ in both body weight and body shape. Second, Garner *et al.* (1980) suggest that media and fashion glorifies slimness to such an extent that even normal weight women find dieting necessary. The present paper reports, consistent with previous findings, that both male and female participants judge normal weight rather than underweight figures as most attractive. These findings suggest that the role of culture in preferred female body shape may be very different than its role for body weight. Singh and Luis (1995) found that neither US black or Indonesian males and females judge overweight figures as more attractive than normal weight figures. It is important to speculate (at least) why depiction of varying WHR alone with body weight makes cross-cultural participants judge normal weight figures in such a strikingly similar manner. It is quite possible that biology overcomes culture because of the known fecundity of relationships with WHR. That is, whilst there are cultural differences in the preferences for body weight, once shape in the WHR is carefully controlled, these apparent differences are considerably reduced (Furnham & Alibhai, 1983; Furnham & Baguma, 1994).

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